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Agric. & Irrigation

FORM NO. 57 INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. I.P.M. Cargill DATE: June 13, 1968

FROM: Gregory Votaw and Robert Picciotto

SUBJECT: INDIA - Lending for Agriculture

1. This note is complementary to Mr. Wapenhans' memorandum to Files dated March 25, 1968. It proposes a program of staff activity designed to increase the level of IDA lending for agricultural development in India. It does not deal with normal supervision activities or Indus-type studies. It assumes that current input financing may be provided by IDA in connection with high priority projects. If implemented, we estimate that the program could lead to about $400 million worth of external financing support for agriculture between now and mid-1972. You will recall that $260 million has been included under the heading of agriculture and irrigation in our five-year forecast of IDA operations. The balance of $140 million (if our project expectations materialize) might come from allocations now proposed for other activities (e.g. railways) -- or, alternatively, from parallel financing by interested consortium members.

A. THE NEED FOR MORE PROJECTS

2. The case for more agricultural projects in India can be simply stated:

(a) India has a third of the population and 30 percent of the cultivated area of IDA's less developed country membership. Agriculture originates half of India's domestic product, 70 percent of its employment and about three-fourths of its exports. By contrast, direct IBRD/IDA lending for agriculture in India ($64 million) amounts to 6 percent of the Bank Group's worldwide agricultural lending and to 4 percent of its total lending to India (Table 1). There has been no direct lending to agriculture by the Bank Group since 1962.

(b) Of course, Indian agriculture has been an indirect beneficiary of Bank Group investments in other sectors of the Indian economy. Through the industrial imports program, manufacturers of fertilizer, pesticides, pumps and tractors have secured supplies which are essential to meet a growing farmers' demand for modern inputs. 1/ Through the transportation loans and credits, elements of a basic railway and road infrastructure have been built and this is facilitating the growth of market-oriented farming. Finally, Bank Group assistance to the power sector has helped to meet a growing tubewell energy demand upon which much of the country's modern irrigated farming activity depends. However, the benefits which the agricultural sector has derived from such indirect aid and, more generally, of the Bank's role as

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1/ IDA has so far disbursed more than $40 million to agricultural input and tractor manufacturers.

Consortium Chairman are difficult to trace, even though they are substantial.

(c) The staggering capital and foreign exchange requirements of India's agricultural sector will not be met without external support. An estimate for annual foreign exchange outlays of $400 - $450 million, (including $310 million for fertilizers) would be roughly consistent with the original Draft Fourth Plan Outline (Table 2). Total capital requirements have been estimated at $1,400 million a year by Willem Holst, a consultant to the U.S. President's Science Advisory Committee on World Food Problems.

(d) There is a need to induce or accelerate change in domestic resource allocation, administration and attitudes within the sector. Past GOI policy (pre-1965) was characterized by low resource allocation and ambitious production targets for agriculture. Fortunately, the high priority of the sector is now being translated into increased availability of modern inputs to the progressive farming sector. 1/ But sustained progress will require not only increased resource allocation to the sector, but also a closer interdependence of the current input, institutional and infrastructure requirements of Indian agriculture (particularly in the water field) as well as more emphasis on specific schemes to guide the resource allocation process. This means more projects.

3. In many ways, the present task of building up a pipeline of projects in India's agricultural sector differs from the job which faced IDA in the early sixties when IDA's "first generation" of agricultural projects was conceived. This was a felicitous time from the standpoint of IDA resources. The Bank had not yet built the diverse staff strength and competence it now enjoys in the agricultural field. These elements, and the haste with which the projects were put together, explain the "civil engineering" orientation of IDA's assistance. The irrigation and drainage projects to which IDA provided support are implemented by irrigation departments rather than by departments of agriculture on which the major responsibility for agricultural development rests.

4. Recognition of the need for more and better IDA projects in Indian agriculture is of course not new. The two agricultural projects now being appraised (Tarai Seeds and Punjab/Haryana Drainage) are the results of considerable efforts since 1964 by the Projects Department, FAO and the India Division. Together, these two projects may account for about $27 million worth of lending. However, their importance reaches far beyond their size or their direct production merits. The Tarai project would strengthen a crucial component of the New Agricultural Strategy -- modern seed production

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1/ The following documents set forth the main elements of India's new agricultural policy: Report to the President of IBRD and IDA on India's Economic Development Effort, Volumes II to V, October 1, 1965, Indian Economic Policy and the Fourth Five-Year Plan, Volume II, May 23, 1967. The two economic reports dated October 13, 1967, and April 25, 1968, review the recent progress of this policy.

and processing. The Punjab/Haryana irrigation study would integrate groundwater utilization and surface system improvements -- particularly weak spots of current agricultural programs. Both projects experiment with administrative concepts which are relatively new to the sector. Tarai would be managed by an autonomous corporate entity grouping farmers, a land-grant type college, and input distribution firms in the public and private sectors. The project would also bring a major commercial bank into agricultural lending. The Punjab/Haryana project would provide expatriate consulting talent for an investment-oriented study in two states.

5. Beyond Tarai Seeds and Punjab/Haryana, there are no agricultural projects in the pipeline. This results from a number of related factors: uncertainty as to IDA resources; inadequate project preparation efforts by Indian authorities; differences in approach with respect to procurement practices and current input financing. But at least as important are the obstacles which result from the rules which seem to have governed IDA's relationship with GOI in matters of project design and selection. To these obstacles we now turn.

B. PREREQUISITES FOR PROGRAM SUCCESS

6. GOI's strategy in the aid game aims at maximizing the flow of non-project assistance from IDA both because of the special quality of IDA money and because of the exacting preparatory work associated with project finance. Central to the strategy is the assumed inelasticity of total IDA assistance to India. The game then consists in putting up relatively few agricultural projects for finance. Furthermore, even the few proposals which are put forward are more in the nature of requests for on-going programs rather than for specific investment projects. This strategy is effectively supported by rationing of information on alternative investment opportunities, by obstruction of other Indian players' entry into the game and by an allocation system of Central funds which leaves little incentive to individual States to go through the rigors (the Indians often use the term 'agony') of project preparation. 1/ The game is nearly over and successful, from the standpoint of the GOI player, when the focus of the project debate can be shifted from basic sectoral issues to IDA's own procedures, e.g. the channel for lending, current input financing, procurement policy, etc.

7. The behavior of the IDA player is more difficult to define since we run a much less disciplined team than GOI and also because we play the game in GOI's field, with teams originating from various divisions, departments and sections of the Bank and FAO. One danger of IDA's approach to the game is a growing dichotomy between its economic and sectoral analysis and its project work.

8. The following pre-conditions are necessary if the proposed program of staff activity in the agricultural sector is to be effective:

(a) Substantial support forthcoming from the Central and State Governments in all phases of IDA's project design work;

(b) Adequate headquarters support and leadership (involving the active participation of most sections of the Agricultural

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1/ IDA standards seem especially severe to Indian administrators given India's rather casual and imprecise approach to public investment budgeting.

Division) during project design as well as during appraisal and supervision;

(c) Close coordination between IDA's economic work and project identification activities;

(d) Substantial utilization of the FAO/Bank Program, UNDP and consultants at the post-identification stage.

9. Condition (a) is likely to obtain only if GOI understands that IDA plans to invest a stated minimum amount of its available funds in suitable agricultural projects identified by IDA. Under present operational assumptions concerning IDA replenishment, this would mean $260 million worth of agricultural lending over the next five years; higher allocation to the sector would be provided if suitable opportunities for investment are developed. GOI should also be informed that IDA proposes to intensify its contacts with individual States during its project work. For this purpose, we would expect working groups including State as well as GOI officials to be organized to work with IDA/FAO.

10. Condition (b) implies that India will receive adequate priority in the working program of the Agriculture Division. A rather large portion of the manpower requirements which the Division would have to meet would be for pre-appraisal activities. This is due not only to an empty project pipeline but also to the overwhelming importance of coordinated project design in a country so vast and complex as India requiring continuity of staff attention. The first year's program of pre-appraisal activities should be agreed with the Agricultural Division as soon as possible.

11. Condition (c) results from the substantial effort already invested by IDA in agricultural policy assessment. Consortium reporting in agriculture should increasingly focus on a review of the country's investment program and on the identification of areas and actions deserving special support within these programs. Close liaison with other external agencies (FAO, UNDP, AID) operating in India is crucial in this connection. Given existing staff limits in the New Delhi Office, such a role largely hinges on whether (as assumed above) adequate headquarters staff support is made available.

12. Condition (d) is prompted by past agricultural project experience in India which suggests that unless Bank staff is intimately involved in initial stages of project design, subsequent efforts run the risk of being counter-productive. Hence, the role of FAO/Bank, UNDP and consultants has been deliberately geared to 'second stage' design activities.

C. INVESTMENT PRIORITIES

13. Administrative weaknesses in India (as in most developing countries) constitute a major constraint on agricultural development. These weaknesses (divided authority, poor coordination, weak management) are widely recognized and there is mounting farmer-based clamor for more effective supporting services to agriculture. The art of project design will largely consist in selecting or building up institutional devices which fit local conditions and offer the promise of satisfactory performance. As in the case of Tarai, IDA could assist Indian farming through a variety of institutions - including

agricultural universities, research institutions, industrial firms and commercial banks. Indeed, diversification of the institutional structure at the service of agriculture should be one of the criteria of our project work.

14. Farm production growth in India is dependent on increasing crop yields and the area under multiple cropping. In general, timely moisture supply rather than adequate temperature is the bottleneck to plant growth and, given the irregular and seasonal pattern of rainfall, intensive land use calls for assured water control through irrigation. In many areas, past irrigation policy has failed to provide adequate water control on the farm for the following reasons: (a) lack of adequate networks of terminal channels and lack of adequate maintenance on major works; (b) absence of consolidation measures where fragmented holdings prevail; (c) neglect of drainage works; (d) surface water systems overextended in relation to water requirements; (e) groundwater exploitation poorly integrated with the surface water utilization; (f) system operation unadapted to crop requirements; (g) water charges leading to inefficient water use.

15. Given the above, better use of existing irrigation assets through complementary agricultural programs should have high priority in IDA's investment program. The proposed program of staff activity would help identify such projects in Madras, Andhra Pradesh and three or four other states. Integrated river basin development programming should be initiated. All these activities may require substantial support by consultants.

16. Untapped groundwater resources are substantial and their increasing use under private management is an encouraging trend under the New Agricultural Strategy. If accompanied by detailed hydrologic examination, groundwater exploitation should have high priority in IDA's program. This would require the design and operation of expanded credit services to farmers and contractors as well as step-up of power transmission and connection programs. A tubewell project is likely to emerge soon from the Punjab study. In addition, we propose that a new credit scheme be developed for promoting minor irrigation development and mechanization in Andhra Pradesh, Madras, Maharashtra, Gujarat and/or Mysore.

17. The 1968 bumper rabi crop has brought to the fore the need for additional grain storage facilities in surplus areas. But here again, IDA should take a broad view of the country's agricultural marketing and processing structure before detailed project preparation is undertaken. Basic policy issues, including the removal of inter-state trade restrictions, may have to be settled before IDA invests in this sector.

18. Much of the impetus behind the New Agricultural Strategy is the outcome of foodgrains breeding and research. Yet, there are disturbing signs that production-oriented research programs are not receiving the support they deserve. Furthermore, the gap between research and extension at the Center and in most States leads to poor diffusion of agricultural innovation. The program of IDA lending proposed here would back up seed research in connection with a multi-state seed production project. Strengthening of the research-extension link would be achieved through assistance to selected agricultural universities.

19. The diffusion of the new technology is creating a rising demand for short, medium and long-term credit which the existing farm credit

structure is ill-equipped to handle. An immediate need is to develop new production credit arrangements adapted to an emerging pattern of input distribution where private dealers are becoming increasingly active. A further need is to strengthen the development lending programs of nationally important financial bodies such as the Agricultural Refinance Corporation and its network of Land Mortgage and commercial banks.

20. The Government's New Agricultural Strategy has centered mainly on foodgrains production and, as a result, actions to promote commercial crop development (such as tea, jute or oilseeds) and livestock production (dairy and poultry) have been neglected. The intelligence available to IDA on these important areas of agriculture is limited. The proposed program of activity makes provision for fact-finding missions in these sectors to lay the basis for possible project activity by IDA.

D. THE PROGRAM

21. The proposed five-year staff activity program and the related project lending forecast which it supports are set forth in Tables 3 and 4. The manpower estimated to be required relates both to economic and (pre-yellow cover) project activities. It excludes coordinating and supporting staff requirements (e.g. India Division and Delhi Office) as well as staff commitments already made. On this basis, about 60 man-years would be required for the five-year program, i.e. an annual requirement of 12 man-years on the average. Of this amount, 32 man-years (i.e. about 6 - 7 man-years each year) would come from the Bank and the Bank/FAO Cooperative Program. This is only 10 percent of the existing professional staff capacity of the division. The balance of the requirements would be covered by consultants and UNDP, as follows (in man-years):

	Bank and Bank/FAO	Consultants and UNDP	Total
Project Identification (including economic work and sector analysis)	10.4	-	10.4
Feasibility Studies and Project Preparation	10.9	26.4	37.3
Project Appraisal	11.6	-	11.6
Total, 5 years	32.4	26.4	59.3
Annual Average	6.4	4.4	10.8

22. The following missions are proposed for the next few months:

(a) Fourth Plan Review in Agriculture: This review should involve contacts at the State level and concentrate on the weak areas of the New Agricultural Strategy, i.e. research, credit, water, export crops and livestock. In addition to the New Delhi Office staff, participation of an agronomist and a livestock specialist would be desirable. Field work should start in August.

(b) Credit Project: A fact-finding mission including a credit specialist, an engineer, an agronomist and an economist is required to identify in broad outline a project to promote private minor irrigation and mechanization in selected Indian States. The mission should review the activities and structure of the Agricultural Refinance Corporation and other financial bodies active in agricultural lending, undertake a preliminary assessment of regional demand for irrigation and mechanization credit and build the framework of further project preparation activity. Field work should start in September.

(c) Irrigation: An irrigation reconnaisance team including a senior irrigation engineer, an agricultural economist and an agronomist should visit India around November to review possibilities for improved planning and preparation of major irrigation projects. The mission's objective would be to identify potentially useful studies and project preparation activities in the irrigation field. It would undertake a preliminary review of investment possibilities in the Cauvery delta, in the Krishna-Godavari delta, as well as in other areas included in the Fourth Plan Outline list of major irrigation projects. It would discuss with the Government the need for integrated basin development studies. Another mission would probably have to follow up the results of this reconnaissance early next year.

(d) Fertilizer Program: The identification and preparation of a production scheme through private channels is proposed within the marketing area of the Tarai Seeds Project. Agronomists, credit specialists and marketing consultants would be required for this activity. Field work could start before the end of the year.

E. SUMMARY

23. To sum up, direct IDA lending to Indian agriculture has heretofore been too small in relation to the needs of the sector, and its potential for productive investment under the Government's New Agricultural Strategy. To foster development of an agricultural system in which essential elements are adequately balanced and coordinated, investment in the following fields would have high priority: irrigation, groundwater development, research, output diversification, storage and farm credit. More agricultural project activity would help guide the resource allocation process within India. It would also give additional weight to IDA's economic policy recommendations and lead to improved reporting on agricultural development to Consortium members. In the past, agricultural project activity has been hindered by lack of suitable projects, scarcity of IDA funds and the exclusion of fertilizer imports as such from IDA's operational scope because of IDA's reluctance to finance current inputs. Budgeting of a minimum share of IDA funds for agricultural projects, intensification of IDA's contacts at the State level, better coordination of IDA and FAO staff activities and relaxation of IDA's current input financing criteria are suggested for improved project work.

Table 1

INDIA - AGRICULTURE

IBRD Loans and IDA Credits

		Original Principal Amount			Principal Amounts Disbursed	
	IBRD	No.	$ Million	%	$ Million	%
1.	Agriculture	1	10.0	0.9	7.2	0.7
2.	Industry & mining	14	408.5	38.4	295.7	34.3
3.	Transport	13	448.6	42.1	441.0	51.2
4.	Public utilities	8	198.0	18.6	118.7	13.8
	Total IBRD	36	1,065.1	100.0	862.6	100.0
	IDA					
1.	Agriculture	7	67.5	7.5	57.0	6.9
2.	Industry	4	415.0	46.1	392.1	47.5
3.	Transport	5	275.5	30.6	252.4	30.5
4.	Public utilities	6	143.0	15.8	124.4	15.1
	Total IDA	22	901.0	100.0	825.9	100.0
	Total Agriculture	8	77.5	3.9	64.2	3.8
	Total IBRD & IDA	58	1,966.1	100.0	1,688.5	100.0

Table 2

INDIA - AGRICULTURE

Estimated Foreign Exchange Requirements[1/]
($ Million)

	Total	1968/69	1969/70	1970/71	1971/72	1972/73
Fertilizer						
Nitrogen	985	234	228	198	175	150
Phosphate	326	47	57	74	74	74
Potash	203	29	36	46	46	46
	1,514	310	321	318	295	270
Pesticides	199	39	40	40	40	40
Tractors						
Crawler Tractors	59	23	12	8	8	8
Wheel Tractors	110	27	23	20	20	20
Power Tillers	118	16	21	27	27	27
	287	66	56	55	55	55
Major Irrigation	230[2/]	46	46	46	46	46
Minor Irrigation	19	6	4	3	3	3
Other Uses	65[2/]	13	13	13	13	13
Total	2,314	480	480	475	452	427

1/ Based on Appendix IV, Vol. II (Agricultural Policy in India) of the Bell Mission Report - Indian Economic Policy and the Fourth Five-Year Plan, Asia Department, May 23, 1967. As a rough approximation, the requirements of 1970/71 have been carried through the following two years, except for nitrogen where a gradual decline after 1970/71 is assumed. The fertilizer price assumptions have been adjusted downwards to take account of recent price movements.

2/ Fourth Plan Outline assumption.

INDIA - AGRICULTURE

Indicative Projection of IDA Commitments

($ Million)

	1968/69	1969/70	1970/71	1971/72	1972/73	Total
1. Seed project I[1]	14					14
2. Punjab/Haryana I[2]	14					14
3. Fertilizer program[3]		60				60
4. Credit project[4]			60			60
5. Seed project II[5]			20			20
6. Punjab Haryana II[6]			30			30
7. Sone/Shetrunji/ Salandi/Purna[7]				35		35
8. Krishna Godavari[8]				25		25
9. Cauvery[9]				15		15
10. Grain storage[10]				30		30
11. Punjab/Haryana III[11]					35	35
12. Export crop development[12]					30	30
13. Livestock development[13]					25	25
14. Agricultural universities[14]	—	—	—	—	15	15
Total	28	60	110	105	105	408

N.B. This list is for illustrative purposes only. Many items could be deleted, others could be added and the amounts indicated should be viewed as rough orders of magnitude.

(Footnotes on next page)

Footnotes to Table 3

1/ The project cost is estimated at $27 million in the application (of which $18 million is classified as investment).

2/ The project cost including the study is estimated at $21 million (appraisal mission's back-to-office report).

3/ A scheme to provide fertilizer credit to farmers in selected Indian states through input dealers, commercial banks and other private entities. According to the Fertilizer Association Credit Committee, US$50-60 million would represent one-fifth of the fertilizer credit requirements of farmers to be met in 1969-70 by sources other than co-ops. The IDA scheme would concentrate on North India where Terai seed is expected to be marketed.

4/ A scheme to provide medium- and long-term credit to farmers of selected Indian states for groundwater development and mechanization. The scheme would also provide for groundwater surveys, power transmission facilities and contractors' credit. The borrower would be the Agricultural Refinance Corporation. The funds would be channelled through selected Land-Mortgage Banks and commercial banks. The following states, where Land-Mortgage Banks are already active, would be covered by the scheme: Andhra Pradesh, Madras, Maharashtra, Gujarat and Mysore.

5/ A $30 million project for development of 50,000 acres of seed production land in selected areas of Punjab, Maharashtra, Madras and Andhra Pradesh. The project would include provision for seed processing facilities and support of related research activities.

6/ A $45 million groundwater development project to finance approximately 20,000 private tubewells in Punjab and Haryana over a four-year period. This would benefit approximately 300,000 acres, at a cost of US$150 per acre.

7/ One or more "follow-up" projects designed to strengthen agricultural development programs within the command areas of existing IDA-financed schemes.

8/ This amount is based on a preliminary cost estimate of $38 million for a drainage and flood control project prepared by the Andhra Pradesh PWO department for the Kolleru basin and adjoining areas of the Krishna-Godavari delta. More detailed studies are likely to be required to make economic use of existing infra-structure and available groundwater.

9/ This amount is based on a preliminary cost estimate of $23 million for a scheme prepared by a Madras Government official. A UNDP survey is proposed for the area. Additional studies to integrate surface water system rehabilitation with groundwater utilization are likely to be required.

(continued on next page)

Footnotes to Table 3

10/ A project designed to increase grain storage capacity in selected surplus areas (0.6-0.7 million tons of storage at $100 a ton).

11/ An integrated surface water system rehabilitation-cum-groundwater development project in Punjab and Haryana covering 600,000 acres at a cost of $100 per acre.

12/ Support of export-oriented crop production programs (jute, tea, oil-seeds, tobacco, etc.). This might include plantation schemes or small holder development projects.

13/ Support of dairy and poultry schemes.

14/ Support of research, extension and education programs of selected agricultural universities.

Table 4

INDIA - AGRICULTURE

Tentative Program of Activities and Related Manpower Requirements[1]

	Mission Type	Expected Period	Man-Months* A	AE	E	FA	Total	Suggested Sources
Fourth Plan Review - Agriculture	Economic	July-Dec.'68	4				4	P
Consortium Reporting[2]	Economic	1969	4				4	P
Consortium Reporting[2]	Economic	1970	4				4	P
Consortium Reporting[2]	Economic	1971	4				4	P
Consortium Reporting[2]	Economic	1972	4				4	P
Consortium Reporting[2]	Economic	1973	4				4	P
Fertilizer Program - State Plan Review	PP	Sep.-Dec.'68	6	6			12	PE
Fertilizer Program - Organization[5]	PP	Jan.-Mar.'69		4		6	10	F,PC,PE
Fertilizer Program[5]	PA	Mar.-Jun.'69	3	4		3	10	PE
Credit Project	PI	July-Dec.'68	1	2	2	1	6	PS,PC or Ec
Credit Project[5]	PP	Mar'69-Mar'70	3	5	4	3	15	PC,Ec,FB
Credit Project[2]	PA	Mar.-Jun.'70		4	4	3	12	PC
Seed Project II	PI	Jan.-Jun.'69	1				1	PG
Seed Project II[5]	PP	Jan.-Jun.'70	3	4	3	3	13	PG,FB
Seed Project II[2]	PA	Oct.-Dec.'70	3	4	2	2	11	PG
Punjab-Haryana II[2]	PP	Jan.-Feb.'70	1	2	2		5	PI,PS
Punjab-Haryana II[2]	PA	Mar.-Jun.'70	3	4	4		11	PI
Sone/Shetrunji/Salandi/Purna[3/4]	PI	Jan.-Feb.'69	4	5	4		13	PI,D,Ec
Sone/Shetrunji/Salandi/Purna[5]	PP	Jun'69-Jun'71	48	24	24		96	C or U
Sone/Shetrunji/Salandi/Purna[2]	PA	Jun.-Aug.'71	4	5	4	4	17	P
Krishna Godavari[4]	PI	July-Dec.'68	1	2	1		4	D,PS,PI
Krishna Godavari[5]	PP	Jun'69-Jun'71	40	24	24		96	C or U
Krishna Godavari	PA	Jun.-Aug.'71	3	4	3		10	P
Cauvery[2]	PI	July-Dec.'68	1	2	1		4	PS,PI
Cauvery[4]	PI	Sep.-Dec.'70	1	2	1		4	PS,PI
Cauvery[5]	PP	Jan.-Jun.'71	6	6	6		18	PI,C,FB
Cauvery[2]	PA	Jun.-Aug.'71	3	4	3		10	PI
Grain Storage[4]	PI	Jun.-July'69	1	2	1		4	PS,PG
Grain Storage[5]	PP	Jan'70-Dec'71	24	24	24		72	C,U
Grain Storage[2]	PA	Mar'71-Jun'71	3	4	3		10	PG
Punjab-Haryana III[2]	PI	Jan.-Mar.'71	1	2	1		4	PS,PI
Punjab-Haryana III[2]	PA	Mar.-Jun.'72	3	4	3		10	PI
Export Crop Development	PI	Jan.-Jun.'69	3	4			7	PE,Ec or FB
Export Crop Development[5]	PP	Mar'71-Mar'72	4	4		4	12	PG,FB
Export Crop Development[2]	PA	Jul.-Sep.'72	3	4		3	10	PG,PC
Livestock Development	PI	Jun.-Dec.'69	3	4			7	PC,FB
Livestock Development[5]	PP	Mar'71-Mar'72	4	4		4	12	PC,FB
Livestock Development[2]	PA	Jul.-Sep.'72	3	4		3	10	PC
Agricultural Universities	PI	Jan.-Mar.'70	3	3		3[6]	9	E,PE,UE
Agricultural Universities[5]	PP	Jul'71-Jul'72	4	4		4	12	E,UE
Agricultural Universities[5]	PA	Jul'72-Sep'72	3	3		3	9	E
Total:			234	187	124	49	594	
Of which: (Consultants and UNDP			121	71	72	-	264	
(Bank and FAO/Bank			113	116	52	49	330	

1/ This does not include supervision activities except those likely to lead to new appraisal activity. It excludes manpower resources already committed. It also excludes supporting field and headquarters staff requirements (e.g., Delhi Office, India Division, etc.).
2/ A mission to review the progres of a study.
3/ A "reappraisal" mission.
4/ A mission to establish terms of reference for a study.
5/ Scope and timing dependent on the results of a prior mission.
6/ Education specialist.
* On the basis of 10 working man-months per man-year.

Nomenclature:

A Agriculturist	E Projects Depart.- Educ. Division	PS Studies Section	PI Project Identification		
AE Agricultural Economist	F IFC	PC Credit/Livestock Section	PP Project Preparation		
E Engineer	P Projects Depart.- Agri.Division	PG Gen. Agriculture Section	PA Project Appraisal		
FA Financial Analyst or Credit Specialist	Ec Economics Depart.	U UNDP Program	PS Project Supervision		
	PE Economic Section	UE UNESCO			
	PI Irrigation Section	FB FAO/IBRD Program			
		C Consultant			

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Files August 30, 1968

R. Picciotto

INDIA - Agricultural Situation

1. The final unrevised estimate 1/ of the 1967/68 record foodgrains harvest is 95.6 million tons. (Tables 1 and 2). According to this estimate, wheat, barley and maize would have exceeded the previous 1964/65 high by more than one third, implying an annual growth in the intervening period of 10 per cent or more. Bajra would also have performed well with an output 15 per cent above the 1964/65 level, equivalent to an annual growth of 4.7 per cent. Jowar, on the other hand, would only be 4 per cent above the 1964/65 level while, at the bottom of the scale, rice would have scored 1.1 million tons below 1964/65 output.

2. A 95.6 million ton crop would only imply a 2.6 per cent annual growth from 1964/65 output. Yet, 1967/68 kharif weather conditions were, on the whole, quite favourable, even though excessive fall and winter rains affected standing crops in some areas. As for the 1967/68 rabi weather, it was, by all accounts, exceptionally good. With this in view, taking account of farmers' rising use of modern inputs and keeping in mind the political cuisine in which food statistics are cooked, the official figure (based on individual States returns) may well understate the harvest by 2-3 million tons.

3. The bulk of the shortfall between program expectations and officially estimated output relates to rice production (Table 3). As suggested above, the most likely explanation for the gap is that official rice output statistics for 1967/68 err on the conservative side. Still, there is no doubt that the "green revolution" has been more pervasive in the wheat areas of the North than the paddy fields of the Center and South. One cause for this uneven performance relates to the genetic base of the new agricultural strategy. Whereas the high yielding wheats have proved responsive to relatively simple management practices, resistant to diseases and pests and (insofar as the new amber seeded lines are concerned) well adapted to consumers tastes, the exotic paddy varieties released on a large scale in 1967 were subject to blight and insect attack (especially during the wet season), demanding in terms of cultural practices (particularly in the field of water control), and, in most instances, at variance with the tastes and cooking habits of the Indian public. No new paddy varieties are likely to be released in 1968/69. However, an excellent breeding program for rice is underway and a new varietal breakthrough may come within 2-3 years.

4. Total fertilizer consumption in 1967/68 was about 1.5 million tons 2/ -

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1/ Fully revised estimates are only issued by the Directorate of Economics and Statistics with a 2-3 years lag.

2/ $N/P_2O_5/K_2O$ consumption as follows (million tons): 1.01/0.34/0.17 as compared to 1.5/0.50/0.20 tons targets for the year.

of which 1.1 million tons may have gone to foodgrains. This is about 0.5 - 0.6 million tons above the volume which may have been applied to traditional foodgrains varieties in 1964/65. The High Yielding Varieties Program (HYVP), initiated in 1965/66 is reported to have covered 15 million acres in 1967/68. At recommended dosages (which are well below optimum levels) HYVP would have required 1.2 million tons of fertilizer nutrients 1/. But in practice, fertilizer use in many HYVP districts is reported to have been only a fraction of official recommendations. Late kharif arrivals explain part of the consumption shortfall. Fertilizer credit and marketing systems were limiting factors. Furthermore, for many HYVP participants, uncertain water supply on the farm made large fertilizer application a risky investment.

5. Cereal prices have declined as a result of the bumper harvest (Table 4). By June, the cereal price index had fallen below 1967 mid-year levels - the rapid drop in wheat prices following the bumper rabi crop being tempered by upward seasonal movement of rice and coarse grain prices. From January to June 1968, wheat prices dropped 18 per cent 2/. However, the decline would have been much steeper (and would have undoubtedly impaired producers incentives) had it not been for the recent Government procurement operations in North India. From April to July 31st, the Government procured 2.2 million tons of rabi foodgrains (mostly wheat) - 1.5 million tons in Punjab and Haryana. Lack of adequate storage in these States coupled with transport bottlenecks and inter-state movement restrictions led to some rain damage to procured grain 3/. However, the operation was relatively well managed in the face of unprecedented market flows - two to five times higher than in the previous year. Coordination between the various procurement, transport and financing agencies was more effective in Punjab/Haryana than in UP and Rajasthan where, at times, farmers' prices dropped 10-20 per cent below procurement levels.

6. Inter-state grain price differentials have narrowed in recent months. However, they remain substantial for rice which is still subject to severe movement restrictions between and within States (Table 5). In July 1968, course rice which was officially sold at Rs. 66 a quintal in Madras was transacted at Rs. 140 a quintal in Bihar. Procurement operations in surplus States are generally taking place by compulsory levy, 20-30 per cent below market prices.

7. Total procurement of kharif cereals (mainly rice) stood at 3.7 million

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1/ On the basis of the following recommended $N/P_2O_5/K_2O$ application (lb/acre): 80/60/40 for HYVP.

2/ The price drop was particularly marked in UP, the only major wheat producing State outside the Northern wheat zone. Thus, red wheat price at Kanpur fell from Rs. 107 a quintal in January to Rs. 73 a quintal in July.

3/ The late outbreak of the monsoon limited the extent of the loss.

tons by the end of July and may reach 4 million tons by the end of October (2 million tons short of target). By contrast, procurement of rabi cereals (mainly wheat) is already above target so that total procurement during 1967/68 may well reach 6.5 million tons. With regard to imports, arrangements have already been made to bring in 5.2 million tons of grain (of which 4.4 million tons of wheat). Total imports for the year are estimated at about 7.5 million tons by the Food Department. Releases from Central Government account to-date suggest that public distribution requirements may amount to 10 million tons during the year. If these import and public distribution expectations materialize, a 4 million ton stock carry-over into 1969 will be possible. By strengthening the Center's hand, this might further facilitate liberalization of foodgrains trade.

8. Subsidy on centrally issued foodgrains is being reduced. With effect from June 17, the issue prices for red wheat was raised from Rs. 67 to Rs. 70 and that of imported white wheat from Rs. 67 to Rs. 90.

9. The weather picture for the current year (1968/69) has so far been mixed. The onset of the monsoon was delayed a fortnight or more in Gujarat, Rajasthan and UP. While adequate rainfall for sowing has been received in most areas, it has been deficient over Rajasthan, Andhra Pradesh and parts of Mysore and Madras. On the other hand, heavy rains in Kerala and Gujarat have caused substantial flood damage. For the country as a whole, kharif crop prospects look distinctly less promising than last year. This holds for the cotton and groundnut crops as well as for rice and jower.

10. The 1968/69 Annual Plan provides for substantial expansion of fertilizer and high yielding seed availabilities (Table 6). Considerable step-up of development credit through the Agricultural Refinance Corporation and land mortgage banks is also provided for, particularly for minor irrigation. Increased utilization of major/medium irrigation potential is emphasised. The effort contemplated is broadly in line with subsectoral priorities. But it is much too early to assess performance or production prospects for the year. The irrigation system being what it is, these prospects will depend in large part on weather developments over the next few months.

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TABLE 1.

INDIA - AGRICULTURE

Production Statistics.
(Million Tons)

	1963/64	1964/65	1965/66	1966/67	1967/68 (prel.)
Kharif Cereals					
Rice	36.89	39.03	30.66	30.44	37.86
Jowar	9.14	9.75	7.53	9.22	10.11
Bajra	3.73	4.45	3.66	4.47	5.13
Maize	4.55	4.66	4.76	4.89	6.28
Ragi	1.96	1.89	1.18	1.63	2.03
Small Millets	2.02	1.95	1.66	1.49	1.91
	58.29	61.75	49.43	52.14	63.32
Rabi Cereals					
Wheat	9.86	12.29	10.42	11.39	16.57
Barley	2.04	2.52	2.38	2.35	3.47
	11.89	14.81	12.80	13.74	20.04
Pulses	10.06	12.14	9.80	8.35	12.23
Total Foodgrains	80.24	89.00	72.03	74.23	95.59
Oilseeds					
Groundnut	5.22	5.89	4.23	4.41	5.83
Other	3.66	4.62	3.99	3.84	4.67
	8.88	10.51	8.12	8.25	10.50
Cotton	5.49	5.66	4.76	4.93	n.a.
Jute	6.19	6.02	4.47	5.36	6.37
Sugar Cane	10.60	12.03	12.10	9.49	9.50

Source: Directorate of Economics and Statistics.

(RP/mm)

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INDIA - AGRICULTURE

TABLE 2.

Production of Foodgrains

	1964/65		1965/66		1966/67		1967/68	
	Area (mil.ha)	Prod. (mil.MT)	Area (mil.ha)	Prod. (mil.MT)	Area (mil.ha)	Prod. (mil.T)	Area (mil.ha)	Prod. (mil.T
Kharif Cereals								
Rice	36.4	39.0	35.3	30.6	35.3	30.4	36.7	37.9
Jowar	17.9	9.7	17.5	7.5	18.1	9.2	18.6	10.1
Bajra	11.7	4.5	11.6	3.7	12.2	4.5	12.5	5.1
Maize	4.6	4.7	4.8	4.8	5.1	4.9	5.6	6.3
Ragi	2.4	1.9	2.3	1.2	2.3	1.6	2.4	2.0
Small Millets	4.5	2.0	4.4	1.7	4.6	1.5	4.8	1.9
TOTAL	77.6	61.8	75.8	49.4	77.6	52.1	80.6	63.3
Rabi Cereals								
Wheat	13.5	12.3	12.7	10.4	12.8	11.4	14.9	16.6
Barley	2.7	2.5	2.6	2.4	2.8	2.3	3.3	3.5
	16.1	14.8	15.3	12.8	15.6	13.7	18.2	20.1
Total Cereals	93.7	76.6	91.1	62.2	93.2	65.8	98.8	83.4
Pulses								
Gram	8.9	5.8	8.0	4.2	8.0	3.6	8.2	6.0
Tur	2.5	1.9	2.5	1.7	2.5	1.1	2.7	1.7
Other	12.4	4.8	11.6	3.9	11.6	3.6	11.7	4.4
	23.8	12.4	22.1	9.8	22.1	8.3	22.6	12.1
Total Foodgrains	117.5	89.0	113.2	72.0	115.3	74.1	121.4	95.5

Source: Directorate of Economics and Statistics.

(RP/mm)
August 23, 1968)

Estimated Response Compared to Actual Production.

	1 1964/65 Base 1/	2 Area Expansion (mil. ha)	3 Increment due to area	4 HYVP Area	5 Expected increment due to HYVP	6 1 + 3 + 5	7 Y Estimate (Unrevised)
Rice	38.0	0.3	0.31	5.3	3.50	41.8	37.9
Maize	4.5	1.0	0.97	0.9	0.45	6.0	6.3
Jowar	9.5	0.7	0.37	1.8	0.90	10.8	10.1
Bajra	4.5	0.8	0.31	1.0	0.25	5.1	5.1
Wheat	12.0	1.4	1.24	6.0	3.96	16.0	16.6
Other	18.5	(0.3)	(0.30)	-	-	18.2	19.6
	87.0	3.9	2.90	15.0	9.06	97.9 2/	95.6 2/

1/ Actual foodgrains output in 1964/65 was 89 million tons. We estimate that better than average weather accounted for 2 million tons output over the base.

2/ Since 1967/68 weather was above average (kharif was about as good as in 1964/65 and rabi probably better and since no account is taken of production programs outside HYVP (notably in irrigation), the variation between columns 6 and 7 is likely to understate the gap between estimated performance and new strategy expectations. Our best guess is that foodgrains production actually reached 98-99 million tons in 1967/68, of which 2-3 million tons might be ascribed to unusually good weather. This leaves a 2 million ton gap explained in large part by inadequate fertilization of HYVP areas, uncertain water supply and unforeseen pest and disease losses on some of the new grain varieties.

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INDIA - AGRICULTURE

Price Changes

	Wholesale Price Indices			
	Cereals	Rice	Wheat	All Commodities
January	186.8	179	181	198.6
February 1967	194.1	184	189	203.0
March 1967	194.5	182	191	203.4
April 1967	192.0	184	183	204.2
May 1967	196.2	191	180	208.4
June 1967	209.4	204	196	214.2
July 1967	225.6	216	218	220.5
August 1967	231.5	230	211	219.6
September 1967	228.1	227	212	220.3
October 1967	220.1	215	217	221.0
November 1967	208.5	202	206	215.2
December 1967	199.9	192	195	210.8
January 1968	208.0	200	212	209.7
February 1968	206.2	204	202	205.2
March 1968	202.2	206	191	199.6
April 1968	202.5	212	182	204.6
May 1968	203.2	217	172	205.7
June 1968	205.7	220	173	205.6

Source: Reserve Bank of India.

(RP/mm)
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INDIA - AGRICULTURE

TABLE 5.

Inter-State Price Differentials
(July 1968)

	Rice (Rs/Quintal)	Wheat (Rs/Quintal)
Andhra Pradesh	106	n.a.
Assam	66	n.a.
Bihar	140	100
Gujarat	n.a.	77
Haryana	84	n.a.
Kerala	96	n.a.
Madhya Pradesh	104	95
Madras	67	79
Maharastra	85	75
Mysore	127	n.a.
Orissa	113	n.a.
Punjab	n.a.	81
UP	119	74
West Bengal	159	78
Rajasthan	n.a.	73

Source: Directorate of Economics and Statistics.

(/mm)
August 30, 1968).

TABLE 6.

INDIA - AGRICULTURE

Selected Targets from 1968/69 Annual Plan.

	1967/68 Achievement (est.)	1968/69 Target.
1. Minor/Medium Irrigation (million acres) 1/		
Potential	20.9	23.1
Utilisation	15.2	19.3
2. Minor Irrigation		
Area (million acres)	3.0	3.6
Loans for minor irrigation (Rs. million)	590.7	1031.0
3. HYVP (million acres)	15.0	21.0 2/
4. Multiple Cropping (million acres)	7.2	15.0
5. Fertilizer Consumption (000 tons)		
N	1,150	1,700
P_2O_5	400	650
K_2O	200	450
Plant protection (million acres)	90	135

1/ Cumulative since First Plan

2/ 8.5 million acres under rice; 5 million acres under wheat and 7.5 million acres under maize, jowar and bajra.

DRAFT

Progress of the New Agricultural Strategy

1. The new agricultural strategy was launched in 1965/66 on the premise that the major bottleneck to agricultural development in India is the lack of modern inputs rather than a restrictive social framework - or the backwardness of the farmer. The main feature of the strategy is a considerable step-up in input availability - mainly high yielding seed and fertilizer under the High Yielding Varieties Program (HYVP). The strategy is also characterized by more groundwater use under private management, more intensive land use through multiple cropping and more diversified institutions at the service of agriculture, notably in the credit field.

2. The two first years of the new agricultural strategy were affected by exceptional drought. Thus, 1967/68 is the first year when adverse weather cannot be said to have annulled the effect of new strategy programs. As always in a country the size of India, the weather picture in 1967/68 has not been good everywhere. Cyclone and drought affected kharif rice production in Orissa and poor October-November rains affected rabi irrigation supplies in Mysore, Andhra Pradesh and Madras. Yet, pre-monsoon and monsoon rains were on the whole good, and winter rains were timely and plentiful. Barring exceptionally poor weather during the rest of the rabi season, the weather factor should have exerted a beneficial influence (or at worst a neutral influence) on production.

3. Advance estimates for 1967-68 put the foodgrains at 95 million tonnes. This is an all-time high for India. It is almost 27 per cent above last year's output. However, output in that year was abnormally depressed on account of the drought. A more sober perspective emerges if this year's production is compared to production in 1964-65 (a good weather year): the implied annual increase is only 2.3 per cent. A still longer view of production trends indicates that a 95 million tonnes crop would merely put production back on the same growth trend about which it has been oscillating since the early fifties. The question therefore arises as to whether a 95 million tonnes crop adequately reflects the efforts which have accompanied the introduction of the new technology.

4. A calculation comparing estimated performance with the expected response of the foodgrains sector to Government programs appears in Appendix A. Given the weaknesses of the data reporting system, this is hardly more than informed guesswork. There is also room for doubt with regard to: (a) base level for calculation 1/; (b) extent of new strategy program coverage; (c) net weather impact on production; (d) importance of area expansion; (e) usefulness of the individual yardstick approach (implying no complementarity in input use and constant returns to scale).

1/ Some long-time observers of the Indian agricultural scene have discerned a declining growth trend for foodgrains production in the early sixties. From their standpoint, even a 95 million tonnes crop represents a record achievement - being above the trend of a declining growth trend line fitted to historical data.

5. On balance, the conclusion emerges that a 95 m. tonnes crop would leave a substantial gap between expected production response and actual agricultural performance. But considering the sad state of production statistics 1/ and the obviously encouraging response of farmers to Government programs, one is tempted to attribute the bulk of the gap to an understatement of the crop. Indeed, many skilled observers of Indian agriculture are talking about a crop around 100 million tonnes this year. An optimistic view is undoubtedly supported by the eagerness with which an upper layer of progressive farmers is taking to the new technology. But a lag between the very high yields achieved by a few farmers and significant increases in yields by a majority of farmers is bound to exist. Whatever the exact levels of production so far, a major task of public policy is the next few years will be to keep this lag to a minimum by attending both to the qualitative and to the quantitative aspects of input use by an increasing number of farmers.

uyyp

6. 1967/68 is the second year of the high yielding varieties program. The official advance estimate of coverage for the year is about 15 million acres but this is based on compilation of State estimates of varying accuracy and may overstate actual coverage by 2-4 million acres 2/. Of course even a coverage of 12-13 million acres would be an impressive achievement over a two-year period.

7. The most successful aspect of the program has been the large-scale introduction of dwarf wheat cultivation in Punjab, Haryana, Uttar Pradesh and Rajasthan. Under favorable conditions (i.e. in well irrigated and drained fields, with adequate fertiliser and improved practices) the new varieties can yield twice or three times as much as the traditional varieties. Some new varieties can be sown late thus opening up profitable opportunities for multiple cropping. 3/ Furthermore, consumer resistance to the dwarf wheats is being broken by the recent release of amber-seeded lines 4/ and

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1/ The Government has initiated improved statistical coverage in two States and two more States may come under this program next year. It will take several seasons for the new statistical apparatus to throw up reliable output data for the country as a whole.

2/ Individual States tend to press for high targets (and to report high achievement) in an attempt to increase their share of scarce supplies - particularly nitrogenous fertilizer. An independent estimate of coverage and better follow-up information on problems of implementation (e.g. through sample survey) is essential for improved management of the new strategy.

3/ Late sowing of Sonora 64 has helped to popularise the following rotations: sugarcane - wheat, potato - wheat, rice - wheat.

4/ Sharbati Sonora released in May 1967 was obtained from Sonora 64 red-wheat Mexican variety by mutation breeding. It is dwarf variety with amber and lustrous grain and good chapati-making characteristics. It has 15-25 per cent more protein than its parent. Other available amber-seeded dwarfs include S308, S227, Sona 227, Kalyan 227 and Safed Lerma.

rust disease problems have not proven serious so far. Already dwarf wheat cultivation could have covered 4-5 million acres during the 1968 rabi season.[1] It could well spread over 10-11 million acres next year, representing the bulk of the irrigated wheat acreage. Uniformly high yields over this acreage will, of course, await qualitative improvements in input use including more widespread use of the seed drill, land levelling, and timely irrigation.

8. India's rice economy has also received a significant boost following the introduction of new, fertilizer responsive, dwarf varieties of paddy, which, under favorable conditions, also yield two to three times more than traditional paddy varieties. However, it is apparent that a breakthrough of the same magnitude as for wheat has yet to materialize even though with the traditional improved varieties there is scope for considerable progress through double cropping, increased fertilizer use and better practices. Dwarf rice cultivation in 1967/68 may have covered 4-5 million acres, i.e. 15-18 per cent of the irrigated rice acreage. However, further expansion may prove more difficult than for wheat as the imported exotic varieties of paddy have proven less adapted to the Indian environment. In several areas of the Center and South, the severe incidence of blight disease and gall midge attack under high moisture condition has discouraged kharif cultivation of TN1 and IR8. Another stumbling block (aggravated by the food zones) has been the absence of high yielding lines with grain shape and cooking characteristics prized by the Indian consumer. Fortunately, research already underway is likely to break this bottleneck within a few seasons.

9. High yielding (hybrid) varieties of maize, jowar and bajra may have been cultivated over 3-4 million acres in 1967/68. This represents only 4-5 per cent of the aggregate area under these crops. As in the case of paddy, the genetic base of the hybrid program is relatively narrow as a result of inadequate public support of research activity.[2] Expansion of the area under hybrid jowar has been set back by the high susceptibility of the released hybrids to attack by the shoot fly. Similarly, released varieties of bajra have provided insufficient protection from bird attack. More significantly, progress of the hybrid program has been set back by poor seed quality [3] partly the result of an inadequate policy framework

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1/ The Government's advance estimate for wheat under HYVP coverage is 6 million acres but this includes some improved non-dwarf varieties.

2/ Coordinated research projects for the wheat, maize, sorghum and millet programs have been under official consideration for almost two years. It seems that red tape and issues of State - Center financing (rather than the amounts involved: Rs. 22 million till 1970) have delayed approval. It is noteworthy that in 1965/66 tobacco received more financial support from the Center than all the foodgrains combined.

3/ There is likely to be enough certified seed output to double (or perhaps treble) the area under hybrids next year (1968/69). However, problems of processing, distribution, storage, and quality control have if anything increased with the rapid expansion of the program.

for private hybrid seed production. However, with the enactment of a Seed Act, better quality controls, an expanded processing industry and a new seed policy under active consideration by the Government, the basis for sound private seed activity is likely to be laid soon.

Water

10. The new agricultural strategy emphasizes the full utilization of available water supplies. Under HYVP, scarce inputs are channelled to areas which (at least in theory) enjoy assured water supply. However, in practice, even districts listed in this category are very much dependent on favorable rainfall for satisfactory production performance. Environmental limitations are compounded by the reluctance of most States to focus staff and resources in limited areas, leading to a thin spread of HYVP - over some 250 districts. The inadequacy of irrigation systems within most of these districts may have been a limiting factor to the penetration and spread of the new technology.

11. With the exception of jowar and bajra, assured water is indispensable to the expansion of the new agricultural strategy. Unfortunately, more than half of India's irrigated area of about 90 million acres is fed by minor tanks, shallow wells and minor diversion works with insufficient water reserves for long dry spells - when water is most needed. A substantial proportion of the remainder is served by extensive canal structures designed for drought protection rather than for intensive year-round cultivation and operated in such a way that farmers at the tail-end of the system can never be sure that they will receive sufficient water at the right times to raise good crops. Against this background, it is not surprising that with the advent of the new technology, a great number of farmers have been eager to relax the constraint of inadequate water systems through investment in minor irrigation - often within the command areas of major irrigation schemes.

12. Reliable figures on the progress of minor irrigation under the new strategy are hard to come by. Yet, available statistics as well as field observations point to an impressive private irrigation boom. Before the new strategy was initiated, a total of about 400,000 wells were energized. In 1965/66, the annual rate of electric pumpset connections rose to 105,000. For the past two years, it has levelled off at about 140,000. But demand is still running ahead of supply. The waiting list is now about 250,000 and only lack of finance for transmission and connection is said to prevent the State Electricity Boards from raising the annual connection rate to 180,000. Private demand for tubewells in the Indo-Gangetic and coastal plains also exceeds public and private capacity to provide the necessary materials, supplies and supporting services.[1/] A major task of public policy in coming years will be to step up the level of these services

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1/ In broad orders of magnitude there may now be about 150,000 private tubewells in India irrigating about 3 million acres and 13,000 State tubewells commanding about two million acres.

several times over present levels. This will involve the design and operation of expanded credit services to farmers and contractors, the implementations of comprehensive groundwater surveys [1] as well as a step-up in power transmission and connection programs.[2]

13. Another unfinished task in the water field is the rational utilization of past investments in major and medium-sized irrigation projects.[3] The ultimate irrigation potential of the schemes initiated to date is estimated by the Central Water & Power Commission at about 44 million acres, of which about 28 million acres may be utilized. One obstacle to a fuller utilization of the country's water potential is the lack of trained personnel for soil and water management programs. In order to meet this need and develop field-tested standards for irrigation, drainage and land shaping designs, the Government has initiated pilot projects in three representative areas of the country: Mysore (black cotton soils); Punjab (drainage problems); UP (groundwater management). The Government is also considering implementation of more projects of this kind, particularly in delta areas. The use of credit by ARC (Agricultural Refinance Corporation) as a means of accelerating land development operations within the command area of major irrigation schemes (Nagarjunasagar, Tungabadra) as well as the improved coordination in these areas of the numerous public and private actions aimed at watershed development illustrates a new approach to irrigation policy. Already water utilization in the past two years is reported to have increased by 2 million acres per annum as compared to an average of one million acres a year during the early sixties.[4] Yet, as things stand now, clearly not enough resources are being provided to ensure a steady expansion of the area in which water supplies and water control are adequate to realize the potential benefits of other agricultural inputs. An urgent need is for investment-oriented basin-wide studies.

Fertilizer

14. The new agricultural strategy is heavily dependent on a stepped-up fertilizer program. This is largely because the dwarf and hybrid varieties

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1/ In most areas, lowering of the water table has not proved a serious problem so far. However, the risk of proceeding without adequate hydrological data will increase as the program expands.

2/ A useful financing device used by some State Electricity Boards is to sell debentures directly to farmers who can use the debentures as security for borrowing from the Land Mortgage Banks and are ensured priority in the electrification program of the Boards. This device may have financed 5,000 connections last year. Methods to involve the commercial banks in similar financial devices are being looked into.

3/ Only about half of the 500 medium and major irrigation schemes undertaken since 1951 have been completed. However, nine major schemes account for a substantial proportion of the unused potential (Annex 3).

4/ These figures should be viewed as broad orders of magnitude based on water releases rather than on accurate area surveys.

require two to three times the fertilizer dosage recommended for ordinary varieties. At low level of fertility, India's traditional improved varieties yield almost as well as the dwarfs and hybrids. Furthermore, they require less care and water, fetch a better price and produce relatively more fodder than the HYVP varieties. The incentive to use high yielding seed is therefore intimately linked to the ease with which fertilizer can be obtained.

15. Since the beginning of the new strategy, nitrogenous fertilizer availability has risen by more than 40 per cent a year (compared to an average of 22 per cent in the early sixties.) Despite this, demand pressures have remained high because of the sharply increased fertilizer absorption of the new technology. To illustrate, the official HYVP targets have implied nitrogenous fertilizer requirements which account for the bulk of increased supplies of N (Annex 6). As a result, pressures to expand the area and crop coverage of HYVP have arisen and rationing of supplies by the public distribution system (still the dominant factor in nitrogenous fertilizer allocation) has continued to be a thankless task.

16. The fertilizer supply situation will considerably ease next year. In fact, nitrogen availability already improved in rabi 1968 following late arrivals and slow unloading of 1967 imports contracted for kharif 1967 (Suez, port congestion). The carry-over into 1968-69 may be of the order of 300,000 tonnes. Since import contracts for approximately 800,000 tonnes have already been passed and indigenous production is likely to exceed 600,000 tonnes, the situation could well arise when, for the first time, limitation in fertilizer demand rather than supply would stand in the way of reaching the Government's nitrogen consumption target (1.7 million tonnes). Phosphate and potash supplies are also easing considerably following improved arrangements for imports of sulphur, phosphate rock and potash.

17. Given the abysmal average level of fertiliser consumption in India, and the new attitude of the Indian cultivator towards chemical fertilizers, a buyer's market for fertilizers seems to be an unlikely prospect for the next few years provided arrangements for credit, distribution and sales promotion receive adequate attention. Reliance on public, mixed as well as strictly private manufacture and sales should help ensure that sales considerations are given sufficient weight in the fertilizer program. But to this end, the Government's liberal fertilizer distribution policies should implemented by all major States.

18. Long term prospects for fertilizer consumption will depend on whether the momentum of the agricultural revolution can be maintained into the seventies i.e. essentially on whether adequate water development programs are implemented in time and better supporting services become available to the commercial farming community.

Credit

19. The cooperatives are the main source of short-term credit to farmers. They now handle about 3,500 million worth of lending a year - of which about Rs. 1,000 million is for fertilizer. But on the basis of the Government's fertilizer consumption targets, the magnitude of farmers' short-term credit needs for fertilizers alone has been estimated at Rs. 5,200 million by 1970-71.

representing an increase of more than 30 per cent a year over present levels.[1/] In order to help meet the increasing demand, far-reaching steps must be taken to equip the co-operative credit institutions to improve their operations. New institutional devices (including the commercial banks) must be found to supplement the cooperatives, particularly in areas where they are weak. In this connection, it would undoubtedly be expedient to make use of private input dealers and perhaps the traditional money-lending channels, to support the rapidly expanding use of modern inputs.

20. In the term lending field, substantially stepped-up financial services to the progressive farming sector are emerging through more flexible procedures and additional branch facilities by Agro-Industries Corporations, Land Mortgage Banks and commercial banks. The loan advances made by the Land Mortgage Banks for medium and long term credit needs of owner cultivators have risen from about Rs. 120 million in the early sixties of Rs. 560 million in 1965-66 and Rs. 830 million in 1967-68. The 1968-69 credit target is Rs. 1,040 million. Perhaps as important as the increase in the scale of Land Mortgage Bank credit has been the gradual re-orientation of its lending towards productive purposes. However, there are many States where Land Mortgage Banks are weak. In order to meet the growing term lending needs of farmers, policies are being designed to encourage increased agricultural activity by the commercial banks. Already, expanded rediscounting facilities (through the Agricultural Refinance Corporation) and lower reserve requirements for agricultural loans have been instituted by the Reserve Bank. Hire-purchase credit for tractors, sprayers, pumpsets is expanding. As tractor production moves up to substantially higher levels (from 5,000 in 1964 to an estimated 18,000 in 1968) and, generally speaking, as the manufacturing sector begins to respond more and more to the demands of the progressive farmers, credit could become a bottleneck to the modernization of Indian agriculture.

Prices

21 For the farmers which are the main focus of the new agricultural strategy (those in water secure areas) recent economic circumstances have been propitious. The surge in food prices following two drought years has rapidly reversed the gradual drift against the cereal farmer's terms of trade of the late fifties and early sixties. But with the return of the good weather, the cereal price index is declining. It dropped 11 per cent from October 1967 to February 1968 (as compared with a 17 per cent rise for the corresponding period last year).

1/ See the excellent Report of the Fertilizer Credit Committee of the Fertilizer Association of India, 1968. (p. 221). Early implementation of this report's recommendations to handle the increased credit demand is essential to the progress of the new strategy. Another official report sponsored by the Reserve Bank on the total rural credit picture is expected soon.

22. The need to revive the industrial economy and to curb inflation militates for food prices substantially lower than prevailing in mid-1967. On the other hand, the Government realizes that a foodgrains price slump below incentive levels must be avoided to maintain the momentum of technical progress in rural areas. This is translated in a readiness to purchase any amount of grain offered at the procurement price (thus making the procurement price a guaranteed floor price). The procurement price announced for common white wheat for rabi 1968 (Rs. 76 a quintal) compares with pre-harvest (February) prices around Rs. 76 - 80 per quintal in Punjab and Haryana and around Rs. 105 - 115 in Uttar Pradesh. Of course, the policy test will consist in making/guarantee hold despite heavy market arrivals expected in the Punjab during April, May and June. The removal of most central subsidies on public distribution of cereals was designed not only as an additional step towards normalcy in foodgrains trade (and as a budget-saving measure) but also as a step to avoid excessive price declines. 1/

23. Because of the large demand to replenish farmers and traders stocks in the Center and South, the total removal of food zoning would have facilitated the fulfillment of the Government's incentive price policy. In addition, such a course would have eliminated the irksome and wasteful price disparities (over and above transfer costs) which have narrowed since last year, but remain significant. For example, the price for coarse rice in Orissa is Rs. 15-30 per quintal below the Bihar price - as compared to a differential of Rs. 65-85 at the same time last year. Similarly, the Uttar Pradesh - Punjab wheat price differential is about Rs. 10-12, compared to Rs. 20-35 last year.

24. The Government recognizes the imperfections of the food zone system. But it views the bumper rabi crop as an opportunity to gain a stronger position on the foodgrains market through expanded procurement and buffer stock build-up. Procurement of kharif foodgrains was disappointing: it is unlikely to yield more than 3.5 - 4.0 million tonnes (as against an original target of 7 million tonnes). By bottling up wheat supplies in an enlarged Northern zone comprising Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir and Delhi, the Government hopes to be able to procure 1.5 - 2.0 million tonnes of rabi foodgrains (as against an original target of 4 million tonnes). Without a monopoly position over long haul transfers of grain it feels that such procurement is unlikely to be reached at official prices. However, further zoning may be considered if the 1968 monsoon proves favorable and a substantial buffer stock has been set aside.

1/ Since January 1968, the issue price for coarse rice went up from Rs. 80 to Rs. 96 a quintal while the issue price for imported wheat went up from Rs. 55 to Rs. 67 a quintal.

25. A foodgrains crop of 95 - 97 m tonnes unless supplemented by imports would mean a per capita availability of only 152 - 156 Kg per capita (taking account of probable private stocks variations). This would only be marginally higher than availability during the past two years of acute scarcity and might imply continued pressures on food prices - a risk which the Government is reluctent to take. Foodgrains imports are therefore needed this year - quite apart from the requirements of Government stocking. With the maintenance of food zones, the public distribution system would need 8-10 m. tonnes for routine transfers and Government welfare objectives. Given the requirements of its buffer stock policy (3 m. tonnes by the end of the year), and a domestic procurement level which may reach 5-6 million tonnes, the Government estimates the year's import demand at 6-8 m. tonnes. All in all, skillful management will be required to strike a favorable economic balance between the varied objectives of the Government's food policy.

26. Implementation of the Government's price stabilization objectives requires additional storage. Total storage space available to the food agencies is now estimated at 5.2 million tonnes. A crash program initiated in the Punjab will only make a marginal addition to these facilities. In addition to expansion and modernization of facilities, there is need for a gradual shift of focus of the storage program from the ports to the interior. However, regional storage needs will depend on the future foodgrains movement policy of the Government.

Prospects

27. A projection of foodgrains production appears in Annex 12. It is based on Draft Fourth Plan Outline input targets for 1970-71 and on currently used yardsticks (which would be consistent with an output of 97-98 million tonnes this year). It assumes that multiple cropping benefits are already counted under the heading of minor irrigation and it takes no account of potential benefits from large scale irrigation projects. It yields a foodgrains output level of about 114 million tonnes in 1970-71 (6 million tonnes below the Government's official target). While not much should be made of this kind of rough arithmetic, the exercise does emphasize a view prevalent in many policy-making circles that existing fertilizer availability targets should be viewed as minimum requirements and that increased emphasis on water should characterize agricultural programs during the next few years.

28. There is no conclusive evidence yet that agriculture has embarked on a higher growth path as a result of the Government's new agricultural strategy. On the other hand, the trends in public and private agricultural activity described in this paper suggest that the agricultural economy is indeed picking up speed. In order to maintain the momentum generated by the growing acceptance of high yielding seed by Indian farmers, the Government will need to: (a) strengthen its support for research; (b) devote additional resources to water development; (c) maintain the priority of the fertilizer production and import programs; (d) build up stronger and more effective supporting services for the progressive farming sector; (e) remove the burden of archaic foodgrains marketing practices.

INDIA - 1968

Estimated Production Impact of the New Strategy

1. In order to assess the impact of the new agricultural strategy against the Government's targets, one needs a production base from which to start. It seems natural to pick 1964-65 as the base: this is the last agricultural year preceding the introduction of the new technology on a substantial scale. It is also the most recent year with production statistics relatively free from political bias. Foodgrains production during that year reached 89 million tonnes. However, this was, in part, a reflection of relatively good weather. A statistical analysis of production trends suggests that India's foodgrains potential for that year is nearer 87 million tonnes: this is the computed value obtained by fitting a constant growth curve to 1950/51 - 1963-64 production data. It falls midway between estimates computed on the basis of 3-year and 5-year moving averages and it is consistent with earlier official estimates of the 1965-66 production potential base (90 million tonnes).

2. Agricultural development schemes can generally be described in terms of physical units of works or supplies or (for a given input-mix) in terms of area coverage. The planning "yardsticks" in use in India measure, for the country as a whole, the average output expected from each physical or area unit involved in major works or supply schemes.[1/] Some important yardsticks at present in use at all-India level are listed below. They refer to the three main components of the new agricultural strategy.[2/]

Table I : MAJOR PRODUCTION YARDSTICKS [3/]
(in terms of incremental foodgrains production)

High Yielding Varieties Program	:	0.6
Fertilizer		
N	:	10.0 MT per MT (nutrient)
P_2O_5	:	6.0 MT per MT (nutrient)
Minor Irrigation	:	0.2 MT per acre

1/ The use of individual yardsticks assumes that benefits from each individual measure are additive. In fact, there is a close interdependence between all production factors so that the resultant benefits of a combination of measures may be either more or less than the sum of individual yardsticks.

2/ Yardsticks also exist for land improvement schemes, application of manure and improved seeds distribution. But, in order to lean on the side of caution, these yardsticks have not been taken into account in the assessment which follows.

3/ The HYVP yardstick is derived from Table A.1 attached. The other yardsticks are derived from Report on Estimation and Assessment of Production Potential of Crops, Ministry of Food and Agriculture, 1968.

3. As already noted, much of the impetus behind the new strategy results from the introduction of fertilizer responsive cereal grain varieties and their growing acceptance by farmers. The current agricultural year is the second of the High Yielding Varieties Program (HYVP). The official advance estimate of 1967/68 coverage is about 15 million acres. However, spot checks indicate that this may be an overestimate and that 13 million acres could be a better approximation of coverage. On the basis of the HYVP yardstick, this implies an addition of 7.8 million tonnes of foodgrains over the 1964/65 base (Annex 3).

4. The full impact of increased fertilizer supplies on foodgrains production is difficult to assess given the lack of reliable data on consumption. According to rough estimates which appear below, the response of traditional foodgrains varieties to increased 1967/68 fertilizer supplies might be in the neighborhood of 1.6 million tonnes.

Table II : PRODUCTION RESPONSE OF TRADITIONAL VARIETIES TO : N AND P_2O_5

(000 MT)

	N	P_2O_5
Increment 1967/68 over 1964/65	610	330
Less HYVP Requirements	460	210
Residual	150	120
Of which, applied on traditional varieties 1/	105	65
Response	1,050	510

5. Minor irrigation under private management has received official encouragement under the new strategy. The official projection of minor irrigation expansion between 1964-65 and 1967-68 is in the neighborhood of 9-10 million acres. It is estimated that about 80 percent of the irrigated area is under foodgrains so that, using the relevant yardstick of Table I, the expected contribution of the minor irrigation programs to India's foodgrains production potential works out to about 1.4 - 1.6 million tonnes.

6. Other components of the new agricultural strategy include:

(a) multiple cropping: the promotion of multiple cropping in areas having adequate irrigation may have covered 7.5 million acres in 1967/68. This program is linked to the availability of new short-duration cereal varieties but it is not clear how much of the expanded acreage has actually gone into foodgrains and how much into groundnut, cotton and other commercial crops;

1/ Arbitrarily taken as 70 percent of the residual.

(b) expanded plant protection measures: the acreage treated against pests and diseases is estimated to have tripled over the past two years reaching an estimated 126 million acres during 1967/68;

(c) mechanization: domestic production and imports of wheel tractors and power tillers has also tripled over the past three years. Total tractor requirements for the year are estimated at 25 thousand units.

To a large extent, those programs are complementary to those geared to the distribution of high yielding seeds and chemical fertilizers: no additional productive response has therefore been assumed on their account.

7. The minimum aggregate 1967/68 production response to the new strategy as it emerges both from official yardsticks and reasonable expectations of program coverage appears below. It conservatively assumes no increase in the area under foodgrains. It suggests that a 95.0 million tonnes crop in 1967/68, if confirmed, would leave little room for complacency as it would imply a gap of nearly 3 million tonnes (or about 25 percent) in relation to the expected impact of the new technology. There is, of course, room for reasonable doubt with regard to the appropriate base level for the calculation, to the net influence of the weather factor this year and (from a methodological standpoint) to the usefulness of the individual yardstick approach. On balance, given the obviously encouraging reaction of farmers to Government programs and taking account of the sad state of agricultural statistics in India, one would be tempted to attribute the bulk of the calculated gap to an understatement of the crop.

Table III : EXPECTED 1967/68 PRODUCTION COMPARED TO ESTIMATED PERFORMANCE

Expected HYVP Response	7.8 m. tonnes
Expected Fertilizer Response of Traditional Varieties	1.5 m. tonnes
Expected Minor Irrigation Response	1.4 m. tonnes
Other Programs	no allowance
Total Expected Response	10.7 m. tonnes
Base for 1964-65	87.0 m. tonnes
Total Expected Production	97.7 m. tonnes
Actual Estimated Production	95.0 m. tonnes
Gap	2.7 m. tonnes

Table No. 1

Estimated HYVP Production Response Compared to Actual Production

	1 1964/65 Production Base (Million MT)	2 1967/68 HYVP Estimated (Million acres)	3 Original 1/ Yardstick (MT/acre)	4 HYVP Increment (Million MT)	5 1967/68 Production Base 2/ (Million MT)	6 Actual 1967/68 Estimate (Million MT)
Rice	38.0	5.3	0.66	3.50	41.50	40.50
Maize	4.5	0.9	0.50	0.45	4.95	5.00
Jowar	9.5	1.8	0.50	0.90	10.40	10.50
Bajra	4.5	1.0	0.25	0.25	4.75	5.00
Wheat	12.0	6.0	0.66	3.96	15.96	15.00
Other	18.5	-	-	-	18.50	19.00
	87.0	15.0	0.60	9.06	96.06	95.00

1/ The maize, jowar and bajra yardsticks are those set forth in Indian Economic Policy and the Fourth Five Year Plan, Volume II - Agricultural Policy in India, IBRD Report, May 23, 1967 on the basis of official statements. The wheat and paddy official yardsticks which stood at 1.00 MT/acre have since been reduced to 0.66 according to information furnished by the Directorate of Economics and Statistics.

2/ On account of HYVP alone.

ANNEX I

PRODUCTION OF FOODGRAINS

	1964/65 (Partially revised)	1965/66 (Partially revised)	1966/67 (final)	1967/68 1/ (Est.)
Kharif Cereals				
Rice	39.03	30.66	30.44	40.50
Jowar	9.75	7.53	8.94	10.50
Bajra	4.45	3.66	4.50	5.00
Maize	4.66	4.76	4.99	5.00
Ragi	1.90	1.18	1.60	2.00
Small Millets	1.95	1.66	1.67	2.00
	61.75	49.43	52.15	65.00
Rabi Cereals				
Wheat	12.29	10.42	11.53	15.00
Barley	2.52	2.38	2.45	2.50
	14.81	12.80	13.98	17.50
Total Cereals	76.56	62.23	66.13	82.50
Pulses				
Gram	5.79	4.21	3.61	5.50
Tur	1.89	1.74	1.73	2.00
Other	4.77	3.85	3.53	5.00
	12.44	9.80	8.92	12.50
Total Foodgrains	89.00	72.03	75.05	95.00
Trend Line Projection 2/	87.30	89.70	92.20	94.80

Source: Ministry of Food & Agriculture

1/ This is only an informal guess as the detailed State returns for the Kharif season were not available.

2/ Extrapolation of a constant annual growth curve fitted to 1950-196[illegible] data. The exercise yields an annual growth rate of 2.6 per cent.

ANNEX 2

High Yielding Varieties Program

(000 acres)

	1966/67 Target	1966/67 Estimated	1967/68 Target	1967/68 Estimated	1968/69 Target	1970/71 Target
Kharif						
Paddy	1,540	1,258	4,137	3,583	7,561	
Maize	488	342	1,183	606	1,459	
Jowar	342	117	1,461	780	2,720	
Bajra	283	101	1,077	929	2,777	
Total	2,653	1,818	7,858	5,898	14,522 2/	
(%)	(100.0)	(68.5)	(100.0)	(75.1)		
Rabi						
Paddy	1,715	937	2,022	1,650 1/		
Maize	422	171	483	250 1/		
Jowar	585	354	1,159	1,000 1/		
Bajra	93	44	150	100 1/		
Wheat	1,593	1,337	4,562	6,000 1/		
Total	4,423	2,848	8,376	9,000	6,478 3/	
(%)	(100.0)	(64.3)	(100.0)	(107.4)		
Total for year	7,081	4,661	16,234	14,898	21,000 3/	32,000
(%)	(100.0)	(65.8)	(100.0)	(91.8)		

Not available

Source: Ministry of Food & Agriculture

1/ An informed guess based on a conversation with the Extension Commissioner.

2/ The source for this figure and the kharif breakdown is a Ministry of Agriculture booklet entitled "Breakthrough in Agriculture through Better Seeds" (1968).

3/ This target is preliminary. If the kharif target is kept at 14.5 million acres, the rabi and total targets may well be raised.

ANNEX 3.

Information on Important Irrigation Projects

Included in the 1967-68 Plan.

	Estimated Cost	Spent Up to March'68	Ultimate Irrigation Potential (000 acres gross)	Potential created (March'67) (000 acres gross)	Potential Utilized (March'67) (000 acres gross)
Nagarjunasagar (AP)	1,600 1/	1,327	2,200	650	15
Gandak 2/ (Bihar & UP)	1,417	498	3,560	-	-
Kangsabati (West Bengal)	360	204	950	130	72
Mahanadi Delta (Orissa)	343	263	1,610	720	610
Rajasthan Canal (Rajasthan)	747	505	1,300	273	137
Tungabadra (AP and Mysore)	500	193	820	780	670
Kosi (E) (Bihar)	450	406	140	67	50
Chambal (MP and Rajasthan)	743	641	140	89	31
Perambi Kulam Ahyar	379	360	240	75	18
	6,539	4,397	10,960	2,784	1,595

1/ Includes power

2/ Nepal also deserves benefits from this project

ANNEX 4

Rural Electrification.

	States	Approved programme 1967-68		States capacity for energising pump sets 1967-68		No. of applications pending (March 31, 1967)
		Outlay (Rs 00000)	Target	Outlay (Rs 00000)	Target	
1.	Andhra Pradesh	384	15000	534	19,000	79,897
2.	Assam	60	100	60	1,000	nil
3.	Bihar	650	15000	800	19,000	24,532
4.	Gujarat	350	7620	550	11,820	14,000
5.	Haryana	150	3000	250	5,000	13,000
6.	Jammu & Kashmir	45	100	45	100	Nil
7.	Kerala	40	1000	100	2,500	900
8.	Madhya Pradesh	217	5000	350	9,000	6,800
9.	Madras	600	30000	700	35,000	27,800
10.	Maharashtra	720	10300	800	11,800	not available
11.	Mysore	600	20000	600	20,000	14,178
12.	Orissa	88	1600	100	1,800	330
13.	Punjab	350	7000	450	9,000	24,634
14.	Rajasthan	175	4000	250	5,800	10,757
15.	Uttar Pradesh	750	17000	1350	30,000	27,126
16.	West Bengal	200	2500	300	4,000	547
17.	Nagaland	06	-	46	Nil	-
	Total (States)	5385	1,40,120	7,283	1,84,820	2,44,921

Source: Planning Commission.

Annex 5

Minor Irrigation

	Status at End of Third Plan 1965/66	Estimated construction during 1966/67	Estimated construction during 1967/68	Target for 1968/69
Nos. Wells (000)				
Boring and deepening of Dug Wells	205.00	130.00	140.00	150.00
Construction of Shallow Tubewells 1/ - Private	90.00	32.00	42.00	52.00
Construction of Deep Tubewells - State	11.90	1.00	1.00	1.50
Nos. Pumpsets (000)				
Electric	498.80	137.00	140.00	
Diesel	535.20	78.00	75.00	250.00

Source: Ministry of Food and Agriculture

1/ Including "filter points", a name for shallow tubewells sunk in sandy soils in Madras State.

A. Fertilizer Consumption
(million MT)

	N	P_2O_5	K_2O
1964-65	0.49	0.15	0.08
1965-66	0.58	0.13	0.09
1966-67	0.83	0,28	0.13
1967-68 (est.)	1.15	0.50	0.20
1968-69 (proj.)	1.70	0.65	0.45
1970-71 (proj.)	2.40	1.00	0.70

B. Nitrogen Availability
(000 MT)

	1 Production	2 Imports	3 Total	4 Increase	5 HYVP Demand	%
1965-66	238	376	614	-		
1966-67	309	575	884	270	250	93.
1967-68 (est.)	360	900	1,260	646	570	88
1968-69 (proj)	600	1,100	1,700	1,086.	740	68
1970-71 (proj)	1,300	1,100	2,400	1,786	1,140	64

Source: Ministry of Food and Agriculture
Fertilizer Association of India.

Annex 7

Index Numbers of wholesale prices

(1952-53 = 100)

	Agricultural Commodities	Total	Foodgrains	Rice	Wheat	All Commodities
March 1956	96	95	86	88	83	99.2
March 1957	106	102	96	98	94	105.1
March 1958	102	103	91	102	84	106.1
March 1959	113	113	102	92	110	112.1
March 1960	117	116	100	106	92	118.7
March 1961	126	118	99	101	92	127.5
March 1962	119	118	100	103	92	122.9
March 1963	121	124	102	111	86	127.3
March 1964	138	141	124	122	113	138.9
March 1965	154	154	142	128	144	151.0
March 1966	178	175	156	158	136	174.0
March 1967	214	218	201	183	190	202.9
January 1968		238	221	200	212	210.0

Annex 8

Inter-State Price Relationships

(Coarse milled rice)

	Rs. per quintal January 1968	
Madras (Kumbakonam)	67.25	
Kerala (Trivandrum)	96.00	
Ratio		143
Andhra (Vijayawada)	73.72	
Mysore (Shimoga)	118.00	
Ratio		161
Orissa (Sambalpur)	85.00	
Orissa (Cuttack)	96.00	
Average Surplus	90.50	
Bihar (Dumka)	136.64	
West Bengal (Contai)	171.20	
West Bengal (Sainthia)	122.00	
Average Deficit	143.00	
Ratio		158
Madhya Pradesh (Raipur)	95.00	
Maharashtra (Nagur)	101.82	
Ratio		107

ANNEX 9

Ratio Price Index to Total Commodities Index

	Agricultural Commodities	Food	Foodgrains	Rice	Wheat
1965					
March	102.0	102.0	94.0	85.0	95.5
June	101.0	101.5	87.5	81.0	83.5
September	102.5	103.0	92.5	86.0	84.0
December	104.0	102.0	91.0	87.0	83.0
Average	102.4	102.1	91.0	85.0	87.0
1966					
March	102.0	100.5	89.5	91.0	78.0
June	102.5	103.0	90.0	89.5	76.5
September	103.5	104.5	91.5	91.3	78.2
December	103.5	105.0	97.0	89.5	88.0
Average	103.0	103.4	92.0	90.0	80.0
1967					
March	104.0	107.5	99.0	90.0	93.5
June	102.5	114.0	106.0	98.0	98.0
September	103.0	118.0	109.0	100.5	95.0
December	105.0	112.5	102.0	91.5	88.0
	103.6	114.0	104.0	94.0	85.0

Ratio of wholesale prices of selected items of wholesale cereal price index

	All Manufacturers	Iron & Steel	Fertilizer	Cement	Cotton Mfg.	Kerosene
1960	108	140	91	128	121	89
1961	125	148	94	136	125	97
1962	121	149	87	140	122	94
1963	117	145	83	137	120	117
1964	101	126	69	117	102	101
1965	101	125	63	116	96	99
1966	97	n.a.	n.a.	n.a.	90	n.a.
Dec.30,1967	83	108	62	97	79	79

ANNEX II

Indices of Food Policy 1963-1967, and Projection for 1968

	1963 (est.)	1964 (est.)	1965 (est.)	1966 (est.)	1967 (est.)	1968 (proj.) 1/
1. Gross Production (m. tonnes)	80.2	80.6	89.0	72.0	75.1	95.0
2. Net Production (m. tonnes)	70.1	70.6	77.9	63.0	65.7	83.1
3. Imports (m. tonnes)	4.6	6.3	7.5	10.3	8.7	7.0
4. Public stock increase (m. tonnes)	-	-1.2	1.1	0.1	-0.4	3.0
5. Net availability (m. tonnes)	74.7	78.1	84.3	73.2	74.8	87.1
6. Population (m.)	464	476	487	499	511	52[illegible]
7. Per capita availability 2/ (Kg/year)	162	164	173	147	146	166
8. Per capita availability 2/ (Oz/day)	15.6	15.8	16.7	14.2	14.1	16.0
9. Marketable surplus 3/ (m. tonnes)	21.0	21.2	23.3	18.9	19.6	24.9
10. Procurement (m. tonnes)	0.8	1.4	4.0	4.0	4.3	5.5
11. Public Distribution (m. tonnes)	5.2	8.7	10.1	14.1	13.0	9.5
12. Foodgrains Price Index (June)	111.5	134.2	140.0	168.0	231.0	n.a.
13. All Commodities Index (June)	134.0	146.8	158.3	186.2	217.0	n.a.
14. Relative Foodgrains Price (12/13)	83	92	89	91	106	n.a.

1/ This is the policy alternative which emerges from official Government statements. It assumes the maintenance of the food zone system.

2/ Excluding private stock variations on which no reliable data are available.

3/ Arbitrarity taken as 30 per cent of net production.

Projection for 1970/71 1/

	Base 1964/65	Assumed 1967/68	Projected 1970/71
HYVP (Million acres)	-	13.00	32.50
N requirement (million MT)	-	0.53	1.14
P_2O_5 requirements (million MT)	-	0.22	0.46
Total N. Supplies (million MT)	0.50	1.10	2.40
(On Traditional FG Varieties)	0.38	0.49	0.53
Total P_2O_5 Supplies (million MT)	0.15	0.50	1.00
(On Traditional FG Varieties)	0.11	0.20	0.28
Increase in Minor Irrigation (million acres)	-	9.0	21.00
Production (million MT)	89.00	97.80	113.9
Net Production (million MT)	77.87	85.6	99.7
Imports (million MT)	7.45	7.0	-
Government Stock Increase (million MT)	1.06	3.0	
Consumption per capita (Kg./year)	173	171	177
Population (million)	487	524	563
INCREMENTS OVER BASE (87 m. tonnes in 64-65)			
HYVP		7.80	19.5
N/P_2O_5 on Trad. Var.		1.56	3.2
Minor Irrigation		1.45	4.2
		10.81	26.9

1/ The assumed yardsticks are: HYVP - 0.60 MT/acre; N on trad.varieties - 10.0 kg/kg; P_2O_5 - on trad. varieties - 6.0 MT/MT; Minor Irrigation - 0.2 MT/acre.

FOOD GRAIN PRODUCTION AND IRRIGATION DEVELOPMENT

Introduction

1. About 50% of India's land area, equivalent to some 390 million acres, is arable.1/ The net area under cultivation is about 330 million acres. Two crops per year are grown on about 65 million acres. The total area cropped in any one year is thus around 400 million acres.

2. Some 300 million acres, i.e., 75% of the cropped acreage, are devoted to food grain production. Most important is the grain grown during the summer (wet season, or kharif, crop) with around 90 million acres of rice and 95 million acres of sorghum and millets. During the winter (dry season, or rabi, crop) cereals, principally wheat, account for another 40-45 million acres. The remainder is mainly pulses and maize.

3. Food grain output fluctuates significantly from year to year. The most important determinants of annual production are the area sown to grain crops and the timeliness and intensity of the monsoon rainfalls. No sustained improvement in the national trend of average yield levels is as yet discernible, though in localized areas impressive progress has been achieved. The crop year 1967/68 was a record, with an estimated grain crop of 95.5 million metric tons. This was, however, only 6.5 million tons higher than the 1964/65 crop of 89 million tons. Because of adverse weather conditions and reductions in the areas sown to food grain crops the annual production in 1965/66 and 1966/67 was 72 million tons and 74 million tons respectively.

4. Various types of irrigation facilities serve a gross command area 2/of slightly more than 100 million acres. The area actually irrigated was estimated at about 63 million acres for the production year 1965. In many areas irrigation facilities are used as drought insurance only. They provide supplementary water if the rains are late or insufficient but often do not provide adequate water control. Even for major surface irrigation systems the design criteria has often been to maximize the area commanded rather than to optimize water deliveries per unit of land. This makes even irrigated land very vulnerable to rainfall fluctuations as evidenced by the effects of the severe droughts of 1965/66 and 1966/67.

1/ FAO Production Year Book 1967, Vol. 21, Rome, 1968.

2/ Gross command area is the total acreage within reach of a distribution system, though the whole area may not necessarily receive irrigation supplies.

Food Grain Production and Policy

Production

5. The following table summarizes the experience of the last four years:

Acreage and Production of Major Food Crops

	1964/65		1965/66		1966/67		1967/68	
	Acres	Metric Tons	Acres	Metric Tons	Acres	Metric Tons	Acres	Metric Tons
	(million)							
Summer (Kharif) Cereals								
Rice	91.0	39.0	88.3	30.6	88.3	30.4	91.8	37.9
Maize	11.5	4.7	12.0	4.8	12.8	4.9	14.0	6.3
Sorghum & Millets	91.4	18.1	89.5	14.0	93.9	16.8	95.7	19.1
Sub-total:	193.9	61.8	189.8	49.4	194.0	52.1	201.5	63.3
Winter (rabi) Cereal								
Wheat	33.8	12.3	31.7	10.4	32.0	11.4	37.3	16.6
Barley	6.7	2.5	6.5	2.4	7.0	2.3	8.2	3.5
Sub-total	40.5	14.8	38.2	12.8	39.0	13.7	45.5	20.1
Pulses	59.5	12.4	55.3	9.8	55.3	8.3	56.5	12.1
TOTAL FOOD GRAINS :	293.9	89.0	283.3	72.0	288.3	74.1	303.5	95.5

Rice is by far the most important food grain accounting for about 40% of total production and 30% of the area sown. Aside from fluctuations due to weather, the extent of rice production, both in terms of area and total output, has remained fairly constant since the beginning of this decade. Winter cereals indicate an upward trend in production as well as area sown.

6. It is noteworthy that the introduction of new high-yielding rice varieties with shorter maturity periods make double cropping of rice possible, though this has yet to make a significant impact on overall production in India. In some irrigated areas substantial use is already being made of such varieties and the results have been rather encouraging. Other high-yielding varieties (wheat and hybrids such as maize and sorgham) also find ready acceptance in many areas of India.

7. The disconcerting aspect of Indian food grain production is the absence of sustained improvements in average yield levels despite the comparatively low starting point. This is illustrated by the following comparison:

Growth of Yields

Country Comparison - National Averages 1/

	Rice (Paddy)			Wheat		
	1962	1964	1966	1962	1964	1966
	(Metric Tons/Acre)					
India	0.58	0.67	0.53	0.37	0.31	0.34
Ceylon	0.81	0.83	0.77	-	-	-
Pakistan	0.63	0.70	0.65	0.34	0.34	0.31
Korea	1.49	1.86	1.79	0.84	0.88	0.86
Japan	2.14	2.08	2.12	1.06	1.02	1.02

1/ FAO Production Year Book 1967, Vol. 21, Rome, 1968.

To a large extent this must be ascribed to the lack of fertilizer in the past. The recent decision of the GOI to give priority to fertilizer imports together with the use of better varieties on a larger area should have a discernible impact on yield levels in due course. There are no readily available statistics to make a similar comparison for yields on irrigated and non-irrigated lands. About 35 to 40% of the major food crops are grown on irrigated lands. Yields under proper irrigation are likely to exceed substantially in many instances the averages shown for Ceylon and there is basically no reason why they should not reach those of Korea.

8. The record crop of 1967/68 of 95.5 million metric tons of food grains is a remarkable achievement. However, the year to year fluctuations shown in para. 5 indicate the difficulties of forward projections based on a single year's experience. The food grain requirements for 1970/71 are estimated at 110 million metric tons or roughly 15 million metric tons more than last year's record crop. It will require intensive efforts and continued priority for agriculture if this target is to be reached.

Policies

9. The priority allocation of foreign exchange for the importation of fertilizer by GOI has already been mentioned. Under a recent Government decision, fertilizers and improved seeds are now being distributed under priority area programs. These so-called "High-Yielding Varieties Programs" and "Intensive Agricultural Area Programs" will eventually extend to 32 million acres with assured water supplies. The High-Yielding Varieties Program (HYVP), initiated in 1965/66, is reported to have covered 15 million acres in 1967/68. The HYVP target for 1968/69 is 21.0 million acres, of which 8.5 million acres would be under rice, 5.0 million acres under wheat and 7.5 million acres under maize, jowar (sorghum) and bajra (millet). The area programs are entrusted to special extension service cadres and given priority in the allocation of essential inputs. It is planned that some 50% of the target area will be served in the forthcoming crop year.

10. Within the framework of improving the agricultural services and institutional framework necessary to achieve the full utilization of expanded irrigation capacity, we recommend serious consideration be given to financing current inputs such as fertilizers, such as has been proposed for the Tarai Seeds project.1/ Especially where adequate irrigation supplies are available, the timely provision of additional current inputs would improve the efficiency of resource use and the resulting output should relieve import requirements with a value perhaps many times that of the foreign exchange spent on the inputs. The effectiveness of current input financing will depend largely on the extent to which the creation and improvement of necessary institutional services support their distribution and use.

11. The recent food crises in India have led to considerably improved domestic terms of trade for agriculture. For instance, wholesale prices for wheat and rice nearly doubled between 1960 and 1966:

Selected Wholesale Prices 2/

	Wheat	Rice	
		Coarse	Fine
	(Rs/100 kg)		
1960	41.7	44.7	69.6
1966	71.9	88.0	79.9

While this has undoubtedly had a stimulating effect on 1967/68 production, the maintenance of food zones and food management by Government is likely to militate against the full impact of such incentives. The GOI is, however, in a somewhat difficult position to effect changes since, under the constitution, agriculture is the responsibility of the States. It appears that many officials in the GOI now agree that a gradual elimination of food zoning is desirable.

12. Such a move would require the availability of a Stabilization Stock.3/ Indian estimates put the size of such a stock at 9 million tons. Others 4/ feel that a minimum-sized stock should be not less than 5 million tons. This in turn requires the availability of appropriate grain storage facilities and, as India approaches self-sufficiency in food grains, a reorientation of the nation's storage systems commensurate with the changing flow of grains. This is under discussion in the Ministry of Agriculture, New Delhi, but no plans are available to us as yet.

1/ Memorandum of June 14, 1968: Tarai Seeds Project, Fertilizer Financing (Messrs. Darnell and Picciotto to Messrs. Evans and Votaw). (Attached)

2/ FAO Production Year Book, 1967, Vol. 21, Rome, 1968; the prices shown for fine rice are not directly comparable as they include amendment of quality classification.

3/ In addition it would probably require subsidy programs for the provision of food to the poor.

4/ Willard W. Cochrane, Food and Agricultural Policy for India, Ford Foundation, New Delhi, 1968.

Irrigation Development

Institutional Aspects

13. Irrigated agriculture in India suffers from a division of administrative responsibilities. Medium and major irrigation and drainage works are the responsibility of the Ministry of Irrigation and are usually diversions of river flows to the irrigated land. So-called minor schemes are handled by the Ministry of Agriculture, where water may be supplied by means of shallow wells, tubewells, tanks or from small streams and springs. These latter schemes, however, command a large area (see para. 16). Groundwater resource surveys are carried out by the Exploratory Tubewell Organization. Technical approval rights for major undertakings and for those involving more than one State rest with the Central Water and Power Commission.

14. Cooperation between the various institutions is not too well developed. This has led in the past to a situation where major surface system designs were principally engineering-oriented with little regard to the needs of the farmer, i.e, maximum command area rather than optimum watering depth per unit of land, and construction of major distribution works with field channels left for the farmer to dig. This lack of cooperation has also retarded the integrated development of surface and groundwater resources and the operational reorientation of existing systems towards the opportunities and needs for double cropping. It may also account in a number of cases for the priority allocation of resources for new developments at the expense of maintenance of existing systems.

15. There is an urgent need to coordinate the activities of the various departments involved and to introduce new irrigation planning concepts. The latter are dealt with in para. 19 below.

Existing Development

16. At the end of the Third Plan Period (1966) irrigation development covered a gross command area of about 100 million acres :

Gross Command Area Under Irrigation 1/

	Prior to 1950-51	1st Plan	2nd Plan	3rd Plan	Contemplated Under 4th Plan
	(million acres)				
Minor Schemes	32.0	41.5	50.5	63.6	80.6
Medium and Major Schemes	24.0	27.1	32.3	37.8	46.8
Total:	56.0	68.6	82.8	101.4	127.4

The net irrigable area was estimated in 1965 at 63 million acres. 2/
A number of medium and major schemes were started in the Second and Third

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1/ Government of India, Planning Commission, "Fourth Five-Year Plan - A Draft Outline", Delhi, 1966.

2/ FAO Production Year Book 1967, Vol. 21, Rome, 1968.

Plan Periods and have not yet been completed. At present the GOI is giving priority to the completion of such projects over the initiation of new projects.

17. Up to now, there has been only limited groundwater development within the service areas of existing surface irrigation systems. Because of the recharge from rainfall and irrigation applications, it is believed that a substantial potential exists for such development which would (a) provide additional irrigation water, (b) enable double cropping through integration of groundwater supplies together with reorientation of the operation of the surface systems, and (c) avoid rising water-tables and/or waterlogging. A more systematic investigation of such possibilities is expected in the context of the Punjab Study to be financed under the Punjab Drainage Loan. This would deal with the Indian part of the Indus river system, where rising water tables and some waterlogging are already being observed.

Development Potential

18. No comprehensive assessment of the development potential for irrigated agriculture is available to us. India is laced with eight major river systems, all of which have been partially tapped for irrigation. Two, the Indus and the Ganges-Brahmaputra systems, involve international water rights problems. Most of the others run through more than one State. The systems and the States involved are shown in the following table:

Major Indian River Systems

River System	Riparian States	International Waters
Ganges-Brahmaputra	Uttar Pradesh	East Pakistan 1/
	Bihar	
	West Bengal	
	Assam	
Indus	Haryana Punjab	West Pakistan
	Himachal Pradesh	
	Jammu and Kashmir	
Narmada	Gujarat	
	Madhya Pradesh	

1/ Discussed in memorandum to Mr. McNamara from Mr. Cargill of May 14, 1968, and updating memorandum from Mr. Feldman to Mr. Cargill of October 2, 1968.

River System	Riparian States	International Waters
Tapti	Gujarat	
	Maharashtra	
	Madhya Pradesh	
Mahanadi	Madhya Pradesh	
	Orissa	
Godavari	Andhra Pradesh	
	Maharastra	
Krishna	Andhra Pradesh	
	Maharashtra	
	Mysore	
Cauvery	Madras	

Some developments on these rivers are as much as two thousand years old and are still operational.

19. What is now required is a systematic review of the development potential of these river basins, followed by integrated river basin development planning. Such planning should be comprehensive in the sense that it orients water resource development, both surface and groundwater, to the needs of increasing double cropping, which requires different delivery schedules than those at present obtaining in existing systems. It would also need to cover power aspects since the lifting of groundwater will require extensive rural electrification and may lead to significant changes in the time distribution of power demand.

20. Meanwhile, there is substantial scope for the completion of on-going irrigation projects, the most urgent of which are shown in Annex I. In addition, the Draft Outline of the Fourth Five-Year Plan lists some 54 irrigation projects in various stages of preparation and development, a number of which could probably be proceeded with in the absence of detailed river basin development planning. Furthermore, groundwater development, as stated in para.17, offers considerable potential.

Policy Aspects 1/

21. Aside from planning concepts and design criteria dealt with

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1/ For policy aspects relating to Bank financing of irrigation projects see also memorandum of Mr. Chadenet and Mr. Bell to Mr. Aldewereld dated November 2, 1967. (Attached)

above, the major policy aspects of concern to us in the context of our participation in irrigation development are:

(i) funding of projects;

(ii) operation and maintenance problems;

(iii) recovery of investment costs from beneficiaries;

(iv) project organization and administration;

(v) procurement; and

(vi) use of expatriate consultants for planning and project preparation.

In addition, there is, of course, the problem of maintaining appropriate incentives to producers to ensure full utilization of the facilities to be provided, involving pricing and market policies and the availability of credit.

22. Funding of Projects: Execution of irrigation projects has in the past been hampered by inadequate local currency funding of projects under way. The recent emphasis on completion of on-going projects is thus a step in the right direction. To help ensure prompt utilization of irrigation facilities, initial funding should provide for the minor, as well as the major, structures, since farmers are often not able to organize and carry out extensive field channelling. Many of the problems in this area are the result of the complex relations between Center and State. 1/

23. Operation and Maintenance Problems: The operation of existing irrigation projects tends to be oriented towards the water requirements of cropping patterns of low intensity. With supplementary development, operational procedures should be reviewed, and if possible adjusted, to provide for effective water control rather than drought insurance. Similarly, many systems appear to suffer from deferred maintenance often due to inadequate budget allocations. In some cases this may make complete overhaul of irrigation systems necessary. Unless adequate provisions for regular maintenance can be assured there is little point in initiating new projects.

24. Recovery of Investment Costs from Beneficiaries: There is a tendency to subsidize producers via low water charges. With improved terms of trade for agriculture and increasing productivity, there is less

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1/ See memorandum from Mr. W.A. Wapenhans to Files, dated March 25, 1968. (Attached)

justification for such a policy, except for very small holdings capable of producing little more than subsistence requirements, particularly in the absence of significant action on taxation in the agricultural sector. 1/ In view of the increasing burden on public funds, because of irrigation development and maintenance expenditures, it is essential to require ultimate beneficiaries to contribute to the recovery of capital invested as well as to cover operation and maintenance expenditures.

25. Project Organization and Administration: The effectiveness of the organizational and administrative arrangements made for the construction and operation of irrigation works has been found to vary considerably from one State to another and from one type of project to another. Overall, little consideration is given to the agricultural aspects when devising and staffing a project organization, and the institutional division already referred to usually continues into the operational phases of irrigation projects. For our future involvement in irrigation development, it would be essential that clear and concentrated responsibilities be assigned for each project.

26. Procurement: You have been provided with a separate brief on procurement, which has been the subject of intensive discussion during recent months. It is the present policy for all procurement from abroad to be channelled through State and Center authorities for review and approval, and little responsibility is delegated to the authorities directly executing a project. In the process, specifications may be changed and considerable delays are generally incurred.

27. Use of Expatriate Consultants: Indian authorities, especially those dealing with irrigation, have consistently objected to the employment of expatriate consultants. This has contributed to the fact that the attempt to solve today's problems with pre-war technology and planning concepts is still frequently made. If the approach outlined in para.19 above is to be followed, it will be essential that expatriate expertise is brought to bear upon the immense planning job. For there is only limited Indian expertise in integrated river basin development planning embracing both ground and surface water, and many of the planning activities are extra-curricular to the functions of existing institutions, and might strain their capacities.

1/ During the past decade the contribution of land revenue to State revenues has fallen from 25% to 7%. While agricultural income increased by 50% between 1960 and 1966, land revenues increased by only 21%; see Stanley Please, Aspects of Agricultural Tax Policies in India and Pakistan, IBRD, November, 1968.

Agriculture Projects Department
November 5, 1968

Annex 1

Priorities for Completion of Major On-going Irrigation Projects

Project (State)	River	Date of Start	Est. Cost (Rs.mil)	Already spent (Rs.mil)	Irrigation Potential (000 acres)	Remarks
Pochampad (Andhra Pradesh)	Godavari	1963	401	80	570	Work on the dam is about half complete. The canal is only 17% complete.
Upper Krishna - I (Mysore)	Krishna	1964	582	21	600	Very little work has been undertaken. Stage II would extend the irrigation potential to 1.2 million acres.
Bhima (Maharastra)	Pawna and Bhima	1964	426	26	469	Two dams, one of which nearly completed.
Jayakwadi (Maharastra)	Godavari	1964	385	52	350	Work on the dam is about half complete.
Broach (Gujarat)	Narmada	1959	414	57	962	Project scope under review.
Mahi-Banswara (Rajasthan)	Mahi	-	290	-	72	Multi-purpose. Joint project with Gujarat.
Mahi-Kadana (Gujarat)	Mahi	1956 (prel.)	163	9	220	Project would also firm up water supplies.
Tawa (Madhya Pradesh)	Tawa	1962	341	58	750	Work on dam and canals started.
argi (Madhya Pradesh)	Narmada	-	670	-	70	Multi-purpose (70MW)

Source: Ministry of Irrigation and Power, New Delhi
(K.S.S. Murthy's letter dated August 23, 1968)

TO: Mr. L.J.C. Evans and Mr. G. Votaw June 14, 1968

FROM: G. F. Darnell and R. Picciotto

SUBJECT: INDIA - Tarai Seeds Project
Fertilizer Financing

1. In connection with the appraisal of the above project we wish to recommend that IDA be prepared to consider financing of fertilizer imports both for the direct use of farmers who will be growing certified seed under the project and (provided a suitable project can be developed) for the farmers who will make use of that seed for growing foodgrains.

2. There are few problems on the production side of Tarai. Unusually favorable physical conditions, the large size of holdings, the enterprise of the local farmers and the technical competence of the Uttar Pradesh Agricultural University (UPAU) provide excellent conditions for productive farming. Indeed, the on-farm investments proposed under the project would pay their way even if quality seed production was not part of the project. However, there are few regions of India where the capital intensive pattern of agriculture proposed for Tarai would be appropriate. Rather than its direct production merits (which are substantial) the major contribution of the project to the economy as a whole would be its focus on a particularly crucial element of the Government's agricultural program -- seed.

3. The dwarf and hybrid seed varieties which the project would produce call for two to three times the fertilizer applications recommended for ordinary varieties. This means that unless adequate and timely amounts of chemical fertilizers (adequately supported by credit) are made available, the incentive of farmers to purchase the new seed varieties would be reduced. The following orders of magnitude illustrate the dimensions of the Tarai Seeds marketing task. By 1972/73 the project would produce some 50,000 tons of high yielding wheat, rice, maize, sorghum and millet seeds -- 23 per cent of the all-India draft Fourth Plan target for the High Yielding Varieties Program (HYVP). Taking account of the seed rates applicable to the varieties to be produced under the project, this implies an eventual end-use area for Tarai seed of approximately seven million acres. The related annual requirements for fertilizer would be about 0.7 million tons in terms of nutrients (worth US $140 million) representing about one-third of the current fertilizer utilization for India as a whole.

4. At the present time, the marketing of seed and fertilizer in India is largely the province of Government departments and cooperative agencies. There are exceptions to this pattern but they occur mostly in the South, i.e. outside UP, Punjab, Haryana and Rajasthan where most of the Tarai-produced seed is expected to be sold. In UP, fertilizer is distributed by the Provincial Cooperative Federation, the Cane Producers

Union Federation, and the Agricultural Supplies Organization (State Department of Agriculture). In Punjab (and almost to the same extent in Haryana) fertilizer distribution is handled exclusively by the Cooperative Marketing Federation. In Rajasthan, fertilizer distribution is equally shared by cooperatives and government departments. The shortcomings of these agencies are serious and too numerous to be listed here. Given these shortcomings, the Central Government has recognized that near-monopoly distribution by public agencies or cooperatives is inconsistent with the large increases in fertilizer supplies proposed for the next few years. However, some State Governments, notably Punjab, have been reluctant to allow manufacturers the freedom to make their own distribution arrangements. The same reluctance broadly applies to seed from which State agricultural departments (and sometimes their officials) now derive substantial income.

5. The use of high yielding foodgrains seed and fertilizer requires additional direct on-farm expenditures of about Rs.200 - 300 (US $25 - 40) per acre. This is a significant financial burden for the bulk of Indian farmers. Up to now, because inputs were scarce and product prices favorable, production credit has not been limiting to the expansion of the new foodgrains technology. Progressive farmers have been willing to pay cash for the new seeds and the UPAU has been able to sell its entire seed output at good prices with minimal promotional activity. However, as seed production picks up and HYVP begins to reach beyond an upper layer of prosperous farmers, credit is bound to limit modern input use unless expanded credit facilities are made available through appropriate channels. For fertilizer alone, the Fertilizer Association of India estimates that annual production credit amounting to US$210 million will need to be provided in Northern India by 1970/71, and that less than half of this amount could be handled effectively by traditional cooperative channels.

6. In view of the above, the project might run into marketing problems well before project maturity unless:

(a) appropriate links between seed and fertilizer distribution are forged;

(b) adequate supporting credit arrangements are implemented (taking cognizance of an expected pattern of seed and fertilizer distribution in which manufacturers and private dealers will play a greater role); and

(c) adequate quantities of chemical fertilizer are made available for distribution through appropriate channels in North India.

7. With respect to (a), it is proposed that the Tarai Development Corporation (TDC) 1/ make its own arrangements for seed marketing. To

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1/ TDC, a newly formed corporate body of the seed-producing farmers, UPAU and others, would process and market the seed produced under the project.

facilitate such arrangements, IDA has encouraged an association between TDC and Indian Explosives Ltd. (IEL), a fertilizer company of the ICI-India group in which IFC holds shares. Discussions about this association (which might involve a ten percent contribution by IEL to the share capital of TDC) are now underway. By 1972/73, IEL's area plant located at Kanpur (UP) is expected to market about 180,000 tons of N. This is about two-thirds of the requirements associated with Tarai-produced seed in that year. An IEL-TDC partnership would therefore greatly strengthen the marketing programs of both organizations and we would therefore recommend that such a partnership be a condition of IDA lending for the Tarai project. In due course, suitable working arrangements between TDC and other fertilizer manufacturers might be framed to further promote effective seed marketing.

8. With respect to (b), IDA should obtain an assurance from the Government that it would undertake to meet the credit requirements for seed and fertilizer distribution including the requirements of commercial channels.

9. With respect to (c), it should be pointed out that, given the present shortage of fertilizer in India the full economic impact of the project would be realized only if the fertilizer supplied under the project is additional to existing supplies. Since India's fertilizer production capacity is not expected to match domestic requirements for at least five years, additional fertilizer supplies means additional imports (Annex 1). Given India's tight foreign exchange situation, these additional imports would require external financing, over those same five years.

10. IDA financing of fertilizer for the project could therefore be justified on two project grounds -- to assist the Government of India in providing the necessary credit for seed and fertilizer distribution (para. 8) and to allow the additional imports (para. 9). While India's external financing requirements for fertilizer are now covered in large part through bilateral aid programs, they are pledged within the Consortium framework only on an annual basis. Furthermore, the amounts of fertilizer required are small compared to estimated import requirements, at least for the next four years (orders of magnitude only):

	1968/69	1969/70	1970/71	1971/72	1972/73	Total
			(US $ Million)			
Project Needs 1/	0	16	31	46	76	169.0
All-India import requirements	310	335	335	282	205	1,467.0

1/ Gross needs of farmers planting with high yielding seed, less amounts of fertilizer assumed to be already in regular use.

Subject to satisfaction on a number of points (which are spelled out in para. 11 onwards) we would therefore recommend that IDA consider financing fertilizer imports of the following orders of magnitude, a small percentage of import requirements:

	1968/69	1969/70	1970/71	1971/72	1972/73	Total
			(US $ Million)			
For seed-producing farmers:	0.4	0.8	0.8	1.0	1.0	4.0
For end-users of project seed:	-	15.0	30.0	30.0	25.0	100.0
Total:	0.4	15.8	30.8	31.0	26.0	104.0

The US $4 million proposed for seed-producing farmers would be part of the credit under active consideration, and for which the appraisal report is under preparation. The remaining US $100 million (order of magnitude only) would be the subject of another credit following further preparation and appraisal. It would be a condition of lending that the rupee funds generated by IDA financing of fertilizer be used for meeting other agricultural credit needs, in particular those arising from the project itself.

11. The proposed US $100 million credit would entail further staff activity. As a first step, we would recommend that a mission be sent to India in the fall to review the marketing and distribution of seed and fertilizer in North India and to investigate other restraints on the end-users (such as, for example, water). This mission might well point up the need for a more detailed investment-oriented study of the needs of those end-users, the cost of which could be included under either credit.

12. Substantial fertilizer financing by IDA would only be justified, of course, if IDA was satisfied that India was making sufficient effort to make full use of existing fertilizer capacity and to expand such capacity; that, during any period of such financing, domestic requirements did, in fact, substantially exceed production capacity and that alternative sources of suitable external finance to fill the gap between domestic supply and requirements remain uncertain. Any credit for fertilizer imports would, therefore, have to be subject to fairly frequent review.

13. We would be grateful for your views on these recommendations prior to further discussion in working party.

cc: Messrs. Chadenet, Bell, Wapenhans, Pickering, Eccles, Courbois (Rome), Bartsch, Dunn, Gilmartin/Bohr (Delhi Office), J. David Dodd (IFC)

RPicciotto/SEccles:gz

India's Fertilizer Import Requirements[1/]

1. The target fertilizer consumption figures set by the Sivaraman Committee in 1965 have official status. They are generally considered as representing minimum requirements for the sectoral growth targets proposed by the Government (implying foodgrains self-sufficiency in the early seventies). The Committee's consumption projections beyond 1970/71 are only "reasonable goals." Considerable improvements in water management were assumed in setting these goals and a great deal of effort will be required to meet them even if the supply of fertilizer is assured.

2. Nitrogenous fertilizers are by far the most important, in terms of quantity and cost, and a chart is attached showing a projection of possible domestic production against the Sivaraman Committee consumption projections. The chart assumes that plant production never exceeds 90 percent of installed capacity, that new plants take two years to come into production after the start of construction, and that production is 50 percent of capacity in the first year, 75 percent in the second year and 90 percent thereafter. The production forecast from plants already in existence, under construction, or whose construction might start in 1968/69 is Mr. Bohr's. In order to make a projection of the future contribution from extensions and plants under active consideration not falling within the above three categories, it has been assumed that construction of one-half of that capacity would begin in 1969/70, with the other half a year behind. Clearly, some of these plans will be delayed or abandoned and others might or might not take their place. On the other hand, the consumption forecast is also dependent on many imponderables. So that our production assumption may serve as a tentative guide to the future trend towards self-sufficiency in nitrogen production. The chart indicates that domestic production could be sufficient to meet requirements for nitrogenous fertilizers by 1973/74.

3. The situation with regard to phosphates is not as hopeful since total productive capacity is not expected to reach above 1.6 million tons of P_2O_5 equivalent prior to 1975/76 even if all plants under active consideration materialize. Consumption at that time might be expected to have reached around 2.0 million tons equivalent.

4. All potassic fertilizer requirements have to be imported.

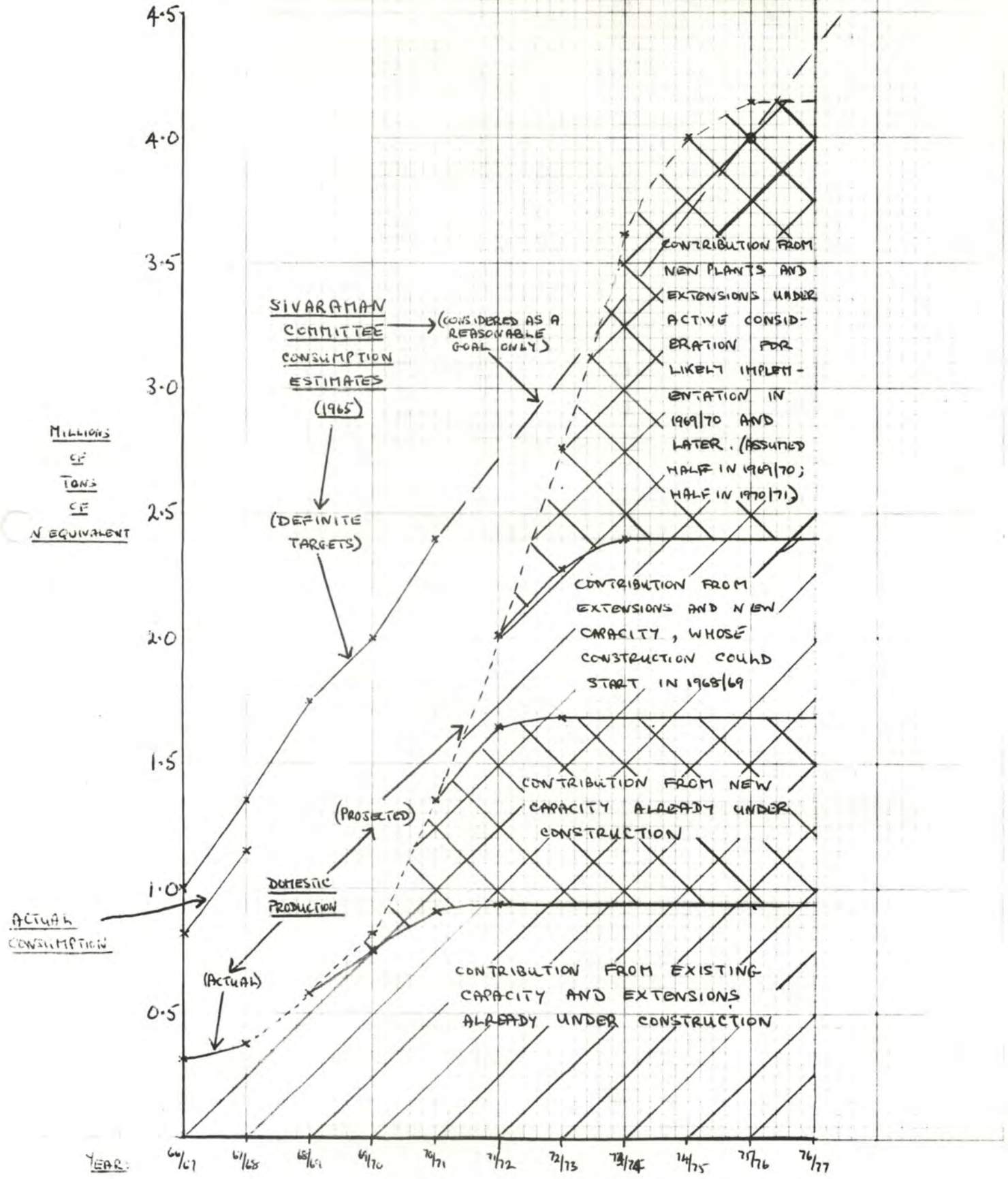
5. On the basis of the above assumptions, India's fertilizer import requirements are projected as follows:

1/ Principal sources for this Annex are:
(i) Notes by Mr. Kenneth A. Bohr, as attached to his letter of April 3, 1968, addressed to Mr. Votaw; (ii) "Report on the Fertilizer Industry in India", IFC/T-27, of May 6, 1968, prepared by Mr. J. David Dodd with assistance from Mr. Bohr and other members of the Bank's Resident Mission in India; (iii) Memorandum to files dated April 30, 1968, by Mr. Bong S. Lee.

	N		P_2O_5		K_2O		Total	
	'000 MT	$ Mill.	'000 MT	$ Mill.	'000 MT	$ Mill.	'000 MT	$ Mill.
1968/69	1,150	230	350	50	450	30	1,950	310
1969/70	1,200	240	440	60	550	35	2,190	335
1970/71	1,050	210	590	80	700	45	2,340	335
1971/72	700	140	665	90	800	52	2,165	282
1972/73	300	60	600	85	900	60	1,800	205

INDIA – TARAI SEEDS PROJECT

CONSUMPTION / DOMESTIC PRODUCTION OF NITROGENOUS FERTILIZER



FORM NO. 57 | INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Files

DATE: March 25, 1968

FROM: W. A. Wapenhans

SUBJECT: INDIA - Lending for Agriculture

1. Further to my notes to Files on specific projects and activities, I am setting out below a few more general observations regarding future Bank/IDA lending for agriculture to India. These were developed during a mission to India from January 30 to February 15, 1968.

2. To introduce the theme of this memo I will repeat a few of the pertinent statistics. India has a population of over 510 million people. Its cropped area is about 400 million acres of which nearly two-thirds are under foodgrains. The agricultural sector produces roughly 50 percent of the national income. In spite of these enormous magnitudes, their problems and opportunities, our involvement and acquaintance with Indian agriculture has been less intimate than that with many other countries of less than one-tenth its size.

Past Experience and Present Relations

3. Bank and IDA lending for Indian agriculture in the past has been predominantly for capital intensive major irrigation works, because it has been projects of this type that India proposed to the Bank. IDA financing since 1961 supported five irrigation projects and one drainage project. These involved relations with the respective Ministries of Irrigation at the Center and State levels, but very little with the Ministries of Agriculture and other agencies directly concerned with production. Practically no experience has been gained in lending for Indian agriculture proper and hence our relations with the agricultural authorities have been only slight. This is unfortunate especially because of the rather rigid compartmentalization within the Indian administration, which at times results in the setting of priorities for development not necessarily complementary to each other. The comprehensive approach long advocated by the Bank is now being given increasing emphasis by agricultural authorities. However, more could be done to ensure adequate integration of the various activities at the grassroots level especially in the case of major irrigation schemes with divided responsibilities.

4. For the Bank to be of assistance in this area, the dialogue on project concepts and designs would need to start at a very early stage, i.e. perhaps two to three years before a project ready for financing would emerge. It would also require close and continuing contacts between the Indian authorities responsible for such project preparation at the Center and State levels and the Bank's technical staff. A frank and constructive dialogue depends on mutual understanding and confidence which can only be built up by better acquaintance with the system, its problems, and the personalities who operate it, and by the Indian officials learning more about our intentions, procedures and concepts.

5. The Terai Seeds project and the Punjab Drainage Project and Agricultural Study already offer an opportunity to intensify our relations with

Indian agricultural authorities. However, this should be regarded only as a first step. A continuous exchange on future projects and programs should follow, which in turn would increase the prospects of a pipeline of soundly conceived projects.

6. The latter in turn requires that the agricultural authorities (State and Federal) are given some incentives to take an active part in such project preparation. Repeatedly I was given to understand that IDA finance for agricultural projects would not necessarily increase the total allocation of resources to agriculture either at the Center or at the State level. This results from an intricate planning mechanism under which external financing is anticipated and possibly allocated in accordance with criteria for priorities inherent in the system. Since most projects in the field of agriculture require little foreign exchange IDA finance may thus be in substitution of budget allocations rather than incremental. Rejection of a project for external support on technical grounds can thus have serious budgetary consequences for a particular State budget. Since this is recognized, there is in the mind of the Indian agricultural administrator little purpose in going through the rigors of project preparation for IDA financing when the same amount of resources can be obtained with less effort and uncertainty. I suspect this applies generally especially if non-project financing can be had in the absence of suitable projects ready for financing.

7. Consideration might therefore be given to the introduction of a system by which a given sum of IDA finance would be made available only for soundly conceived projects in the field of agriculture and irrigation. It would need to be made clear that these resources would otherwise not be available and would thus not substitute those allocated at any rate in the States' annual development budgets. The allocation of these funds should then be strictly in accordance with project criteria and irrespective of the concept of equality amongst States. This might lead to a constructive competition amongst States for incremental resources for the development of agriculture. Since these funds would not otherwise be available and since they could simultaneously provide free foreign exchange for the Central Government this should result in a rather powerful incentive to prepare acceptable projects and to seek help in such preparation. Such an approach would not necessarily improve the quality of project preparation across the board and might initially even lead to a concentration on a few promising prospects. There should be, nevertheless, a considerable demonstration effect in the long run.

Current Input Financing

8. Foreign exchange requirements in agriculture proper, as distinct from irrigation works, occur at present mainly in regard to current inputs. Our unwillingness to finance a rather large fertilizer import program in conjunction with the UP Tubewell project has caused some consternation and resentment with the Central Ministry of Agriculture. Their argument is that a much better utilization of already developed land and water resources can be obtained at low costs through the incremental provision of current inputs, especially fertilizer. In view of the absolute scarcity of fertilizers this argument is not without merit. The counter-argument that the economy ought to devise mechanisms for priority allocations of such scarce current inputs does not appear very persuasive to the Indian administrator who is charged with the responsibility for immediate increases in food production.

9. The case could be made that the provisions for fertilizer imports closely resembles commodity imports for better utilization of industrial capacities. Where adequate irrigation supplies are available the provision of extra current inputs would undoubtedly improve the efficiency of such resource use. The resulting output is bound to relieve import requirements in value terms perhaps many times that of the foreign exchange spent on fertilizers. Increasingly the provision of such inputs should come from local manufacture and any interim financing of fertilizer imports should probably be made contingent upon the establishment of such production facilities.

10. The criteria for the financing of fertilizer imports would thus appear to be:

i) that it be in anticipation of local manufacture for which it would prepare the market;

ii) that appropriate priority distribution in accordance with the concept of efficient resource utilization would be ensured;

iii) that such support would be made available only on the evidence that the country is making adequate provision for fertilizer supplies from its own as well as third party resources.

Such input financing should preferably be done in the context of agricultural projects suitable for external assistance and then only on the basis of an acceptable fertilizer supply program for the entire sector.

Future Lending Prospects

11. An attempt was made to discuss future projects and programs with the Central Ministry of Agriculture. However, the Secretary of Agriculture and his deputy were initially not willing to discuss any of their future plans beyond Terai Seeds and the Agricultural Study in connection with the Punjab Drainage project. In my opinion this attitude was mainly conditioned by inadequate preparation on the Indian side, a desire to ration information and, in their minds, our lack of understanding for current input financing. The atmosphere improved somewhat at the end of my stay in India. Arising out of their interest in work done by the Bank elsewhere, it was possible to develop a preliminary exchange on river basin development programming and the need for integrated development and use of surface and groundwater. The desirability of a more intensive dialogue between the Indian agricultural authorities and their counterparts in the Bank became apparent in the course of these discussions.

12. The contacts at the State level (Mysore and Madràs) were less inhibited. There is, nevertheless, a lack of understanding for our emphasis on the project approach, mainly because of the reasons given in para. 6 above. In vogue are the so-called "Intensive Agricultural District Programs "(IADP) and more recently the "Intensive Agricultural Area Programs" (IAP). These consist mainly of the provision of current inputs such as fertilizers and quality seeds at rations higher than usual. The programs are frequently formulated around some previous irrigation development and once accepted by the Central Government receive Center support. The results are not always convincing and the reason may well be the lack

of coordination between such activities as double cropping, irrigation operations, water management, on-farm development, drainage provision, etc., all required in addition to current inputs but several controlled by departments other than agriculture.

13. In their present form these programs would not appear to provide a suitable basis for lending to agriculture. They would need to be enlarged to encompass the aspects mentioned above. In particular the irrigation operations would need to be revised to meet the needs of the cultivators for increasing double cropping and more intensive current input applications. Unless this is done there is the danger that such intensive area programs just substitute for the deterioration of such basic resources as irrigation supplies. In this context it may be worth mentioning that there appear to be substantial opportunities for groundwater development within existing surface irrigation systems. This in turn would require careful planning with regard to the rural electrification programs and the integrated operation of such combined resource development (see also my note to Files on the groundwater study in Tanjore, Madras).

14. Discussions were also held with the Secretary of Food, Central Ministry of Agriculture. His staff is presently thinking of a gradual relaxation of the food zoning policy. This may result in substantial changes in inter-State grain flow patterns. In turn, this is likely to result in increased storage requirements with future capacities so located as to enable the maintenance of strategic reserves mainly from local production and their use for price stabilization. The Secretary of Food in conjunction with the Food Corporation of India is presently revising his plans for the increase and location of grain storage capacities. He promised to make his revised plans available to our Resident Mission as soon as they become available.

15. The future program of major irrigation development was discussed with the Secretary of Irrigation, Central Government. The present plan includes some 63 major irrigation projects of which 17 are nearing completion. Because of shortage of rupee funds it became necessary to concentrate on 8 of these 17 projects on which preliminary discussions had taken place on previous occasion. Most of these are more than 70 percent complete and offer very little prospect for a useful contribution from IDA.

16. In the past the divergence of views between Indian irrigation officials and the Bank was mainly in relation to design aspects, such as intensive vs. extensive cropping patterns. While there appears to be a less rigid attitude on this aspect on the Indian side, there is the danger that the traditional concept of extensive irrigation system designs will perpetuate itself unless continuous influence is brought to bear on those responsible. We have already commented on the need to employ consultants for project preparation and implementation on previous occasions (see Mr. Evans' memo to Mr. Chadenet of September 20, 1967). To make this acceptable is, in my opinion, again not only a question of insistence but also of our continued presence. The new element of possible integrated surface and groundwater use in the case of irrigation projects might make the Indian engineers more accessible to outside expert advice. I see a considerable opportunity here to help in the planning and preparation of

major irrigation projects which are still in their infant stages. Because of the groundwater element the acceptability of outside consultants should no longer be excluded; but steady persistence will be required to bring this about. Again this would require a continuous dialogue between the Indian irrigation authorities and the Bank's technical staff. A first step in this exchange should be a reconnaissance mission to India which would concentrate on those major irrigation projects where the design is yet preliminary and where there is a good chance of integrated exploitation of surface and groundwater. Such a mission could usefully visit India in early fall of this year. It should not be expected that there would be immediate lending prospects. However, this could be the beginning of building up a continuous pipeline of soundly conceived projects. A conducive working atmosphere at the State level should not be overlooked in the selection of such projects, especially if the approach set out in para. 6 above is found to be acceptable. If in the long run, the level of disbursements for projects is expected to substitute also largely for those of import financing the early concentration on such a pipeline would seem of high priority.

Conclusions

17. In summary the above leads to the following conclusions:

i) Our dialogue with Indian authorities responsible for agriculture and irrigation should be intensified and additional emphasis should be given to our contacts at State levels;

ii) A system should be conceived which would make it attractive for Indian officials to engage actively in and seek help for project preparation which would eventually lead to an acceptable balance of non-project and project financing;

iii) Financing of current inputs especially fertilizers should be given consideration, provided this would be in support of the country's own efforts in this field and adequate priority allocations can be assured;

iv) In future project preparation in agriculture emphasis should be given to the comprehensive planning and execution of such projects including review and, if necessary, revision of traditional patterns of irrigation systems operations, maintenance, drainage and groundwater development;

v) The development of changes in food zoning policies and the possibilities of revisions and increases in grain storage capacities should continue to be watched;

vi) Possibilities for improved planning and preparation of major irrigation projects with the possible help of outside consultants should be followed up with an early irrigation reconnaissance mission.

Unless these steps are taken I see little prospects for expanded lending for agriculture to India.

18. The agricultural staff of the Resident Mission in Delhi has made a very encouraging start in familiarizing themselves with project prospects in various States. It would be unrealistic, however, to expect a contingent of two staff to devote, in addition to their other duties, sufficient time to project identification and help in preparation. Substantially more headquarters support is required. More frequent missions of agricultural staff to India would strengthen their efforts as well as support those in the Indian administration who are prepared to work with us. The FAO/IBRD Cooperative Program could also play a useful role in this effort. There are, however, some tendencies to play FAO against the Bank and vice versa. It is, therefore, essential that the Bank retain the lead in the dialogue and ask FAO help for the specific follow-up activities in the sphere of project preparation.

WAW:at
Bank/IDA

cc: Messrs. Chadenet, Bell, Evans, B. King, Votaw

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WAW:at
Bank/IDA

cc: Messrs. Chadenet, Bell, Evans, B. King, Votaw

Mr. Chadenet

Mr. S. Aldewereld
B. Chadenet Bernard R. Bell
B. Chadenet and B. R. Bell

November 2, 1967

Conditions for Lending to India

1. We suggest in this memorandum certain conditions which the Bank and IDA should stipulate in future lending to India. We confine ourselves to general conditions which are necessary to ensure the economic and effective conduct of investment operations financed by the Bank in various sectors of the Indian economy. We do not include either conditions which relate to the general economic and financial policies and performance of India or conditions which are specific to individual projects. Our suggestions relate to the agricultural, transportation, communications, electric power and water supply sectors of the Indian economy, to Government policies which affect the development of those sectors, to project organization and management in those sectors, to the use of consultants, to contracting arrangements, to procurement and land acquisition procedures and to other administrative and procedural arrangements. We do not discuss the education sector since we have had no experience of it in India and no expression of interest in borrowing for this purpose from the Government.

2. Government Policies which Directly Affect Development of the Sectors

(a) In agriculture we are concerned about the policies which affect the price incentives and disincentives to farm production and the availability to farmers of essential inputs, especially of fertilizers, plant protection materials, seed and water. Although in the past several years severe drought has ensured that agricultural commodity prices in India were at levels which provided strong incentives to production and to the use of purchased inputs for production, the prospect of a very good crop this year and the possibility of continuing better crops poses the issue of price policy. We believe that the existing Indian policy which permits the States to forbid or restrict the shipment of farm products outside their boundaries might result in sharply declining prices in some of the surplus-producing States and might have significant disincentive effects. We believe that this possibility calls for the abolition of these zonal restrictions and also for a policy of Government procurement at minimum support prices (or, if necessary, at higher, market prices) in order to prevent prices from falling to disincentive levels and also in order to accumulate the buffer stock of foodgrains so necessary for other reasons.

We are concerned also with the fact that a good measure of the benefits possible from irrigation projects, which we are or may be financing, will materialize only if the other necessary inputs, such as fertilizers, plant protection materials and improved seed, are available in sufficient quantity to meet the demands of farmers in the project areas.

We should consider and discuss with the Asia Department how far we can go in stipulating conditions designed to ensure incentive prices and input availabilities and just how these conditions can be designed to achieve our purposes.

(b) In transportation we have been concerned with the Government policies which have impeded the development of highway transport and prevented the most economic distribution of traffic among competing modes of transport. We have already advised the Government in connection with the last IDA credit for the railways that future lending for the railways would be dependent on the formulation and implementation of an agreed plan of action for more effective transport coordination. Some measures to this end were included in the railway credit and the Government undertook to advise us of progress. Thus far, however, only one report has been received and this does not evidence significant progress. We suggest that, as a condition of any future loans in the transport sector, the Government should specify the policies adopted and implementing steps taken and planned for the removal of the existing restrictions on road transport, for the rationalization of road transport taxation, for the removal of taxation which discriminates against highway transport and for less railway-biased allocation of Government funds and bank credit, including foreign exchange. There should be an agreed target time schedule for action in these directions although clearly the schedule would need to be both realistic and flexible in view of the complicated problems of the relations between the Center Government and the States. Future continuing lending operations in the sector should be consonant with progress in the matter.

(c) In the other sectors in which we are active we do not at this time suggest important conditions relating to Government policy.

3. Project Organization and Management

(a) In the agricultural sector we have been plagued by inadequate project organization and management. We must insist on conditions designed to correct these inadequacies. Our objective should be to obtain clear and concentrated authority and responsibility for each project. This might sometimes require the setting up of a special agency, such as an autonomous or semi-autonomous project authority. This is particularly the case where the project requires the deployment of services from a number of different Government departments including, especially, the agriculture and irrigation departments. Coordinating committees, at least in India, do not serve this purpose. Even in the case of simpler projects, primarily the responsibility of single departments of Government, clear and concentrated authority and responsibility for particular projects rarely exists but is a necessary condition to effective construction and management.

(b) As a condition of further lending for telecommunications, the Indian P and T should be reorganized into an autonomous or semi-autonomous government entity and commercial accounting should be introduced to reflect accurately its operations. In accordance with one of the conditions of the Credit 28-IN in 1962 the Indian P and T employed outside consultants, Messrs. Peat, Marwick and Mitchell, to review its accounting procedures. At the time of the second Credit, 50-IN, in 1964, the Consultants' report was almost completed. Steps have since been taken by the Indian Government in the direction of endowing the P and T with more autonomy but no action has been taken on the Consultants' basic recommendations. In August 1967 a letter was sent to the Chairman of the P and T Board in which we requested before the end of 1967 a schedule of implementation of the Consultants' recommendations; we suggested that the telecommunications activities should be reorganized into a "self-contained entity responsible for telecommunications operations" and that continued help from accounting consultants would be needed. The letter has been acknowledged and we are awaiting a substantive reply.

(c) In the transport sector a necessary condition to the effective execution of a highway construction program is the reorganization of the roads wing of the Ministry of Transport, which is the highway authority in the Central Government. It may also be similarly necessary to achieve reorganization of the State Government entities responsible for highway construction and maintenance within each State. We are not in a position to spell out the specific organizational changes or the changes in engineering practices which are necessary. The Transportation Division suggests that a condition primary to any future lending in the sector should be the employment by the Government of India of management consultants to carry out a study and make recommendations for strengthening the highway authority and streamlining its operations. The Division further suggests that implementation of the consultants' recommendations should also be a condition of future lending. We are, ourselves, skeptical about the usefulness of management consultants for the accomplishment of our purposes. An engineering consulting firm experienced in the conduct of highway construction and maintenance operations working closely with Indian Government officials who understand the complexity of relationships between the Central Government and the States and within the Central Government itself would, in our opinion, be likely to produce more useful and practicable plans and recommendations.

4. Use of Consultants

(a) In the agricultural sector, including irrigation, the Government of India has resisted suggestions that non-Indian consulting firms and individual experts be used in the conduct of studies and for the design and supervision of construction. India has a larger number of trained and experienced irrigation engineers than most of our borrowers. Nevertheless, our experience is that faulty work has been done by Indian engineers in the planning and design of surface water irrigation projects. Furthermore, there are many indications that Indian personnel have much to learn from outside experts with respect to underground waters and their use. We suggest that a condition of further lending in the agricultural sector or at least for irrigation projects be that non-Indian experts, drawn either from private firms or from Government organizations, be employed.

At this time one of the most important and promising opportunities in Indian agriculture is afforded by the development within the past few years of high-yielding varieties of wheat and rice and also of hybrid corn, sorghum and millet. The emergence of these high-yielding seed varieties is the result of a cooperative effort on the part of technicians of the Rockefeller Foundation and Indian scientists to which an enormous push was given by Minister Subramaniam, the predecessor of the present Minister of Agriculture. Given the necessary effort there may be similar possibilities in connection with other crops (e.g. cotton, legumes, jute, etc.) commonly grown in India. In addition, particularly in the case of the hybrid seed varieties although not so much in the case of wheat and rice, there are significant as yet unsolved problems in the development of an industry which can produce in much greater volume reliable supplies of the hybrid seed required. We suggest that as another condition of lending in the agricultural sector we should require that steps be taken by the Government of India to use the help of experienced non-Indian personnel. It may be that this can be adequately provided through the Rockefeller Foundation; it may be that we need to

go further than this and require that foreign firms experienced in the production and distribution of seed be permitted and invited to assist in the Indian effort.

(b) In the field of electric power we believe that some assistance from outside consultants should be required particularly in connection with design or the review of design. This is equally true in the case of water supply projects.

(c) In the case of highway transport we believe that it should be a condition of highway loans that non-Indian engineering consultants be used to some degree in the design and supervision of construction of highway projects.

5. Construction Contracting

(a) In some States in India and particularly in connection with very large projects, the State Irrigation Departments, working by force account or with local contractors, have not succeeded in constructing the civil works involved at reasonable cost or at a satisfactory rate. We suggest that, particularly in connection with large projects, international competitive bidding for the contracts should be a condition of loans. This will, at least, provide a standard or yardstick and a competitive spur.

(b) We make the same suggestion with respect to highway and port construction. International competitive bidding on highway construction contracts would, among other things, provide some comparative measure of the relative efficiency and cost of labor-intensive versus non-labor-intensive methods of construction.

6. Procurement Procedures

In connection with the procurement of equipment and materials for projects in all sectors we face two problems. One is the problem involved in domestic versus foreign procurement and the other is the problem of procurement procedures whatever the source of supply. The Indians assiduously attempt to reserve for domestic procurement everything which they believe can possibly be supplied from domestic sources. Whether or not the domestic procurement is financed with Bank/IDA funds, this sometimes has unfortunate results. These include the supply of equipment and materials which are inferior or completely deficient in quality, delays in supply which delay execution of the entire project, high costs. Procurement procedures are extraordinarily cumbersome and time-consuming. This reflects partly the delays involved while the question of possible local availability is being explored; partly the fact that the authority responsible for constructing or executing the project must, under existing procedures, have its proposed purchases reviewed and approved by two or three higher authorities in the State and/or Central Government. As is customary in India, little authority, even with respect to specifications, is delegated to the responsible entity. We suggest that a condition of our loans be a streamlining of the existing procurement procedures. Particular means of doing this need further exploration with the Indian authorities. On the first matter referred to above, domestic versus foreign procurement, we suggest that we require that a much larger portion of the procurement for

any project be via international competitive bidding with an adequate degree of preference to domestic suppliers.

7. Land Acquisition

A number of projects we have financed in India have been inordinately delayed by very time-consuming land acquisition processes. We are aware that the problem involved is very complex and that Indian citizens are entitled to adequate protection by due processes of law. We believe, however, that steps can be taken to ensure that the delays frequently encountered are eliminated. Subject to further exploration designed to devise the particular changes in laws and procedures required, we suggest that such changes be a condition of lending in all sectors.

We can expect to encounter considerable resistance from the Government of India in almost all of these matters. It is probably fair to say that resistance on the part of India will be more bitter and protracted than in most of the cases with which we deal. We will certainly be accused by Indian civil servants, Ministers, Parliamentarians and the public of tying unfair strings to our aid, of unwarranted interference in Indian affairs, and of stupidity and ignorance. At the same time the deficiencies of Indian performance in the execution of projects in these sectors and in the adoption and implementation of policies affecting these sectors are large and there is room for considerable improvement. We are not singling out India for special criticism but we are suggesting that the Bank and the Government of India together recognize the deficiencies, identify the opportunities for improvement and join together in attempting to realize these opportunities. The conditions we have suggested are designed to improve both performance and policy and we believe, on the basis of experience, would result in India enjoying much higher returns from the very substantial investments which it has been and will continue to be making.

DChadenet/ERBell:emcc
BANK

c.c. Mr. Cargill
Mr. Ballantine
Mr. Baun
Mr. Evans
Mr. Knox

Headquarters:
Washington, D.C., U.S.A.

OP Files

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

RESIDENT REPRESENTATIVE IN INDIA
7 Sardar Patel Marg · New Delhi
Telephone 30152, 30153 · Cable Address - INTBAFRAD NEW DELHI · Postal Address - P.O. Box 416

Letter no: 287

September 9, 1968

Mr. G. Votaw
Asia Department
International Bank for Reconstruction
and Development
1818 H Street, N.W.
Washington D.C. 20433

Copies to: Cargill, Goodwin, Stuart, Cash, Dodd

Dear Greg:

Attached you will find the promised note on fertilizer and a memo giving some details on the current reasons for delay of the Burmah Shell project.

I have not made any new estimates of production. Those made last spring and included in Dodd's report still look good. On the basis of production this far this year there is no basis yet for changing our estimate of 580,000 tons of nitrogen for the year.

There are no new estimates of import requirements in the note but not because Dodd's figure is satisfactory. In this case we are in pursuit of stock and consumption estimates and the latest on import orders. I will be sending something on this as soon as I lay my hands on the material. As indicated in the note we do not expect consumption of nitrogen this year to come very close to the target of 1,700,000 tons. Furthermore stocks of P_2O_5 are reported to be very high with some manufacturers of superphosphate finding difficulty in moving their production. We would therefore expect the import bill for fertilizers and fertilizer materials in 1968/69 to be less than Dodd's estimate (which is given in Table II of the noteand is based on achieving the target levels of consumption). I shall be more specific on this as soon as I can.

Best regards,

Sincerely yours,

Kenneth A. Bohr

KAB:yd

Encls:

The Fertilizer Situation

September 1968

A. The Problem

Starting from very low levels of consumption and production an extremely rapid increase in the use of all three major fertilizer elements, nitrogen, phosphate and potash, is needed to sustain the program for agricultural growth. At the time the new agricultural strategy was adopted (1965/66) the annual level of fertilizer consumption 1/ was 580,000 tons of nitrogen, 135,000 tons of phosphate and 90,000 tons of potash. Consumption targets for 1970/71, 5 years later, require an increase in consumption of about 4 times for nitrogen, 7 times for phosphate and 6 times for potash. Thereafter, until 1973/74 the last year of the IV Plan, the targets are projected to grow at average annual rates of 16% for nitrogen, 20% for phosphate and 17% for potash.

These are very ambitious targets. In relation to recent consumption experience they seem particularly ambitious. Although consumption has grown rapidly over the last three years, it has remained quite short of the target amounts and 1968/69 will be no exception 2/. (See Table I). Thus far experience has lagged expectations by about one year. It could take several good years and the help of an exceptional monsoon to increase consumption to the target levels. However, even if target amounts are not actually reached the growth can still be expected to be very rapid and must be if the agricultural goals are to be met.

A fertilizer program of this size and rate of growth requires a very large expenditure of foreign exchange. In the first place imports have had to be increased rapidly to provide for the rapid increase in consumption already achieved. In the second place, the only area where any substantial import substitution can be made is in the production of nitrogen fertilizer and this takes time. In the case of phosphate and potash there are no domestic sources, all must be imported. Where phosphate fertilizer is produced in India from imported phosphate rock, sulphur must also be imported to make the sulphuric acid required by the process or alternatively phosphoric acid may be imported instead of sulphur and rock. However the difference in the foreign exchange costs of the materials and finished

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1/ Actually distribution at the state level. There are no available estimates of stocks held within the states.

2/ Lack of rain in Andhra and Madras has reduced expected consumption in these areas. The Trombay plant of the Fertilizer Capacity has stocks of 30,000 tons of 20-20 complex which it expected to be able to sell in Andhra. Stocks of phosphate fertilizer are reported to be unusually high.

phosphatic fertilizers is small so that there is not much scope for saving foreign exchange by producing phosphatic fertilizer domestically[1/].

The situation is different with nitrogen. The foreign exchange cost of producing a ton of urea in an Indian plant is somewhere between a quarter and a third of the cost of imported urea[2/]. Nitrogen fertilizer plants are complex, expensive and require several years for construction. Although a large program of construction is underway it is not expected that the savings in foreign exchange from the domestic production of nitrogen fertilizer will be sufficient to counterbalance the increased requirements of imported phosphate and potash and the continuing import of nitrogen fertilizer if the proposed targets of consumption are to be met. In fact total cost of fertilizer and fertilizer materials can be expected to increase steadily over the next 3-4 years (See Table II).

Because of the time required to construct new capacity there is little that can be done now to substantially affect the level of production through 1971/72. Projects under construction are tied to delivery schedules of equipment. In some cases slippages might be prevented and it is possible that new capacity might be run in a little more rapidly than we have assumed and production problems corrected a little more quickly. But in general we do not believe it will be possible to increase production much over our estimates. The first year for which there is any substantial freedom of manoeuvre is 1972/73. Projects started from now through the end of 1969 can be expected to be producing in that year and it is still physically possible to substantially reduce the import requirements of nitrogen fertilizer starting in that year even assuming consumption targets are met.

Although the major decisions that will determine the general course of production through 1970/71 have already been taken there are other areas of importance to the program which require planning and investment in the immediate future. In the area of storage and distribution there is a great deal to be done if the best use is to be made of supplies available. Fluctuations in consumption among regions and from year to year as the result of variations in the monsoon are to be expected. As the volume of the fertilizer handled is increased rapidly there are also bound to be problems with distribution, storage, credit and consumer acceptance. These factors will interrupt the steady growth of consumption and raise serious problems for the management of the program. The physical and logistical problems of

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1/ An important reason for importing rock and sulphur or phosphoric acid is to make it possible to produce complex fertilizers in plants producing ammonia and urea.

2/ This assumes a naphtha based plant, about 40% of the plant imported and counting naphtha, most of which is produced from imported crude, and which can be exported as a foreign exchange cost. If imported ammonia is used to produce nitrogen fertilizer, less investment is required, the construction time is reduced, the product is cheaper and the foreign exchange cost is higher.

supply and distribution are only beginning to be given the attention they deserve. The Working Group for the Formulation of the Fourth Plan Proposals on Fertilizers of the Ministry of Agriculture has proposed a program for providing better port facilities for handling bulk imports of fertilizers and a program of storage at ports and in consuming areas. How near these proposals are to implementation are not known. The storage problems being encountered this year emphasise the urgency of this problem.

KAB/yd

B. The Production Program

The progress of the program for increasing nitrogen fertilizer production is shown graphically in Figure I and in tabular form in Table III. Plant by plant details are shown in Table IV. Only capacities actually underway or for which all major decisions have been taken to proceed are included. The estimates of future production are those made earlier this year and included in David Dodd's report.1/

It should be recalled that 1965/66 marks the beginning of the new agricultural strategy. In late 1965, the new policy on fertilizer was adopted to make the industry more attractive to foreign investors. At the same time an increased program of public sector expansion was undertaken. As is clear from the chart and tables, concrete results of the new program were first evident in 1967/68 when construction was started on about 1 million tons of nitrogen capacity. This was split about half and half between the public and private sectors. Of the private sector plants, Kanpur, Kotah and Baroda, only Kanpur has foreign collaboration (I.C.I.) Kotah is wholly Indian owned (Delhi Cloth Mills) and Baroda, though technically in the private sector, has a large (49%) state participation. On the other hand, one of the public sector plants (Madras) is a collaboration between the Government of India and a foreign private company (American International Oil Corp) and management will be in the hands of the foreign partners. Thus, in terms of foreign collaboration two plants are involved, Kanpur and Madras. And there is the interesting situation that Baroda though private, has a large state participation and Madras though public is managed by the foreign partner.(See Table V)

Thus far in 1968/69 it appears that construction will be started on an additional 560,000 tons of nitrogen - all in the public sector and all under the Fertilizer Corporation of India (Barauni, Namrup II and Trombay II) It is possible that more capacity could be started before the end of the year, (March 31, 1969). Whether it will be, depends on decisions still to be made with regard to pending projects in the private sector. New starts during the remainder of calendar 1969 would also depend mainly on private sector proposals.

1/ Report on the Fertilizer Industry in India. IFC/T 27 May 6, 1968
These estimates are somewhat lower than those made by the Petroleum Ministry at the same time.

The F.C.I. is heavily engaged in a very large program of construction. The next two plants it proposes to undertake, are coal based plants at Korba and Ramagudem. Even if they are approved they are unlikely to be started during 1969.

On the basis of past experience projects should not be counted on until they are actually started. The Goa and Mangalore projects were licensed in 1966 and together with Haldia were expected to be in production by 1970/71 in the original Government of India estimates of the IV Plan fertilizer program. Phillips has withdrawn from Haldia and neither Goa nor Mangalore has been started yet. More recently the Modi-Rohm and Haas project (a urea based plant to be built at Ghaziabad, U.P.) has been dropped by its promoters.

The status of the most active pending projects requiring foreign collaboration, in contrast to foreign assistance, is given in Appendix A. As noted, in the case of Kandla, Goa and the Vizag expansion, the decisions to proceed is primarily in the hands of the promoters. On the other hand the Dharamsi-Moraji, Shell and Tata projects require Government of India approval on various matters before they can proceed. In the case of Dharamsi Moraji & Shell the issues are relatively clear and the Government of India position is known. The Tata case, however, is unique in that it is out of the hands of the secretariat and depends on a cabinet decision which is fairly unpredictable as to substance or timing.

Of all the projects listed it looks from here as if the Cooperative project at Kandla is most likely to go ahead at this time.

In addition to the projects listed, we understand that a Letter of Intent is expected to be given soon to Occidental Petroleum Co. for a proposed project at Vizag. This project would involve ammonia imports for the period during which a naphtha based ammonia plant would be under construction.

C. Other recent developments

There have been a series of talks between representatives of the Indian and Iranian governments over a proposal to jointly set up a 1500 T/dy ammonia plant in Iran to supply ammonia to India. Phosphoric acid may also be involved. An Indian mission has just returned from talks in Iran and there is hope that a satisfactory agreement can be reached. Rapid agreement on a proposal along these lines would certainly affect the whole ammonia import program.

Action has been taken on the recent proposals for strengthening the organisation of the public sector fertilizer companies made by a joint TVA Indian team - particularly in terms of strengthening the marketing organisation.

AID has recently been receiving from the Indian Government, through the Fertilizer Corporation, a far greater volume of requests for technical assistance on fertilizer production than ever before. This involves bringing experts to India to assist in various aspects of plant operation and sending Indian engineers abroad.

KAB;yd/5
Sept. 9, 1968

APPENDIX A

STATUS OF PROJECTS UNDER ACTIVE CONSIDERATION
BUT NOT YET UNDERWAY 1/

Capacities in thousand tons of nutrients per year.

A. CASES WHERE DECISION TO PROCEED IS PRIMARILY IN THE HANDS OF THE PROMOTERS:

(1) KANDLA
215 N
130 P_2O_5

Indian Farmers Fertilizer Cooperative Ltd., to be managed by Fertilizer Cooperative International owned by U.S. Fertilizer Cooperatives (Bank of America financing under U.S. AID extended risk guarantee) engineering studies underway; financing arrangements not completed. All major issues with GOI settled.

(2) GOA
160 N

Birla - U.S. Steel
awaiting decision of U.S. Steel on whether to go ahead with the project. Project received licence in 1966 - other parties might be interested if U.S. Steel does not go ahead with it.

(3) VIZAG
(expansion)
I 20 N
II 135 N
35 P_2O_5

Coromandel Fertilizers (Chevron, Int. Minerals & Chemicals and E.I.D. Parry...)
company wants to run present operation successfully and profitably before making further investment. Some anxiety over provision of adequate power and water, situation has improved recently. Letter of Intent for expansion has been issued and extended but detailed proposal required for a licence has not been made by company.

Total Capacities involved: 530 N
165 P_2O_5.

B. CASES WHERE DECISION TO PROCEED REQUIRES FIRST A DECISION OF GOI OR CONCLUSIONS OF NEGOTIATIONS INVOLVING GOI OR REQUIRING APPROVAL OF GOI:

(1) MORARJI-KUWAIT
Bombay area
90 N
230 P_2O_5

Dharamsi Morarji Chemical Co. Ltd., in collaboration with Kuwait Chemicals & Fertilizers Ltd. Agreement on terms for importing liquid ammonia not reached. Kuwait suppliers want fixed price for 7 years. GOI will not agree (in case of Tata proposal, ammonia price is to be fixed for much shorter time) - financing yet to be arranged.

1/ These notes are based on what can be learned in Delhi. It is likely that IFC may have fuller information on some points through its contacts with the firms involved.

(2) BURMAH SHELL
Bombay
250 N

This project depends on expansion of the company's refinery in Bombay. The larger refinery volume provides much of the incentive to go into fertilizer manufacture. The expansion involves negotiation of a new refinery agreement. These negotiations are stuck on the issue of how much Indian crude, indigenous or overseas, as and when found, the refinery would be required to process. The company position is that such crude should be allocated equally along all 6 refineries (3 public and 3 private). The Government has not accepted this view. Its reported position has been that the refinery should take indigenous crude without any restrictions, and that Indian owned overseas crude should be allocated only among the 3 private refineries.

(3) TATA-ALLIED
Gujarat
130 N
140 P_2O_5 I
80 P_2O_5 II

Tata Chemicals - Allied Chemicals
Awaiting Cabinet decision on granting of licence.
Original proposal was approved by the Ministry of Petroleum and Chemicals and by Committee of Secretaries set up to review fertilizer proposals. Because of unusual nature, large imports of ammonia large size requiring heavy commitment of rupee sources and a private port, it was referred to Cabinet where opposition developed. It was then referred to the Planning Commission for study. This took several months. The commission set out the issues and had discussions with Tata representatives before submitting its study to the Cabinet. In the course of these discussions some modifications were agreed to by Tata's in an attempt to meet some of the criticisms in the Cabinet. These modifications involved allowing GOI participation in the project, limiting the time during which ammonia could be imported and possibly altering the size and phasing of the project.

It cannot be known at this time whether these changes will make the project acceptable to the Cabinet or whether other issues, such as the construction of a private jetty for the handling of bulk imports of raw materials will prove a stumbling block. Neither is it known what the attitude of Allied Chemical will be to the alterations that may be necessary to gain Cabinet approval. Because the decision on the project is out of the hands of the secretariat there is a reluctance to discuss theproject in the Ministry of Petroleum & Chemicals or in the Planning Commission, the groups most involved with the project. There still seems to be hope that it will be approved in some modified form but no responsible official seems willing to predict when or in what form. It's simply "up to the Cabinet".

Total Capacities involved: 470 N
450 P_2O_5

C. PROPOSALS INVOLVING FOREIGN COLLABORATION STILL ALIVE BUT IN AN EARLY STAGE OF PREPARATION:

(1) KAISER-BIRLA
160 N

A Letter of Intent was issued on the basis of the original proposal for a naphtha based urea plant at Mirzapur, U.P. Kaiser engineers have drawn up a more complex proposal which we understand to involve coastal plants, the import of ammonia and phosphoric acid, with urea plants at inland locations as a second stage. The proposal was submitted to the GOI in August 1968 and is being studied. We understand that there are questions about some aspects of the proposal which will have to be dealt with before it can be sanctioned. This can be expected to take some time.

(2) MANGALORE
240 N
90 P_2O_5

Malabar Chemicals -(Duggals, International Development and Investment Co., Nassau, Bahamas, and Girdler Corp.) A licence was issued to Duggals for this project in August 1966. No progress was made. An attempt is now being made to change the sponsorship of the project with Mysore State taking a 49% share, IDI's portion reduced and with equipment financed under a Japanese credit. The proposed pattern will be similar to that of the Gujarat State Fertilizer Plant at Baroda.

(3) HALDIA
150 N
80 P_2O_5

Phillips Petroleum who were issued a Letter of Intent for a project at this site decided not to proceed with the project. A consortium of French and Polish interests are considering possible collaboration in a public sector project. Discussions are at an early stage.

Total Capacities involved: 550 N
170 P_2O_5

KAB/yd/5
September 9, 1968

FIGURE I

NITROGEN FERTILIZER

IN THOUSAND TONS OF N

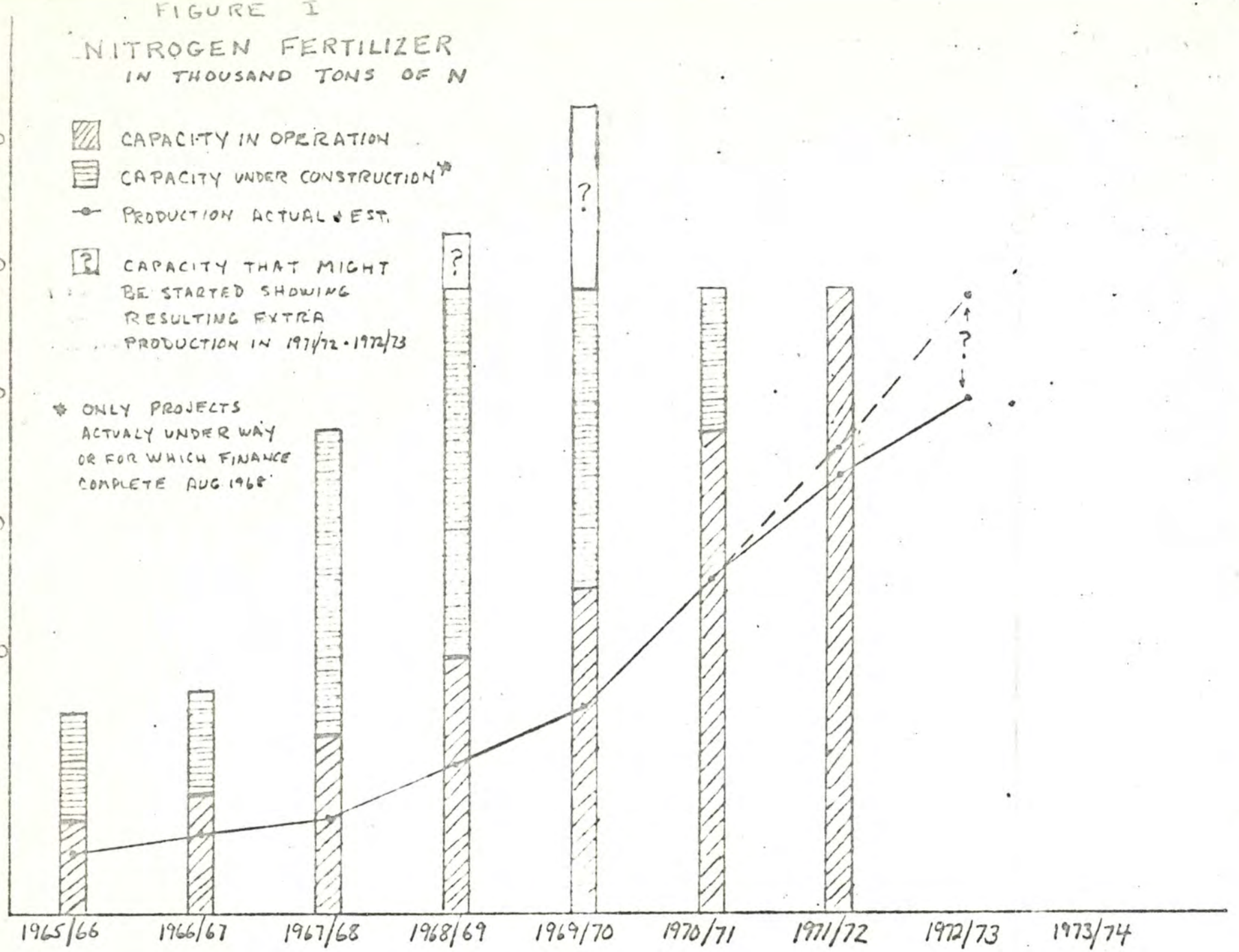


TABLE I

Fertilizer consumption Targets with actual consumption[1/] thru 1967/68

(in 000s tons nutrients)

	NITROGEN		PHOSPHATE		POTASH	
	Target	Actual	Target	Actual	Target	Actual
1965/66[2/]	800	583	250	134	150	90
1966/67	1000	830	370	275	200	134
1967/68	1350	1040	500	430[3/]	300	200
1968/69	1700		650		450	
1969/70	2000		800		550	
1970/71	2400		1000		700	
1971/72	2780		1200		820	
1972/73	3220		1440		950	
1973/74	3730		1740		1110	

1/ Distribution at state level

2/ Revised targets. Original Third Plan targets were 1000 N, 400 P_2O_5 & 200 K_2O

3/ Believed to include substantially increased stocks over previous year.

Sources: Targets: 1966/67 thru 1970/71, Committee on Fertilizer (Sivaraman Committee), Ministry of Food and Agriculture, 1965

1971/72 thru 1973/74, Working Group IV Plan Proposal on Fertilizers & Manures, Ministry of Food and Agriculture, 1968

Actuals: Fertiliser Statistics 1966-67, Fertilizer Association of India.

KAB:5
Sept.5, 1968

TABLE II

ESTIMATED IMPORT REQUIREMENTS OF FERTILIZER AND FERTILIZER MATERIALS

(in millions of dollars)

	1968/69	1969/70	1970/71	1971/72
Nitrogen fertilizer	224	228	198	198
Phosphate fertilizer				
Finished fertilizer	47	57	74	83
materials for manufacture	31	34	39	52
TOTAL	78	91	113	135
Potash	29	36	46	52
TOTAL	331	355	357	385

NOTE These estimates assume a level of imports sufficient to achieve consumption targets given expected levels of production. For 1968/69 actual consumption will be less than target and imports may be expected to be less than shown.

SOURCE Report on The Fertilizer Industry in India IFC/T-27 May 6, 1968.

KAB:yd/5
Sept.6,1968.

TABLE III

NITROGEN FERTILIZER

Capacity in Operation, Capacity under Construction, Production & Consumption targets

(in 000s of tons of N per year)

	Capacity in operation	Capacity under construction	Production	Consumption Targets
1965/66	370	410	240	800
of which new plant	65			
1966/67	470	400	310	1000
of which new plant	70			
1967/68	695	1180	370	1350
of which new plant	237			
1968/69	1000	1435*	580	1700
of which new plant	175			
1969/70	1270	1165*	800	2000
of which new plant	240			
1970/71	1875	560*	1300	2400
of which new plant	605			
1971/72	2435*		1700*	2780
of which new plant	560			
1972/73	2435*		2000*	3220

NOTE

(1) Capacity under construction includes expansion of existing plants, removal of deficiencies in existing plants (e.g. naphtha unit for Rourkela) and new plants. The new plant capacity is indicated separately in the year in which it first comes into production. It is estimated that new plant produces 50%, 75% and 90% of capacity in first three years of operation.

(2) Only plants actually under construction or for which financing is complete as of August 1968 are included. It is likely that some additional new capacity will be started in 1968/69 and certain in 1969. Allowing three years for the completion of plant it follows that capacity in operation and production in 1971/72 are likely to be higher than indicated and certainly the figures shown for 1972/73 will be exceeded. Figures which can be increased by investment decisions yet to be made are indicated with an asterisk*.

KAB:yd/5
Sept. 5, 1968

TABLE IV

NITROGEN FERTILISER

Capacity in operation, Capacity under Construction and Production

(in 000s of tons of N per year)

Capacity in Operation		Capacity under Construction		Production
1965/66				
Sindri	117	Namrup	45	
Nangal	80	Gorakhpur	82	
Trombay	65	Neyveli	70	
FACT	30	Baroda	100	
Rourkela	40	Vizag	80	
Others	35	FACT[1]	30	
	367		407	238
1966/67				
As above	367	Namrup	45	
Neyveli	70	Gorahkpur=	82	
FACT	30	Baroda	100	
		Vizag	80	
		Rourkela[2]	80	
		Others	13	
	467		400	308
1967/68				
As above	467	Namrup	45	
Gorakhpur	82	Rourkela	80	
Baroda [3]	75	Durgapur	150	
Vizag	80	Cochin	150	
Others	13	Madras	200	
		Baroda II	140	
- Sindri[4]	22	Kanpur	205	
		Kotah	130	
		Sindri[4]	22	
		FACT[5]	30	
		Baroda[6]	25	
	695		1177	368
1968/69				
As above	695	Durgapur	150	
Namrup	45	Cochin	150	
Rourkela	80	Madras	200	
Sindri	22	Baroda II	140	
Baroda	25	Kanpur	205	
Kotah	130	FACT[5]	30	
		Namrup II	150	
		Barauni	150	
		Trombay II	260	
	997		1435*	580 (est)

/over

1969/70

As above	1000	Durgapur	150	
Baroda II	140	Cochin	150	
Kanpur (I)	100	Madras	200	
FACT5/	30	Kanpur (2)	105	
		Namrup II	150	
		Barauni	150	
		Trombay II	260	
	1270		1165*	800 (est)

1970/71

As above	1270	Namrup II	150	
Kanpur (2)	105	Barauni	150	
Durgapur	150	Trombay II	260	
Cochin	150			
Madras	200			
	1875		560*	1300(est)

1971/72

As above	1875			
Namrup II	150			
Barauni	150			
Trombay II	260			
	2435*			1700* (est)

1/ FACT 3rd stage expansion
2/ Rourkela - naphtha unit to make up gas deficiency
3/ Power not adequate for full operation
4/ Deterioration of gypsum reduces capacity of plant. New investment required to reach original capacity.
5/ FACT 4th stage
6/ Baroda correcting power deficit

* Only firm projects as of August 1968 considered. These figures do not take into account new plants or expansions of existing plants which may be started from the fall of 1968. Projects started before April 1969 can be expected to produce some output for the year 1971/72.

KAB:yd/5
September 3, 1968

TABLE V

CLASSIFICATION OF MAJOR NITROGEN FERTILIZER PLANTS IN OPERATION OR UNDER CONSTRUCTION BY OWNERSHIP

(capacities in 000s tons of Nitrogen)

A.	PUBLIC SECTOR		
1.	Fertilizer Corporation of India (FCI)		1124
	Sindri	117	
	Nangal	80	
	Trombay	90	
	Trombay II	260	
	Namrup	45	
	Namrup II	150	
	Gorahkpur	82	
	Durgapur	150	
	Barauni	150	
2.	Fertilizers & Chemicals, Travancore (FACT)		240
	FACT, Alwaye	90	
	Cochin	150	
3.	Hindustan Steel		120
	Rourkela	120	
4.	Neyveli Lignite Co.		70
	Neyveli	70	
5.	Madras Fertilizers Ltd.		200
	Collaboration with American International Oil Corporation and National Iranian Oil Corporation, the former will manage the plant. Government of India ownership 51%.		
	TOTAL PUBLIC SECTOR		1754

B. PRIVATE SECTOR

Vizag	- Coromandel Fertilizers Chevron, Int. Minerals & Chemicals & E.I.D. Parry (India)	80
Kanpur	- Indian Explosives - I.C.I. finance from IBRD and IFC	205
Kotah	- Delhi Cloth Mills (DCM) (no foreign collaborator)	130
Baroda	- Gujarat State Fertilizers Gujarat state 49% Coops. and individual shareholders 51%	240
TOTAL PRIVATE SECTOR		655

NOTE This list does not include two small private plants at Ennore and Varanasi and small capacities for by product Ammonium sulphate at steel mills public and private. This capacity classified under 'Others' in Table IV.

KAB:yd/5
Sept.6, 1968

FORM NO. 57A | INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

CONFIDENTIAL

TO: Mr. G. Votaw

DATE: September 9, 1968

FROM: K. A. Bohr KAB

SUBJECT: Current causes for delay in the Burmah Shell Fertilizer Project

The following information is in more detail than I thought appropriate for the fertilizer note. It should be useful as background when the Indian delegation is asked the status of the Burmah Shell proposal. It is based primarily on conversations with the Burmah Shell representative in Delhi, Mr. R.B. Aibara.

The Burmah Shell proposal involves an expansion of their refinery at Bombay from a capacity of 3.75 million tons through put per year to 5 million tons. The extra refining capacity is required to produce the naphtha feedstock for the fertilizer plant, and is an attractive aspect of the proposal from the company's point of view. The naphtha price is set at less than the export price which is not the case with the prices of other products. It is the "other products" which make the proposition attractive combined with the opportunity to supply more crude.

The refinery expansion requires a new refinery agreement. At the present time negotiations on the agreement are stuck. The Government wants Burmah Shell to agree to process any indigenous crude that may be found in the country and also to share with the two other private sector refineries, Caltex and Esso, the processing of Indian crude that may result from present explorations in the Middle East. The company will not agree to this.

The company's position is that both indigenous and foreign crude should be allocated equally among all refineries, the three private sector ones - Shell, Esso and Caltex and the three public sector ones - Cochin, Madras and Haldia. (Haldia and Madras are under construction, Haldia in a very early stage) In the event that indigenous crude is found near Bombay, the Gulf of Cambay is a likely area, the company is willing to process the entire amount subject to "compensation" i.e. providing other refineries take the imports of its own crude, it would forego processing by taking more than its share of the indigenous crude. The company is also willing to take its share of indigenous and overseas crude regardless of what the others do as long as the determination of the share involves all six refineries.

The Government of India has told the Company that its position is unacceptable. According to the Company, the government's objections appear to be based on a reluctance to change the existing agreements for the supply of crude to Cochin, Haldia and Madras, projects in which the government is involved as a partner. The company argues that this would not be difficult to do since the agreement with Phillips to supply Cochin refinery expires in 1970 and the agreement with the French to supply crude for the Haldia refinery allows the government the option

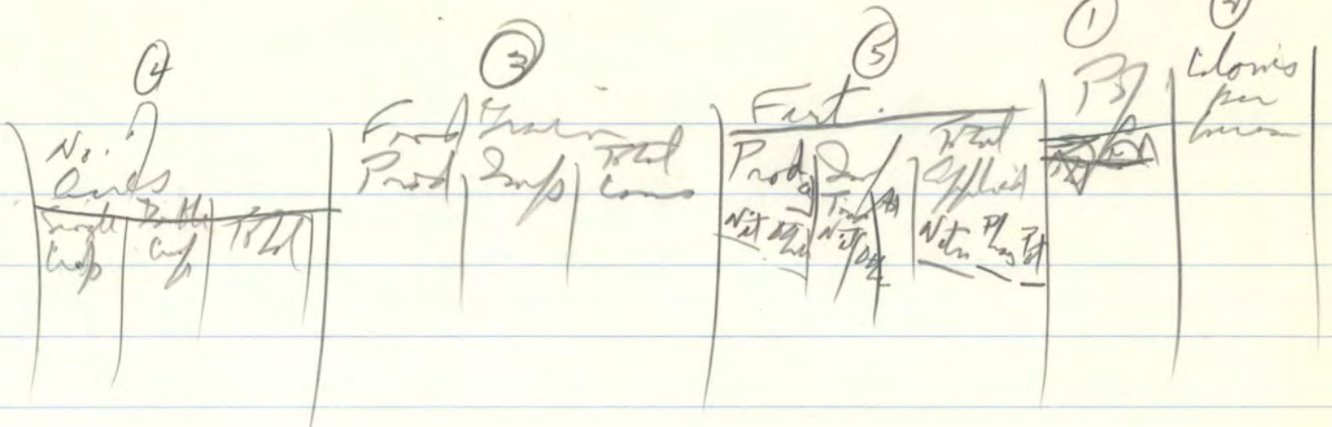
to supply up to one half of the crude requirements. It is also pointed out that Phillips is in partnership with the Government of India in the exploration for crude in the Middle East.

The comments on the Government of India position are those of Aibara. Nayak, Secretary, Ministry of Petroleum and Chemicals has confirmed that the critical issue was the processing of indigenous crude. Although the Government of India has rejected the company's proposal to take up to one sixth of the indigenous crude, it is not clear that it still insists Shell be required to take all of it.

This is a large project (capacity 250,000 tons of nitrogen per year) and a particularly important one in view of the problems other potential projects in the private sector are having. In this case too, there are likely to be problems with the fertilizer plant itself once the refinery agreement is settled, if it is. The plant's size and location with the problem of transporting its output along with that of Trombay to inland markets is a likely issue). However, with all that is at stake, it seems a great pity that the project should founder on the issue of how much yet to be discovered crude in yet to be determined amounts the refinery would have to take. There is no question of not taking any indigenous crude. This was a condition of the original refinery agreement for all three private refineries although no amount or proportion was specified. The question is whether it is all or one sixth or possibly some other amount that might be negotiated.

KAB:yd

India - Food Consn, Agri, Rural + Pop



1966

1988

a) Based on existing plants; plants under construction; + plants formally committed.

October 1, 1968

AN OUTLINE OF CAPACITY REQUIREMENTS TO MEET FERTILIZER NEEDS IN INDIA BY 1974

by J. David Dodd
(an interim report)

ANNEXES

INTRODUCTION

The market for fertilizers in India has been examined in some detail in order to arrive at a supply-demand pattern on a regional basis for the year 1973/74. The reason that the year 1973/74 has been chosen is that any sizeable plant that is being considered now will not be in full production until about this time.

The objective in making this analysis is to outline a programme of construction of new fertilizer plants that could most economically serve India's needs during the 1970's. The relative merits of the various alternatives have been assessed, notably alternative feedstocks and the use of intermediate materials such as elemental phosphorous, phosphoric acid and anhydrous ammonia.

Because of the size of the task and the limited time available, the field trip to India was confined to the eight States comprising the northern and western regions. Basic market data for the southern and eastern States have been derived from statistics supplied by the Central Government and the Fertilizer Association of India and from information supplied by mail from the Directors of Agriculture of the States concerned.

The information so obtained has been synthesized in the main body of the report, whereas much of the statistical data are contained in the Annexes. Similarly, the detailed data on the eight States visited, from which much information for the market assessments for the northern and western regions has been derived, are contained in Annexes I to VII as follows:

Northern Region

Annex I	Uttar Pradesh
II	Punjab, Haryana
III	Rajasthan
IV	Jammu and Kashmir

Western Region

Annex V	Maharashtra
VI	Gujarat
VII	Madhya Pradesh.

A summary of basic data for the other eight States (southern and eastern regions) is given in Annex VIII.

Where annual statistics are quoted, they are given on a financial year basis (April to March) unless otherwise stated. Also all tonnages are expressed in metric tons.

In order to facilitate comparisons between various manufacturing processes, or between the use of different raw or intermediate materials, a constant rate of return of 15% on total investment has been assumed throughout.

SUMMARY

1. With the completion of plans for removing major obstructions to full capacity operation, the existing plants should achieve a production rate of 815,000 tons by 1970/71 and maintain this level thereafter. With the additional capacity either under construction or firmly committed, the level of production is expected to reach 2,175,000 tons of N by 1973/74.

2. The consumption target set by the Central Government for 1973/74 is 3.7 million tons of N. Consumption, however, has been consistently falling short of target in the past, and some reduction in the 1973/74 is indicated if a realistic estimate of the gap in production and consumption is to be made. In assessing the additional capacity needed, a consumption of 3.0 million tons of N for 1973/74 has been assumed.

3. It is expected that approximately half of the nitrogen required will be in the form of complex or compound fertilizers and the balance in the form of straight nitrogenous fertilizers.

4. To simplify analysis, India has been divided into four main regions, as follows:

North:	Jammu and Kashmir	East:	Assam
	Punjab		Bihar
	Haryana		Orissa
	Rajasthan		West Bengal
	Uttar Pradesh		
South:	Andhra Pradesh	West:	Gujarat
	Kerala		Madhya Pradesh
	Madras		Maharashtra
	Mysore		

5. The geographic distribution of existing and firmly committed plants shows considerable mal-location. Furthermore, the expected product-mix is not compatible with market requirements.

6. By 1973/74 there will be an approximate balance of production and consumption of straight nitrogenous fertilizers in three of the regions, but in the eastern region there will be considerable excess capacity. On the other hand, the capacity for complex fertilizers will fall short of requirements by over 1.0 million tons in terms of N. The northern region is expected to account for more than one-third of this additional requirement.

7. The immediate programme for the construction of new capacity that suggests itself is the installation of facilities for the manufacture of between 700,000 and 750,000 tons of N per year in the form of complex fertilizer. The target date for these new plants to be in full production should be 1973/74.

8. Almost all India's requirements of raw materials for fertilizer production will need to be imported; even naphtha as an ammonia feedstock

will not be available in sufficient quantities to meet any significant part of the additional requirements for fertilizer production.

9. The use of intermediate materials, such as ammonia and phosphoric acid or elemental phosphorous, suggest themselves as possible means of achieving production economies and of speeding up the whole fertilizer programme. Both imported wet-process phosphoric acid and furnace acid produced from elemental phosphorous would be more economic than the indigenous manufacture from imported raw materials with no sacrifice of foreign exchange.

10. Anhydrous ammonia imported from a large-scale plant, situated at a cheap source of gas, has advantages in that it spreads the investment load and results in economies of production in a complex fertilizer such as diammonium phosphate (DAP) but is marginally less competitive when used for the manufacture of straight N.

11. It is suggested that the overall target of an additional 725,000 tons per year could be best achieved by the erection of four large-scale complex fertilizer plants - three at coastal locations and one inland. In addition, it is recommended that part of the capacity in the eastern region be converted from straight N to complex fertilizer. This latter proposal needs further study and it does not form part of the plan proposed.

12. Depending on the choice of location for manufacturing facilities and the choice of raw or intermediate materials, the total cost of fixed assets for the programme would be between $310 and $400 million. One configuration that suggests itself would cost about $338 million, of which $110 million would have to be invested in India and a further $100 million in ships which could be Indian-owned or foreign-owned. This case supposes all ammonia being imported. On the other hand, if all ammonia is manufactured locally, the investment needed in India willbbe $185 million and $48 million in ships.

2. PRODUCTION

(a) Nitrogen

There are ten major nitrogen plants and a number of small units with an aggregate annual capacity of 890 tons. Because, however, of limitations of raw materials, feedstock, power and some plant deficiencies, the attainable capacity is substantially below the rated figure. However steps are being taken, or are planned, to remedy these defects and the existing plants, with a modest expansion at one location, can be expected to reach the aggregate of their annual attainable capacities of 815,000 tons by 1971/72.

Annual attainable capacity in this context is defined as 90% of rated capacity for those plants that have no inherent difficulties such as exist at four of the major producers at present. In assessing annual rated capacity, it is assumed that a plant operates at its daily capacity for 330 days out of the year.

There are at present under construction major capacity increases at six locations and there are another three locations where major additional capacities are firmly committed. The total annual capacity of the plants under construction is 975,000 tons per year and for those firmly committed a further 560,000 tons.

In forecasting the future production of new plants, an allowance of two years has been made for running-in time. It is assumed that new plants will operate at 50% for the first 12 months of production, 75% for the second 12 months and 90% of annual capacity (attainable capacity) for the third year and thereafter. For expansions and rationalization schemes a running-in time of only one year has been assumed in the forecasts; production at 75% of the capacity of the expansion is assumed for the first year, with 90% for the second and succeeding years.

The forecasted production, then, of all plants, existing, under construction and firmly committed, is given in Table 1 for the years 1970/71 to 1973/74:

Table 1 - Production Forecasts of N for 1971/72 to 1973/74 - '000 MT

Plants	1971/72	1972/73	1973/74
(a) Existing	815	815	815
(b) Under construction	745	875	875
(c) Firmly committed	140	385	485
Totals	1,700	2,075	2,175

Annex IX gives details how this anticipated production is expected to be achieved indicating plant locations by town and State.

There are also eight projects with an aggregate annual capacity of 1,330,000 tons that have been licensed or to which letters of intent have

been issued. There are also a further four projects, totalling 840,000 tons per year, that are under consideration. Brief details of these twelve projects' are given in Annex X.

A number of these projects may now be considered dead although they may re-materialize later under different sponsorship. Of the balance, it is not possible to gauge when, if at all, they will become operative and whether their designed capacities will be those that are envisaged today. Because, then, of the number of uncertainties surrounding the 'planned projects', the assessment of future production-consumption pattern only takes into account anticipated production from those plants that are either in operation, under construction or firmly committed today.

(b) Phosphorous

There are 37 completed plants, having a total annual capacity of about 430,000 tons of P_2O_5. Of this capacity, about 210,000 tons is in the form of single superphosphate from 30 separate plants. A list of completed plants, together with their locations, is given in Annex XI. There are three units of relatively large size which have recently been completed and which cannot yet be considered as being in full production.

In forecasting future production from existing plants, it has been assumed that the small but established plants will continue to maintain the same rate of production in relation to their annual capacity as that for the past few years, and that the three large units will achieve their attainable capacities within the next two years. Production, then, for 1970/71 and thereafter is expected to be about 340,000 tons of P_2O_5 per year from the existing facilities.

There are three plants with an aggregate annual capacity of 100,000 tons under construction. There are a further two, with annual capacities totalling 160,000, which are firmly committed. There is another project at Sindri which appears virtually committed which would add another 160,000 tons per year of P_2O_5 in the form of triple superphosphate. These six plants should contribute a further 270,000 tons of P_2O_5 by 1973/74.

The forecasted production of P_2O_5 for the years 1971/72 to 1973/74 is given in Table 2:

Table 2 - Production Forecasts of P_2O_5 for 1971/72 to 1973/74 - '000 MT

Plants	1971/72	1972/73	1973/74
(a) Existing	340	340	340
(b) Under construction	160	240	270
(c) Firmly committed	-	110	145
Totals	500	690	755

There are also a number of other projects under consideration with capacities totalling about 1 million tons at eight different locations. Annex X gives brief details.

(c) Complex

Although the expected increases in capacity of both N and P_2O_5 over the next few years are impressive when compared with existing capacity, the anticipated increase in capacity of complex fertilizers is regrettably low. An analysis showing the forecasted production of N and P_2O_5, indicating the tonnages that can be expected in the form of complex fertilizer for the years 1971/72 to 1973/74, is given in Annex XII.

From Annex XII it will be seen that, out of a total anticipated production of over 2 million tons of N in 1973/74, only 325,000 tons will be in the form of complex fertilizer.

Another weakness of the industry is that almost the entire productive capacity of complex fertilizers will be in the eastern and southern regions. There are facilities in Maharashtra, Gujarat, Andhra Pradesh and Kerala; an expansion is planned at the Trombay plant in Maharashtra and the only sizeable new facility at present being built is in the south at Madras.

The first objective of a programme for the construction of new plants should be to confine this initially to the construction of plants to produce complex fertilizers, and the second should be to correct the geographic imbalance of the location of such facilities.

3. CONSUMPTION

(a) Historical Pattern

The consumption of nitrogen, as measured by the quantities distributed, has increased over the past five years from about 410,000 tons in 1963/64 to about 1,070,000 tons in 1967/68; over the same period, and using the same yardstick for consumption, the figures for phosphate are 120,000 tons and 450,000 tons. The production, imports and distribution of nitrogenous and phosphatic fertilizers are given in Tables 3 and 4 respectively:

Table 3 - Nitrogen - Production, Imports and Distribution 1963/64 to 1967/68 - '000 Tons N

	Production	Imports	Distributed	Target Cons.
1963/64	220	200	410	
1964/65	245	260	435	
1965/66	240	375	545	
1966/67	310	575	840	1.0
1967/68	355	750	1,070	1.35

The consumption targets in 1966/67 and 1967/68 were 1.00 and 1.35 million tons of N respectively and so, even by the 'distribution' measurement, consumption was running at about 20% below target in 1967/68.

Table 4 - Phosphate - Production, Imports and Distribution 1963/64 to 1967/68 - '000 Tons P_2O_5

	Production	Imports	Distributed	Target Dist.
1963/64	110	10	120	
1964/65	130	15	150	
1965/66	120	20	130	
1966/67	145	130	250	370
1967/68	200	300	450	500

Targets for consumption in 1966/67 and 1967/68 were 370,000 and 500,000 tons respectively.

There is some question of the accuracy of the estimates of consumption. The official figures give the tonnages distributed to each State and, since there is no central source of ascertaining stocks, there is no quick way to calculate actual consumption figures. However, for eight States, figures are available for the actual distribution to the retailer, or sometimes the farmer, and these can be assumed to reflect reasonably accurately the true consumption figures for the States concerned. On average the Central Government figures indicate a 10% greater consumption than that suggested by the State figures of distribution. Thus the 'true' consumption of N, if this factor is applied on a nation-wide basis, in 1967/68 was probably about 950,000 tons, or some 30% below target.

There is a very considerable variation of consumption between States which, of course, is to be expected in view of the wide variations in areas under cultivation. The State-wise distribution of fertilizers in

1967/68 is given in Annex XIII. There is also a wide variation between States of consumption per hectare, which is a much more significant factor. The estimated consumption of all plant nutrients per hectare of cropped land for each State is shown in Annex XIV.

(b) Forecast of Future Consumption

The target figures of consumption, as estimated by the Central Government for the years 1969/70 to 1973/74, are given in Table 5:

Table 5 - Consumption Targets 1969/70 to 1973/74 -'000 MT

	N	P	K
1969/70	2,000	800	550
1970/71	2,400	1,000	700
1971/72	2,800	1,200	800
1972/73	3,200	1,400	900
1973/74	3,700	1,700	1,100

A breakdown of the nation-wide targets by States is given in Annex XV and these are compared with the individual State forecasts, where these are available. It will be seen that, by and large, the States tend to have more optimistic target figures than those set by the Central Government, which is surprising since the Government figures are, in themselves, ambitious.

As has been noted, consumption in 1967/68 fell short of target by 400,000 tons or 30%; on the other hand, consumption increased by nearly 100% during the preceding two years. There is no reliable method of forecasting fertilizer consumption in the developing countries, and the extrapolation of trends can be particularly misleading. The Central and State Government targets are based on the amounts of fertilizer needed to achieve certain agricultural goals. It seems inevitable that these targets will not be achieved, and the degree to which they are achieved will depend upon (among other things) the skill and vigour with which these agricultural programmes are carried out. However, it is not the purpose of this paper to argue the finer points of what constitute realistic targets. Even if there is a considerable difference between achievement and target, with the existing and firmly committed production capacity, there will remain a substantial gap between consumption and production. An arbitrary reduction, then, in the 1973/74 target of 700,000 tons of N has been assumed, and even then there will be an estimated requirement of over three-quarters of a million tons of additional productive capacity of N in the mid-1970's, if the country is to approach self-sufficiency.

Of equal or more importance than the forecast of all-India consumption is the need to arrive at a reasonable analysis of regional requirements from which a workable plan for the construction of new facilities can be derived.

4. PRODUCTION-CONSUMPTION PATTERN

From the time a firm decision is taken to go ahead on a new plant, it will take about three years to construct a large-scale integrated fertilizer complex in India and a further two years to achieve full production. Simpler plants, but not necessarily with lesser capacities, designed to use intermediate materials such as ammonia and phosphoric acid or elemental phosphorous, could be built in under two years. In either event, however, there will be appreciable lead time, and so the year 1973/74 has been taken as the target year for new capacity to come into full production.

In the light of present knowledge, the production forecasts given in Section 2 are as realistic as any forecast of this nature could be. In Section 3 it has been suggested that the consumption target for N for 1973/74, for the purpose of forecasting future production-consumption balance, be reduced by 700,000 tons, or about 20%.

For a regional breakdown of consumption for 1973/74 one must be guided by the Central Government's estimates, taking into account any modifications suggested by the individual State forecasts when these are appreciably lower than those of the Central Government. On this basis, then, and assuming an all-India consumption figure of 3.0 million tons, estimates of consumption, in terms of N by region and State, are given for the years 1970/71 and 1973/74 in Annex XVI.

It is necessary to break down further the consumption forecasts into types of fertilizer. It will be seen from Annex XV that the Government forecasted overall ratio of N to P_2O_5 is approximately 2-1. It is the practice to apply all the P_2O_5 and K together with a portion of the N at the time of planting, and to apply a top dressing of straight N about four to five weeks later. The overall long-term objective is to achieve a 2-1 ratio whereby half of the nitrogen is applied at the time of planting in the form of a complex or compound fertilizer and the balance as top dressing.

In estimating future requirements, then, it is assumed that half the nitrogen consumed will be in the form of complex or compound fertilizers and the other half in the form of straight nitrogenous fertilizers. It is also estimated that three N-P ratios, with potash added as required, could adequately serve about 90% of the country's total requirements of complex fertilizers; this is a further simplifying factor in planning future capacity, although of course there will be regional variations in agronomic practices.

A regional breakdown of estimated production of N, both as straight N and in complex form, as it relates to estimated consumption (modified Government forecasts) is given in Annex XVII. The projected geographic imbalance between production and consumption, as it relates to complex fertilizers, has already been commented upon. There is also an imbalance with respect to straight nitrogenous fertilizers. Whereas three of the regions can be expected to be approximately in balance by 1973/74, in the eastern region there will be considerable over-capacity.

The expectation is, then, that there will be an overall deficiency of N in excess of 800,000 tons, with an excess capacity in the eastern region causing a small overall excess capacity of about 300,000 tons of straight N. The biggest problem will remain in the complex fertilizer area, where a deficiency of over 1.1 million tons can be expected; a large portion of this - about 450,000 tons - will be in the northern region and the balance divided more or less evenly between the other three regions.

The excess capacity of straight N in the eastern region is likely to be somewhat of an embarrassment, since the transport of large quantities of finished fertilizer to other regions will be costly and will no doubt put some strain on the railway system. Furthermore, over 400,000 tons of the expected production of about 650,000 tons will be in the form of urea which is not compatible with the superphosphates in mixtures.

The question of supplying the northern region with complex fertilizers will remain the single biggest problem. The whole of the northern region is far from any port location and the logistic problem of hauling large quantities of raw materials (phosphate rock, sulphur and even naphtha) for production locally in the region is formidable. Even hauling large quantities of finished fertilizer, although requiring much less rail capacity, would put a severe strain on the rail and port systems in the west which would carry the major part of the load. The solution that suggests itself is the use of intermediates, and this possibility is examined at some length in Sections 7 and 8.

5. DETERMINATION OF FUTURE SELLING PRICES

(a) Existing Price Structure

Until recently, selling prices and the distribution of fertilizers have been closely controlled by the Government. Now, new projects are free to fix prices and arrange their own distribution channels for a period of seven years from the start of commercial production, with the provision that the Government may buy up to 30% of the output of a negotiated price.

There remain, however, fixed prices for fertilizers procured by the Central Fertilizer Pool, either from indigenous or foreign sources; this price is termed the 'pool price' and is arrived at for each grade or type of fertilizer after estimating all costs, including an all-India average freight cost, on both the indigenous and imported product, and then calculating a selling price which will result in a break-even cost to the Central Fertilizer Pool. A fixed distribution margin is added to the pool price and, hence, a retail price is arrived at.

Table 6 gives the current pool and retail prices for the grades and types of fertilizer being made by public sector plants or being imported by the Pool:

Table 6 - Pool Price and Distribution Margins - September 1968

Product	Pool Price Rs	Distribution Margin Rs	Retail Price Rs	Retail Price $ Equivalent
Ammonium sulphate (50 kg bags)	458	55	513	68
Ammonium sulphate (100 kg bags)	447	55	502	67
Urea	780	80	860	114
Ammonium sulphate nitrate (26%)	515	62	577	77
Calcium ammonium nitrate (20.5%)	385	52	437	58
Calcium ammonium nitrate (25%)	455	55	510	68
*Calcium ammonium nitrate (26%)	475	60	535	72
*Diammonium phosphate	1,000	95	1,095	146
*Ammonium phosphate	738	80	818	109

*Imported

Annex XVIII lists the ex-factory and c.i.f. prices, together with the assumed costs that make up the break-even cost to the Pool. The pool price is then fixed on the anticipated proportion of imported to local product that the Pool expects to handle. Annex XIX gives a breakdown of the assumed costs that make up the distribution margin.

Although not explicitly stated, the pool prices do in practice fix a maximum price at which private sector plants can sell comparable products even outside the Pool. The pool prices also tend to regulate prices of other grades of fertilizer (i.e. complex fertilizers) on the basis of equivalent price per unit of nutrient.

(b) Production Costs - Public Sector Plants

The costs of production of the three major public sector plants that were in full production in 1966/67, as reported for that year, are given in Table 7:

Table 7 - Costs of Production - Public Sector Plants - 1966/67

Plant	Product	Rs/Ton	$ Equivalent
Sindri	Ammonium sulphate	308	41
	Double salt	335	45
	Urea	511	68
Nangal	CAN	229	31
FACT	Ammonium sulphate	411	55
	Superphosphate	250	33
	Ammonium phosphate (16-20-0)	609	81

The estimates of expected production costs of the four public sector plants that are at present under construction or just completed are given in Table 8:

Table 8 - Projected Cost of Production Public Sector Plants Under Construction or Recently Completed

Plant	Product	Rs/Ton	$ Equivalent
Namrup	Ammonium sulphate	341	45
	Urea	528	70
Gorakpur	Urea	470	63
Durgapur	Urea	343	46
Cochin	Urea	420	56

It is not known on what accounting basis the 1966/67 production costs have been calculated or how the forecasts of production have been estimated. At the best, then, they are a rough guide as to operating costs in the public sector. The ex-factory prices assumed in calculating pool prices should not, then, be used as a basis for estimating the competitive strength of the public sector plants existing or being built, nor, of course, is it possible to forecast the probable price structure in India in the early and mid-1970's.

In assessing, then, the economic merits of a new plant being planned today, which could be in production at the earliest in 1972, it would be prudent to assume that it would have to compete on the basis of world prices ruling at the time.

(c) Estimate of Future Prices

The present c.i.f. prices, and those expected to obtain in the early 1970's from some of the major potential sources of supply for urea, ammonium sulphate and DAP, are given in Table 9:

Table 9 - Present and Projected Price Levels for Selected Fertilizers (Early 1970's)

Product	Source	1968 $/MT	Early 1970's $/MT
Urea	Japan	84	62-67
	Europe	93	67-70
	USA	95	70-75
	Persian Gulf	*	55-58
Ammonium sulphate	Europe	44	28-33
	USA	34	33-38
DAP	USA	92-93	70-75

*Not yet available.

A brief account of how these estimates of future prices are reached is given in Annex XX.

6. RAW MATERIAL AVAILABILITY

(a) Nitrogen

Table 10 illustrates the pattern of raw material usage as it exists now and the projected usage on completion of those plants under construction and firmly committed:

Table 10

	Existing Capacity	Under Construction and Committed
Electrolysis	75	-
Coal and lignite	110	-
Coke oven	40	-
Naphtha	505	1,270
Natural gas	85	90

Because of the paucity of indigenous reserves of suitable hydrocarbon feedstocks, the emphasis has been placed on naphtha for both existing plants and those plants under construction or firmly committed. The availability of suitable raw materials for ammonia production is briefly reviewed below.

(i) Natural gas

There are at present only a few commercially workable gas fields: two in Assam at Naharkatia and Moran and three in Gujarat at Anfleshwar, Cambay and Kalo-Navagam. The gas occurs partly as associated and partly as non-associated gas.

The Namrup plant is based on natural gas; the expansion at Namrup will also use gas from the same source. The Baroda plant is based partly on natural gas and partly on naphtha. It is planned that, for the expansion, natural gas will be used to the extent that it is available and that for the balance naphtha will be used.

With presently proven reserves, and with the quantities dedicated to other uses, there will be no further gas available for other fertilizer plants.

(ii) Coal and lignite

There are vast resources of non-coking coal concentrated mainly in the Bengal-Bihar mineral belt, but there are also sizeable deposits in Orissa, MP and AP. So far, fertilizer production based on the direct gasification of coal has not yet been attempted, but the plant at Sindri uses coal for the production of coke which is used for the production of synthesis gas. A scheme to locate a public sector plant (FCI) at Korba has been under discussion for some time but is still in the planning stage.

The only lignite-based plant is at Neyveli, which went into production in 1966; so far the results have not been encouraging.

(iii) Naphtha

The total availability of naphtha, according to a study made by the P & D Division of FCI, by the end of 1972/73 will be 4.134 million tons. The regional availability, projected industrial and other requirements, as presently estimated, are given in Annex XXI and are summarized in Table 11:

Table 11 - Estimated Supply and Demand of Naphtha
By Year Ending 1972/73 - '000 Tons

Availability	4.134
Requirements	
Gasoline	1.471
Petrochemicals	0.861
Export	0.515
Sub Total	2.847
Requirements for existing and committed fertilizer plants	1.597
Sub Total	4.444
Deficit	0.310

Provided, then, that the requirements other than those for fertilizers have not been under-estimated, there will be a deficit, if the export goal is to be achieved, of about 300,000 tons by the beginning of 1973/74. However, since the fertilizer plants exist, are under construction or are firmly committed, and feedstock for ammonia production will have to be found, then the amount of naphtha available for export will be a modest 200,000 tons.

There are a number of ways by which naphtha availability could be increased but at present prices, which are about 20% to 25% lower than those attainable f.o.b. prices for export, there is no great incentive for the producers to do so.

In assessing the relative economic merits of new plants to be based on naphtha or other feedstocks that will come into production in the early 1970's, a more realistic level of naphtha prices has been assumed. If plants in India are to pay an economic price for naphtha in 1973/74 they will have to pay between $19.00 and $21.00 per ton, or about .50 cents per million BTU's (see Annex XXII).

(b) Phosphate

The one essential raw material for phosphoric acid production is phosphate rock, and there are no known exploitable reserves of phosphate rock in the country. For the manufacture of phosphoric acid from rock there are a number of possible routes but, of the chemical processes, the one most generally acceptable is the acidulation of rock with sulphuric acid for the manufacture of which, of course, sulphur is required.

There are no known reserves of elemental sulphur in India. Other possible sources are sour gas, gypsum and pyrites. There are sources of gypsum available in India but those presently being used for fertilizer production are proving progressively less suitable. There are said to be large deposits of good-quality gypsum in Bhutan but it is not known whether these are economically exploitable. There are also some deposits of pyrites. It seems, however, that the major part of the country's requirements of sulphur will continue to be imported for the foreseeable future.

(c) Potash

There are no known deposits of potastic minerals in India. The only source of potassium is the bitterns from solar salt works which contain about 2.5% potassium chloride. There are problems involved in its recovery and, in any event, the quantities are small. Virtually all India's requirements of potash will have to be imported in the foreseeable future.

7. ECONOMIC CONSIDERATIONS IN THE SELECTION OF RAW OR INTERMEDIATE MATERIALS

Having determined the regions where there are significant differences between projected production and consumption, and having also come to the conclusion that the initial efforts should be devoted exclusively to increased production of complex fertilizers, the question remains as to the most effective way of achieving the desired level of production.

The first question that suggests itself is the availability of raw materials and the answer is that virtually all will need to be imported.

If ammonia is to be manufactured locally, then naphtha, natural gas or some other feedstock must be made available. Whereas the establishment of coal-based plants may be attractive to the public sector purely on the grounds of foreign exchange savings, such projects would not be attractive to the private sector, nor, because of the localized nature of the coal deposits, would nitrogen from this source appreciably lessen the problems in other regions, notably the north.

To increase nitrogen production, the first step is to decide on the raw or intermediate material base. There are three choices:

(i) import of liquefied natural gas (LNG);

(ii) import of naphtha;

(iii) import of ammonia.

Complex fertilizers require phosphoric acid for their production and, again, the same situation exists: there are no indigenous sources of raw materials. Three routes are available:

(i) import of phosphate rock and sulphur;

(ii) import of phosphoric acid;

(iii) import of elemental phosphorous.

The remainder of this section, then, attempts to evaluate the economic merits of each route, or combination of routes, for the manufacture of finished fertilizers at a port location. The following sections evaluate these conclusions in relation to regional requirements. The basic assumption is that there is a need to establish additional productive capacity of N of about 700,000 to 750,000 tons in the form of complex fertilizers by 1973/74.

(a) Nitrogen

(i) Liquefied natural gas

The first consideration is whether LNG could compete with naphtha and the answer is that it cannot. There are abundant sources of natural

gas within reasonable shipping distance of India. However, detailed calculations show that the use of LNG for ammonia production alone would not be feasible. A summary of these calculations is given in Annex XXIII, from which it will be seen that, even assuming the supply of gas on the scale of 50 x 10^{12} BTU per year (or enough to manufacture over one million tons of N), and under the most favourable conditions of full capacity operation, the cost of gas delivered to an ammonia plant at a dockside location would be about $0.50 per million BTU, or about the same as the forecasted price of naphtha.

(ii) Imported naphtha and imported ammonia

In view of the impracticability of using LNG as a feedstock for indigenous production, the single most important question is whether to import naphtha or to import ammonia. Without attempting to assess the intangible advantages of either procedure, the relative economics of the two alternatives have been calculated in Annex XXIV.

For comparison, two sizes of ammonia plant have been considered for the naphtha plants - 500 and 1,000 tons per day - to illustrate the savings obtainable using centrifugal compressors. Only the larger-sized plant has been considered for the natural gas export-orientated plant. For this example the natural gas location is taken as the Persian Gulf.

In order to facilitate comparison, certain basic assumptions have been used for both locations; the most important of these are:

1. The total investment for a unit is taken as the battery limits US Gulf Coast cost plus 35% for off-sites, utilities and pre-operational expenses, plus an additional factor to take into account the special conditions in the countries concerned.

2. The plants are depreciated on a straight-line basis over a period of ten years.

3. Maintenance is costed at 5% of the investment per year.

4. Insurance, taxes and other incidental costs are assessed at 2%.

5. The return on total capital is taken as 15%.

For an Indian location the total equivalent US investment, as calculated in (1) above, is multiplied by a factor of 1.7 to arrive at total investment costs. In the Persian Gulf, this factor is taken as 1.3. The cost of gas in the Persian Gulf is taken at $0.05 per MM BTU and naphtha in India at $0.50 per MM BTU. There are also certain other assumptions for the Indian-based plants for calculating foreign exchange costs, and these are stated in Annex XXIV. The Indian location assumed is Bombay (or Kandla) and the results of the calculations are summarized overleaf:

	PERSIAN GULF	INDIA	
	1,000 MT NH_3/day $/ton	1,000 MT NH_3/day $/ton	500 MT NH_3/day $/ton
Ex-works cost	31.00		
PG terminal costs	1.50		
Shipping	6.00		
India terminal costs	1.50		
Total cost landed Bombay	40.00	61.66	77.30

The above calculations assume that all the plants have adequate markets and operate at full capacity. The reasons for the lower cost of the imported ammonia (in spite of shipping costs) are (a) the low cost of feedstock - $1.85 compared with $18.50 per ton - and (b) the inherently lower cost of a natural gas plant coupled with the lower 'on-cost' factor assumed in the Persian Gulf area, resulting in considerably lower capital charges.

The calculations in Annex XXIV indicate that the total foreign exchange costs for the 1,000 MT per day ammonia plant in India amount on average to about $25.00 per ton. Thus, if ammonia were shipped in Indian bottoms, there would be very little sacrifice of foreign exchange.

(b) Phosphoric Acid

Three alternative methods of supply are available: firstly, shipment of raw materials and manufacture of acid locally; secondly, manufacture and shipment of an intermediary, elemental phosphorous, followed by local acid manufacture; finally, shipment of the end-product acid from areas of low manufacturing cost, either as a 54% or a 75% P_2O_5 product.

Using the level of raw material costs forecasted in Annex XXV, and the appropriate freight rates tabulated in Annex XXVI, the detailed calculations of the three methods are given in Annexes as follows:

Annex XXVII	Production in India from imported rock and sulphur.
Annex XXVIII	Production in India from imported elemental phosphorous.
Annex XXIX	Import of phosphoric acid.

These calculations have been made on the basis both of a production of 600 MT per day and 300 MT per day P_2O_5. However, for the purpose of the comparisons made below, only the 600 MT per day has been considered. For wet-process acid plants, production costs decrease appreciably with increasing plant capacity up to 400 tons per day of P_2O_5; beyond this level, costs decrease slightly but not significantly. A 600 tons per day phosphoric acid plant would require about 1,600 tons per day sulphuric acid, a capacity well above the capacity at which economics of scale are effective. For elemental phosphorous production, costs would not be lowered significantly beyond the 600 tons per day P_2O_5 capacity level, and for the 'down-stream' acid plants much lower capacities are quite economic.

In the case of both the importation of phosphorous and phosphoric acid, it is assumed that the exporting plants are located adjacent to the shipping facilities and no inland freight or handling charges have been allowed for.

The cost of wet-process acid is dependent primarily upon the cost of sulphur and rock. The cost of wet-process acid has, then, been calculated for five locations at which one or both of these materials are expected to be available at low cost. The expected landed costs at Bombay from the five locations are given in Table 12:

Table 12 - Cost of Wet-Process Phosphoric Acid at Bombay from Various Sources

Source	$/MT P_2O_5
Florida	125.00
Morocco	137.00
Spain	135.60
Iran	149.80
Mexico	136.40

The cost of thermal acid is dependent primarily on power costs and, to a lesser extent, on the cost of phosphate rock. The cost of thermal acid manufactured in Bombay from phosphorous imported from a US Gulf Coast location is estimated at $132.70 per MT P_2O_5. The assumed costs of rock and power are $5.85 per ton and 5.5 mills. The effect of power and rock costs are illustrated by a few representative examples in Table 13:

Table 13 - Effect of Power and Rock Costs on Furnace Acid Production at Bombay

Rock Price $/MT	Power Mills	P_2O_5 $/MT
5.85	5.5	132.70
5.85	3.0	118.20
8.50	4.5	138.70
10.50	3.0	136.30

The freight from US Gulf port is taken as $27.70 per ton phosphorous. The freight from, say, Canada would be less but the cost of rock would be more; power would have to be less than 4 mills in Canada to compete with US Gulf Coast. Similarly, in Europe, with rock at about, say, $10.50 per ton, power would have to be below 3.0 mills to compete with the US Gulf Coast location.

The cost of acid manufactured locally from imported rock and sulphur is estimated at $167.00 per MT P_2O_5. The element of foreign exchange cost is about $120.00 per MT P_2O_5. It can be seen, then, that this method is by far the least attractive proposition.

Of the five wet-process acid locations chosen, the costs at three of them are almost equal. The cost at the Iran-based plant is high because

of the high cost attributed to phosphate rock. The influence of low raw material costs is clearly shown by the example of the Florida-based operation.

The possibility of shipping superphosphoric acid has been examined and it is questionable whether the additional cost of converting ordinary 54% P_2O_5 acid into 75% P_2O_5 acid is offset by the saving in freight cost. There is, in any event, very little experience in the movement of superphosphoric acid and in the calculations a 54% grade of acid has been assumed throughout.

The competitive position of furnace acid is entirely dependent on power costs. It seems, in the short term anyway, that at a port location imported phosphoric acid is likely to have a slight cost advantage. The comparative costs at inland locations are examined in the following section. The advantage of the higher analysis attainable in the end-product by the use of furnace acid is also considered.

8. MANUFACTURE OF COMPLEX FERTILIZER

(a) Port Location

So far, only intermediate products have been considered; whereas in some countries liquid ammonia is used as a finished fertilizer it would not be appropriate for India. The highest analysis complex fertilizer that can be commercially manufactured from ammonia and phosphoric acid alone is diammonium phosphate. Thus, in order to assess the relative economics of the various sources of ammonia and phosphoric acid, the cost of manufacture of DAP - first at a port location - has been calculated. Details of these calculations are given in Annex XXX and are summarized in Table 14:

Table 14 - Production Cost DAP Assuming Various Sources Phosphoric Acid and Ammonia

Import	Local Manufacture	DAP $/ton	Plant Nutrient $/ton
Phosphoric acid, NH_3	-	74	114
Phosphoric acid	NH_3	78	120
NH_3	Phosphoric acid	94	142
-	Phosphoric acid NH_3	98	147
Elemental phosphorous NH_3	-	86	116
Elemental phosphorous	NH_3	90	122

Because of the higher-analysis of DAP made from furnace acid (20-54-0 as opposed to 18-48-0 made from wet-process acid) it is necessary to compare the two products on the basis of cost per ton of plant nutrients. It will be seen that on this basis furnace acid and imported phosphoric acid are almost on a par so that, if a choice between the processes has to be made, the decision would rest on other considerations than those of costs of production alone.

Because of the low ratio of N to P, it will be noted that the effect of the higher cost of the indigenous ammonia is minimal.

DAP manufactured from intermediates results in a price that would be competitive with the level of world prices expected to exist in the 1970's. This competitive position is achieved, however, by assuming very large capacity plants and any substantial reduction in capacity would result in significant increases in production costs. The use of locally-made ammonia would not seriously jeopardize this position, but locally manufactured phosphoric acid would put the local product at a serious disadvantage.

So far only port locations have been considered, and an analysis of the factors affecting an inland location alters the picture quite significantly.

(b) Inland Location

Annex XXXI gives the rail freight rates currently in foree for phosphate rock, sulphur, finished fertilizers and anhydrous ammonia. The ammonia rate has been established on the basis of very small amounts moved. The rates for phosphoric acid and phosphorous would, initially anyway, be the same as that for ammonia. They would, of course, come under review, as would the ammonia rate, as soon as large quantities of the materials become involved.

Annex XXXII gives the estimated cost of raw and intermediate materials at various railheads up to 1,500 km inland. From these costs the manufacturing cost of DAP at various distances from a port have been calculated (cost per ton product and cost per ton plant nutrients) and the results of the calculations are tabulated in Annex XXXIII.

Reference to Annex XXXIII will show that DAP manufactured from imported acid becomes increasingly less competitive with both the imported product and that made from furnace acid as the distance from a port increases. A few selected examples are given in Table 15 to illustrate this point:

Table 15 - Cost of DAP at Various Distances for Sea Port
$/Ton Plant Nutrients

Distance - km	Imported Product	Imported Acid and Ammonia	Furnace Acid and Imported Ammonia
200	114	120	120
800	120	136	125
1,500	121	148	130

If a selection is to be made purely on economic merit (excluding the case of importing the finished product) on the method of supplying DAP to inland markets, the choice would rest with coastal manufacture or manufacture in the market location from furnace acid and imported ammonia.

9. PRODUCTION OF STRAIGHT N FERTILIZER

So far consideration has only been given, in the abstract, to the economics of supplying complex fertilizer in the form of DAP to the Indian market. Also a programme involving the construction of further capacity amounting to 700,000 to 750,000 tons of N per year has been suggested as a reasonable target and this capacity should be in the form of complex fertilizer.

In the previous section, various ways for the manufacture of P_2O_5 in units of 600 tons per day have been considered. Thus, four of such units would have a total annual output of 725,000 tons of P_2O_5. Working on the hypothesis that market requirements dictate an overall 1:1 ratio of N:P, then the equivalent amount of N needs to be found. The nitrogen content of the DAP will be 285,000 tons; thus about a further 440,000 tons of N will be needed.

Economic considerations dictate that this additional N should be produced at the same locations as the DAP, and so four units, each with an annual capacity of 110,000 tons, will be required.

The equivalent daily ammonia capacity is immaterial as far as imported ammonia is concerned, but it will be noted that the sizes of the integrated plants proposed permit the production of ammonia in units of 750 tons per day if the ammonia importation route is rejected. However, the cost of ammonia would be slightly higher than that calculated in Section 7 for a 1,000 tons per day unit.

In order to produce a finished product with a higher proportion of N than DAP, it is proposed that the DAP be granulated with a straight nitrogenous fertilizer. The highest analysis obtainable (29-29-0) is with urea. However, urea cannot be manufactured economically from imported ammonia.

Thus the use of ammonium nitrate suggests itself. Ammonium nitrate, when granulated with DAP, can be made to produce various formulations, and a 25-25-0 analysis is attainable when a 1-1-0 ratio is required.

The urea route has the obvious advantage of a higher analysis in the end-product; it also has the advantage of being universally acceptable and this in India means usable on wet paddy, for which nitrates are generally considered unacceptable. However, reference to Annexes I-VII will show that this is not a serious limitation in the northern and western regions. In the south and east also it is believed that not more than 10% of the market would exclude nitrates on these grounds.

The estimated costs of production of nitric acid and ammonium nitrate are given in Annex XXXIV and these are compared on the basis of cost per ton of N with that of urea in Annex XXXV. It will be seen that the production of ammonium nitrate is strongly influenced by the cost of ammonia. However a comparison of costs with locally-made ammonia is not meaningful, since in the latter case urea would be the preferred end-product. Ammonium nitrate, however, because of the high incidence of capital charges, is at a slight disadvantage compared with a large-scale 820 tons per day urea plant, such as is being considered here.

10. LOCATIONS AND CAPACITIES

For ease of analysis the country has been divided into four geographic regions, determined largely by State boundaries. Since inevitably there is some overlapping, this breakdown is not entirely satisfactory for assessing regional market needs and, hence, possible locations and capacities of new facilities. However, by reference to Annex XVII certain broad conclusions can be reached. Some refinements to these conclusions can also be made by referring to Annex I to VIII. In deciding, then, on the locations for new facilities, the following are the main points to consider:

(a) Because of the lack of local raw materials, sites for new facilities must be considered in relation to the locations of deep-sea ports.

(b) On a regional basis the northern region presents the greatest problem. It is not only the region with the greatest need of ready access to fertilizer supplies, but it is the region most remote from the coast.

(c) In the northern region the States of Jammu and Kashmir, Punjab, Haryana and Rajasthan could best be served from western ports and, although there is some overlap, about half of the Uttar Pradesh market could also be economically served from the west coast. Because of the situation in the eastern region it may be desirable to serve a greater portion of the Uttar Pradesh market from the west, at any rate for the time being.

(d) Madhya Pradesh, although falling in the western region, is geographically situated more or less in the centre of the country. Two-thirds of this State's estimated requirements could best be served from the eastern seaboard.

(e) Similarly, the eastern part of Maharashtra, accounting for about 25% of the market of that State, could best be served from the east.

(f) Almost the whole of Rajasthan and about 40% of the market in Gujarat need to be served on the metre gauge; thus a plant at Kandla for this reason alone is desirable.

(g) It has already been demonstrated that it is less costly to move finished fertilizers than it is to transport the required amount of raw or intermediate materials for their manufacture. As a general principle, then, an inland plant should be located at a point closer to the port serving it than the centre of its market area.

(h) The availability, as well as the cost of transport, will be a major factor in reaching a decision on whether to locate at an inland location. On the premise, then, that it is preferable to move one ton of phosphorous rather than four tons of acid or five tons of finished product, one inland location has been suggested out of the four proposed to meet the 1974 gap in production capacity.

(i) A possible solution to the problem in the eastern region is that some of the facilities for urea production which are presently being

implemented be run at below capacity, thus releasing ammonia for DAP production. The necessary DAP and related plant would, of course, need to be added.

The four locations that appear to fit best into the expected 1974 pattern of demand are:

(i) A deep-sea berth as close as possible to the railhead (both broad and metre gauge) at Kandla. This plant would serve the southern part of the northern region, parts of Gujarat and the western part of Madhya Pradesh.

(ii) At a railhead strategically located towards the south west of the market area, comprising the States of Punjab, Haryana and the western part of Uttar Pradesh (it would also serve Jammu and Kashmir).

(iii) Adjacent to port and rail facilities at Visag to serve the northern part of the southern region (i.e. the northern parts of Mysore and Andhra Pradesh), the eastern parts of Madhya Pradesh and Maharashtra States and the southern extremity of the eastern region.

(iv) Adjacent to port and rail facilities at Cochin to serve the southern region.

To determine locations more exactly would, of course, require a detailed study of each of the four cases.

The expected pattern of future demand suggests that plants of approximately equal size would be appropriate for each location. Some adjustment, no doubt, will be desirable but it is, of course, important that capacities should not be reduced beyond the economic size level. The calculations in the following section assume that 180,000 tons of N and the same amount of P_2O_5 will be produced at each location.

There are various plant configurations possible; in no case, however, has the indigenous manufacture of wet-process phosphoric acid been considered. The port locations would consist of a DAP plant, using imported or furnace acid, and an ammonium nitrate or urea plant, depending on whether imported or locally-manufactured ammonia is used. The inland location would, it is considered, be restricted to the use of furnace acid for DAP production but, again, ammonia could be local or imported. In the following section the investment requirements for the various possibilities are considered.

11. INVESTMENT NEEDS

For the supply of 725,000 tons of N per annum, a total of 900,000 tons of ammonia is required; on the basis of 300 days per year (which has been assumed for India and the Middle East) a daily capacity of 3,000 tons is needed. For the importation of ammonia, three 1,000 tons per day plants have been assumed and for local production four 750 tons per day units are required, since one unit is needed at each location.

The calculations of capital costs have been done on the basis of total cost per plant in India; thus, for the calculations for the case of imported ammonia, three-quarters of the cost of one 1,000 tons per day ammonia plant has been at .ributed to each Indian plant. The breakdown of the capital cost estimates is given in Annex XXXVI, and is summarized below for the four possible combinations (i.e. excluding indigenous production of wet-process acid) on a per Indian plant complex basis. The investment costs are split into Indian and foreign, and the cost of ships is given separately since this could be Indian or foreign owned:

Table 16 - Summary of Capital Cost Estimates for Fixed Assets of a Plant Complex for the Manufacture of 180,000 Tons Per Year of N and P_2O_5

A. Imported ammonia and acid

Location	$ Million
India	27.6
Foreign	26.0
Ships	24.0
	77.6

B. Local ammonia-imported acid

Location	$ Million
India	55.4
Foreign	9.6
Ships	11.0
	76.0

C. Imported ammonia and phosphorous

Location	$ Million
India	31.4
Foreign	50.5
Ships	28.0
	109.9

D. Local ammonia and imported phosphorous

Location	$ Million
India	62.8
Foreign	32.5
Ships	15.0
	110.3

The phosphoric acid route, whether with imported or local ammonia, is the least costly and, using this route, the total cost of the whole programme would be about $305 million excluding working capital. The elemental phosphorous route, on the other hand, would cost, for fixed assets, an estimated total of $440 million. The suggested configuration of three port locations, using imported acid, and one inland location, based on furnace acid, would cost a total of about $338 million, again excluding working capital.

12. CONCLUSION

It is evident that a lot of effort and money is needed to put into effect the sort of programme outlined. It may be that the size of the programme can be cut down if some of the projects, which are already licensed or are under consideration, go ahead. Experience, however, suggests that it is prudent to rely for future production only on those plants which exist, are under construction or are firmly committed, and to qualify for this last category in effect means that all arrangements for financing have been completed.

The question of the use of intermediate materials has been dwelt upon at some length. There are clearly a number of advantages which can be calculated numerically and which are of greater significance in some applications than others. There are, however, a number of intangible advantages.

The use of intermediates could stimulate the interest of a much larger group of potential investors and partners. It would also permit considerable geographic diversity of investment of the not inconsiderable amounts of capital needed. Most importantly, the programme could be expected to move forward much more rapidly than would otherwise be the case.

It is not suggested that India should become imprudently dependent upon the importation of semi-finished materials for the country's fertilizer programme, nor does it make sense to aim at 100% local production. A mixed programme suggests itself whereby the advantages of both procedures can be gained.

Form No. 57 | INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Robert S. McNamara

DATE: July 24, 1968

FROM: Martin M. Rosen

SUBJECT: Fertilizers

Sir Harold Wilkinson, who is coming in tomorrow, is a retired Managing Director of the Royal Dutch Shell. He retired three or four years ago and was and still is one of the leading men in the oil industry of the world. When we became deeply involved in the fertilizer problem, George Woods asked Wilkinson and Stanley Osborne to become personal advisers to him and to me with the idea being that Wilkinson would handle the oil side of the affair and Osborne would handle the chemical companies involved.

Attached is a memorandum prepared by David Dodd, which summarizes the story of the Bank and IFC's interest in and activities with respect to fertilizers.

I am also enclosing two other papers which I think you will find interesting if you have time to look through them. One gives the outline of a "World-wide Concept of Fertilizer Ventures for the Future," which we presented to the meeting of the IFC Advisers last year. The other is a general paper on fertilizers which was circulated to the Board on November 16, 1966 following a Board seminar discussion on fertilizer, which we held in view of the Board's interest in what was being done in the fertilizer area.

Attachments

THE BANK GROUP AND THE FERTILIZER INDUSTRY

During late 1965 and early 1966, because of increasing evidence of the likelihood of serious food shortages, it became apparent that the rate of increase of the world's food production in the developing nations would need substantial stimulus. It was recognized also that the quickest and most effective way to increase food production was by increasing the use of fertilizers, and that a critical factor in the development of fertilizer consumption would be the availability of fertilizer supplies in the required quantities and qualities at the right place and at the proper time. A further point was evident that, whereas some developing countries were over-endowed with essential raw materials for fertilizer production, others were mostly or totally deficient. The most important of these, natural gas, an ideal feedstock for ammonia production, was being flared in enormous quantities in the Middle East and elsewhere.

Up until 1966 the Bank Group, except for two minor investments by IFC totalling $7.5 million, had made no serious financial contribution to the fertilizer industry. It was decided then as a matter of policy that efforts would be concentrated on this important field. The first public pronouncement to this effect was made by Mr. Woods in his speech to the Economic and Social Council of the United Nations in February 1966, in which he expounded at some length on the anticipated increased activity in the fertilizer field. He went on to say that "we stand ready to give prompt and sympathetic consideration to requests for assistance (for fertilizer projects), employing whatever financial techniques seem most appropriate". Mr. Woods also referred to the key raw material - natural gas - being "thrown to the winds".

In his address to the Governors at the 1966 Annual Meeting, Mr. Woods again stressed the need and potential for the increased use of fertilizers. He repeated this theme in a talk to the New York Bond Club in November, and again in December 1966 at another address to the Economic and Social Council of the United Nations. By the end of 1966, then, the willingness of the Bank Group to take an active role in the fertilizer industry had been widely broadcast.

Because of the urgency of the problem, the main efforts of the Bank and IFC were directed towards India. These efforts were concentrated chiefly on two fronts: firstly, the promotion of, and financial assistance to, individual plants in the private sector and, secondly, in trying to speed up the whole development of the industry by actively promoting in government circles the use of intermediates such as ammonia manufactured at the source of cheap gas. On the first of these counts we examined in some detail seven different projects and about four others

in a more superficial way. From this crop, however, only the Indian Explosives project at Kanpur came to fruition. On the other count, GOI were quite unequivocal in their position until early 1968, and held to the policy of establishing ammonia units and finished fertilizer plants based on indigenous supplies of naphtha. In March this year, however, there was some relaxation of GOI's position, when conditional official approval was given to a plant near Bombay based on the importation of ammonia.

Apart from the concentrated activity in India, the Bank and IFC were active in a number of other projects, principally in other parts of Asia, Latin America and Africa. Of these, an IFC investment of $10.5 million in the Ultrafertil project in Brazil was approved in October 1966, a Bank loan of $30 million to Congo Potash was approved in January 1967 and, more recently, a joint Bank/IFC commitment of $36 million was approved this month in the Dawood-Hercules project in Pakistan.

In spite, then, of the considerable time and effort that have been spent, these efforts have not achieved the substantial break-through that was hoped for. This leads one to the conclusion that the individual project approach is not appropriate to a problem of such dimensions. About six months ago it was decided to shift back to the original concept that, if fertilizer production in the developing countries is to be significantly increased, fuller economic exploitation of the necessary raw materials must be realized. This requires a high degree of international co-operation to achieve the chain of primary materials, manufacturing facilities and financing and distribution organizations needed to serve individual countries. On January 1, then, of this year organizational changes were made within IFC so that the full-time efforts of a senior staff member could be directed towards this end.

If one accepts the premise that tackling the problem piece-meal by the promotion of individual and unrelated projects is not satisfactory, then three possible organizational solutions suggest themselves. These are (a) an international organization of which the stock-holders would be governments, (b) a consortium of private oil and chemical companies or (c) a combination of private and governmental interests. Whatever organizational set-up should emerge, it is envisaged that it would possess, in itself, the expertise necessary to implement its programmes which, for example, could require it to develop in a co-ordinated fashion the production of ammonia in the Persian Gulf, the extraction of sulphur in Iraq and its use in Tunisia for the production of phosphoric acid. It would similarly develop the extraction of potash in Jordan or Ethiopia and, to complete the complex, would set up and invest in downstream plants in India for the combination and blending of these basic inputs to yield the desired complex fertilizer products.

It is considered, then, that the most important task for the future is in evolving a workable solution to the group or consortium concept. As a first step to this end, and as a practical exercise to demonstrate

how such an organizational approach could work on a large scale, it is proposed to draw up a comprehensive plan for providing an additional one million tons of nitrogen, with its attendant requirements of phosphate and potash, to India. It is planned, then, to present a fairly precise blue-print of the required physical facilities, the capital and operating costs of these facilities, their planned production and where this production would be marketed. Furthermore, a capital expenditure programme, how this capital might be raised, the appropriate capital structure for such an enterprise and the probable rate of return on investment would be indicated.

J. D. Dodd
July 24, 1968

OPTIONAL FORM NO. 10
MAY 1962 EDITION
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UNITED STATES GOVERNMENT

Memorandum

TO : The Ambassador

DATE: November 14, 1968

FROM : John P. Lewis JPL

SUBJECT: Suggestions for Mr. McNamara -- especially re fertilizer production

You ask what I think Mr. McNamara should brace the Indians on. Let me answer through a process of elimination:

Not agriculture. A vast amount remains to be done, but the breakthrough is well started; what is needed is essentially maintenance of the present momentum and policy vectors; appreciation and encouragement are more in order than further prodding -- even in the area of food pricing and distribution policy, where the best conversational assumption would be that the GOI is disposed to liberalize food zones, etc., as fast as it thinks prudent.

Not (on balance) population control. Despite substantial organizational, programming, and funding progress since 1965, the outlook is clouded because of the present vacuum in Cabinet and Ministerial leadership. But it would be difficult for Mr. McNamara to breeze into town and immediately say to Mrs. Gandhi, "I hear the top leadership of this vital program from you on down leaves much to be desired." The needed prodding will come better from and/or in the wake of the (IBRD-inspired) UN review team due early in 1969.

Not on further import liberalization and internal industrial decontrol -- while the Indians are as strapped as they now are by Consortium aid shortfalls. For the time being they will do well to cling to their present degree of liberalization -- which Mr. McNamara may wish to say he understands and hopes they are not disposed to abandon hastily or lightly.

Not (I guess) about excessive cautiousness in fiscal-monetary policy -- although this, as you know, is something about which we worry greatly. The trouble is, the Ministry of Finance's own tendency to let domestic financial obstacles impede the seizure of the economy's new faster real growth potential is being aggravated by aid disappointments and uncertainties.

This makes it hard for Mr. McNamara to press greater domestic fiscal boldness on his host Morarji Desai (whose personal inclinations he would be most directly challenging).

Perhaps on export expansion. This is India's most urgent current economic problem, and it remains unsolved -- despite the better performance of the past few months. But, although senior Indian officials now are focusing on exports more sharply than ever before, they are pretty allergic just now to outside kibitzing about general export incentives. Probably the best stance would be: evident interest and concern, but no advocacy of particular solutions.

Likewise I would go light on broadside, across-the-board advocacy of foreign private investment. Whatever we say, the Indians are going to continue to be selective in their admission of foreign equity capital and management. The best bet is to encourage them to do a better job of attracting foreign investment in those priority areas where, according to their own estimate, they really want it.

* * *

This brings me then to the one positive suggestion I would put front and center. The IBRD has a long record of concern about the effectiveness of the GOI's attraction of foreign private investment in fertilizer production. We think in the past the Bank sometimes has been too impatient in its appraisal of the new private fertilizer investment policies the GOI adopted at the end of 1965. The policies offered a better, more predictable deal to foreign investors; the individual projects are inherently very complicated; several of the hang-ups and disappointments have come from the side of the potential investors, not the GOI; and what has been committed -- namely, Madras, Kanpur, the two Indian privates at Baroda and Kota, the co-op plant at Kandla, and now Occidental at Vizag and U. S. Steel at Goa -- is substantial.

But now -- as defenders of the propositions that the 1965/66 policy is pretty good, that it should be given time to work, and that outside agencies should not undermine it by holding out to potential investors

the possibility of still sweeter deals if they wait -- we are greatly disturbed by the apparent erosion of the GOI's own commitment to the 1965/66 policy. The latter had three facets:

-- swift, concerted clearance of proposals by a high-level Secretaries' Committee;

-- availability of majority equity to the foreign investor where his Indian partner was not the GOI;

-- marketing and pricing freedom.

All three aspects are in trouble:

- The Cabinet has re-entered into prolonged, substantive second-guessing of recommendations of the Secretaries' Committee.

- A 51 +% equity for Occidental has just, after Cabinet re-consideration, been grudgingly approved, but in a manner suggesting that the automaticity of the previous policy has been abandoned and that each future investor is going to have to battle out this issue case-by-case.

- And while the Center itself is solid enough on maintenance of the (most critical) marketing and pricing freedom component of the policy, it has not yet succeeded in persuading a number of the state governments to remove state controls impeding the markets in which new plants want to distribute their products.

It would be most helpful for Mr. McNamara to weigh in firmly on this issue, noting the good public as well as private sector progress that is being made on fertilizer production, but emphasizing that many more plants are needed; that many of them, certainly, will need foreign private capital and management inputs; and that the efforts of all of us who are trying to overcome the skepticism of potential investors can be shattered if the word gets around that India has reneged on the policies she boldly adopted and actively propagandized only a little over two years ago.

STATEMENT BY MR. CHANMUGAM

About fifteen elements are considered essential for plant survival, and normally the plants obtain them from air, from water, and from the mineral and organic content of the soil. Of these elements three are required in substantially large quantities, and in addition have a very profound effect on plant life. These three elements are nitrogen, phosphorus, and potassium. Materials that contain one or more of these three elements in a form which can be assimilated or taken in by the plants are called fertilizers. We thus speak of nitrogenous fertilizers, phosphoric fertilizers, and potassic fertilizers.

Now, without nitrogen or nitrogenous fertilizers, a plant cannot grow. This is its importance in agriculture. Phosphorus or phosphoric fertilizers are essential for a plant to mature and to give it strength. And similarly, potassium or potassic fertilizers are essential for the plant's natural metabolism and survival.

Fertilizers are generally graded according to the percentage of nitrogen, of phosphate, or of potash that they contain. Fertilizers may contain only one or all three or a combination of nitrogen, phosphorus, and potassium. For example, a very well known nitrogenous fertilizer is ammonium sulphate. This contains 20% nitrogen. A typical fertilizer that is very often used in the developed countries is a grade which is called 20-20-10. This means that it containes 20% nitrogen, 20% phosphate, and 10% potassium.

Fertilizers which contain more than one of these elements are becoming extremely popular. The reason is that the farmer has the opportunity of using one dose of fertilizer, rather than having to use two or three. There are two kinds of such combination fertilizers. One is called a mixed fertilizer in which there is a physical combination of the nutritive elements or you have a complex fertilizer where these elements are combined in chemical form. The tendency in the last few years has been to use a higher percentage of nutrients in the fertilizer, for a number of reasons. One, it is more effective; secondly, it is cheaper in the long run; and thirdly, because of the advantages to be gained in the transport of these materials to the farmers.

Of these three fertilizer elements, nitrogen, phosphate, and potassium, the nitrogenous fertilizer is the one that is most spectacular in terms of its immediate response.

All nitrogenous fertilizer manufacture ultimately involves the capture of nitrogen from the air, and air containe about 80% nitrogen. By far the most important way of capturing nitrogen from the air is by making ammonia. Now, to make ammonia we need two elements: nitrogen and hydrogen. The nitrogen is obtained from the air, and the entire problem of nitrogenous fertilizer and therefore of making ammonia is essentially tied up in the problem of obtaining hydrogen in a cheap, economical way.

Hydrogen can be obtained by electrolysis of water. This is considered to be uneconomical and is generally not considered unless electric power is extremely cheap. Hydrogen can also be obtained by burning coal or coke in the presence of water, and thereby liberating the hydrogen from the water. This is a very expensive technique and is very rarely used.

The most important way of obtaining hydrogen to make ammonia, and therefore nitrogenous fertilizer, is from hydrocarbon. The particular hydrocarbon that is significant is the hydrocarbon obtained from petroleum sources. The petroleum hydrocarbons that make sense are natural gas and refinery products, and of the refinery products two particular products are important: one is naphtha and, to a lesser extent, fuel oil. For the moment, let us forget about fuel oil and concentrate on natural gas and naphtha.

During the last five years there have been some very remarkable developments in the technology for the manufacture of ammonia based on petroleum resources. The economic consequences of these technical developments become truly significant only when relatively large-sized plants are concerned, in addition, of course, to the usual advantages one can gain from the consideration of economies of scale. Typical sizes of ammonia plants involving these economic advantages of the new technologies are of the order of 600 tons of ammonia per day, or larger. It is for this reason that in the IFC paper that was submitted to the Board that paragraphs 5 and 10 are particularly referred to.

Ammonia contains about 80% nitrogen and is obviously one of the more concentrated forms of nitrogen that is available in a commercial form. It is used directly as such in certain parts of the United States, but it is very unlikely that in most of the developing countries it will become a primary commercial fertilizer. Consequently it is necessary to convert the ammonia into a convenient solid but soluble form before it can be used as a fertilizer.

There are four such very important solid forms of nitrogen that can be made from ammonia. The first of these is ammonium sulphate which has been a very popular one for a long time. This unfortunately contains only 20% of nitrogen, and in addition it needs sulphur or sulphuric acid before it can be made into solid form. We will refer to the question of the availability of sulphur a little later on. There is a shortage of sulphur and it is quite expensive, so it is very unlikely that in the years to come ammonium sulphate will have a future.

The next important nitrogenous fertilizer which is made from ammonia is ammonium nitrate. This contains approximately 30% nitrogen. Its manufacture and use has increased very rapidly during the last ten years. Fortunately, in the making of ammonium nitrate, you do not need to have any other raw material, because the nitric acid that is necessary to make ammonium nitrate can be made from ammonia.

The third and by far the most important nitrogenous fertilizer is the substance called urea, which contains about 45% nitrogen. In the manufacture of urea you need one other substance, which is carbon dioxide. Carbon dioxide is generally obtained as a by-product in the manufacture of ammonia itself when you make it from a petroleum source. It is for this reason that most urea facilities are attached to or located adjacent to an ammonia facility, because the carbon dioxide is obtained as a by-product and hence it is quite cheap to make this solid, soluble fertilizer.

If we consider projects in which ammonia has to be transported over distances to be converted into solid form, then it is very unlikely that the making of urea would be an economic concept, for the simple reason that we have to make carbon dioxide; to make carbon dioxide, you have to burn fuel of one form or another. If you are going to burn fuel to make carbon dioxide, you might as well make the ammonia. So it is very unlikely that urea, which is a very concentrated and very desirable form of nitrogen fertilizer, could be made in circumstances where ammonia transport is involved.

The fourth important form of nitrogenous fertilizer is the group of ammonium phosphates. These are particularly significant for the simple reason that in this group you have true complex fertilizers, which contain both nitrogen and phosphate in chemical combination. To make such complex fertilizers phosphoric acid is needed. This will be mentioned later when referring to phosphoric fertilizers.

The phosphorus in phosphoric fertilizers, as we pointed out earlier, is essential for plant maturity and for plant strength. Soils do contain phosphorus, but as a plant grows, it starts depleting the phosphate from the soil, and sooner or later you will have to add back the phosphorus in order to achieve the necessary maturity and strength.

The only commercially exploitable form of phosphate which can be used in fertilizer is phosphate rock, and this phosphate rock is found in only a few places in the world in exploitable quantities. Unfortunately, the phosphate element in phosphate rock cannot be absorbed by the plants because it is not soluble, and for this reason it is necessary to solubilize the phosphate rock before we can make fertilizer.

One of the commonest ways, in fact the most prevalent way, of solubilizing phosphate rock is to use sulphuric acid, and of course if you are going to use sulphuric acid, you will need, one way or another, sulphur.

In the past, most such solubilizing plants, that is, to solubilize phosphate rock into a form that can be absorbed by the plants, was usually done on a small scale because they were generally adjuncts to individual nitrogen fertilizer plants. However, over the years, as people start using more and more nitrogen, as the plants start absorbing more and more phosphate from the soil, one needs to add the phosphate back; and consequently, the expected demand for phosphate is going to increase very rapidly. For this reason, the tendency has been for phosphoric fertilizer plants to become large in size, and in addition to the advantages of scale that we can obtain from the larger sized plants, there is also the question of the transport of phosphate rock and of the sulphur to make sulphuric acid. For this reason, the tendency in recent years has been for phosphatic acid facilities to be located either close to the phosphate rock source or to the sulphur source, and it is for that reason that paragraphs 11 to 13 in the IFC paper refer to these concepts of large-scale phosphate plants.

In general the size of units that make economic sense correspond to about 500 tons of phosphoric acid per day or larger. Smaller units are generally

uneconomical. However, this will depend a lot on the individual nitrogenous fertilizer plants with which this is going to be associated.

In addition to the two elements we have spoken about, we also have the third element, potash. Now, unfortunately, potash also is found only in a very few parts of the world. It is obtained either from mineral sources, that is, from mines, as in the United States, Western Europe, or Canada, or the Congo, or from certain brines in which there is high concentration of potassium, such as the Dead Sea. Because of the very nature of the technology involved in exploiting potash from these sources, the mineral sources or the brine sources, these facilities have to be relatively very large, and consequently one finds that most potash projects are rather high cost, involving high capital investment.

Finally, there is the need to make sure that the forms of the fertilizer that we make available to the farmers are convenient to use. As I mentioned earlier, there is every reason to suppose that the more concentrated the fertilizers are, the more effective it is, the cheaper it is to transport it and the cheaper it is to make it.

IFC - Engineering Department
October 21, 1966

Item No.17

INTERNATIONAL FINANCE CORPORATION

A WORLD-WIDE CONCEPT OF FERTILIZER VENTURES FOR THE FUTURE

We are today on the threshold of a global population explosion closely associated with a rapidly developing food crisis - problems which call for bold and timely action. By their very nature, population control measures cannot be expected to show quick results. On the other hand, it is possible to increase food production rapidly and substantially using available technology and physical resources. Specifically, yield rates of food crops can be increased considerably by more extensive use of chemical fertilizers, provided adequate supplies are made available in the required qualities and at the right places at the proper times.

World fertilizer consumption was about 44 million tons of plant nutrients in 1965-1966, or roughly twice the consumption level in 1956-1957. On a conservative basis, new fertilizer manufacturing capacity of the order of 175 million tons per annum will have to be established within the next three decades, of which about 140 million tons per annum will be required for the developing regions. In money terms, these new plants would call for investments of the order of US$30 billion, about 80% of which would be for plants supplying fertilizer to the developing areas.

In theory, these new plants could be located either within or outside the regions where the fertilizers are to be consumed. In fact, however, the choice of location will depend on several factors, such as availability of raw and intermediate materials, the economics of their transportation vis-a-vis transport of the end products, foreign exchange requirements for capital and operating costs, and the like.

The attached paper examines in broad terms the technical and economic factors involved in developing the necessary raw material resources and their implications on the location of future fertilizer projects. Briefly, the main conclusions are:

(i) raw material resources are adequate to support world fertilizer needs during the foreseeable future;

(ii) an increasing proportion of phosphate rock will be processed into concentrated phosphate materials, such as phosphoric acid, near the mines;

(iii) potash will continue to be imported by most consumers;

(iv) demand for ammonia (in the form of nitrogenous fertilizer) is likely to increase sharply in the coming years and the key questions will be (a) the source of the hydrogen - natural gas or naphtha - and (b) the location of the plant - at the hydrocarbon source or in the vicinity of the market.

The last conclusion has special application to the urgent problem of India. In India, at present, much of the planning for increased production of nitrogenous fertilizers is based on the use of naphtha produced in Indian refineries. Examination of the Indian requirements for fertilizers during the next decade, and the availability of naphtha in the country, strongly suggest that importation of liquified ammonia from the Persian Gulf area to strategic coastal points in India, where mixing plants would be established, will be necessary. Later on, it is expected that the techniques and economics will be so much improved that it could become feasible to import liquified natural gas as an ammonia feedstock.

To illustrate the magnitude of the problem, it is estimated that by the early 1980's India will require an additional 5 million tons of nitrogenous fertilizer over and above the capacity presently under construction or firmly committed. Substantial quantities of phosphates and potash will also be required. If these needs were to be met by an appropriate mixture of urea, diammonium phosphate (DAP) and potash, and assuming that the urea and the ammonia required for it are produced indigenously and DAP is manufactured using imported ammonia and imported phosphoric acid, then the total investment in India to provide these facilities would, at today's prices, amount to $1,600 million. A further investment of $225 million would be required at locations near the Persian Gulf and an additional $500 million would be required near the phosphate mines for the erection and operation of the phosphoric acid facilities. For reasons of transport economics, it seems probable that these investments would also be in the developing countries, in the Mediterranean or the Middle East. Furthermore, approximately half of these sums would be required in foreign exchange.

It is clear, then, that in a relatively short period of time a great deal must be done if India's requirements of fertilizers are to be met, or for that matter those of other developing areas. Existing technical knowledge can provide a solution to the problem and the materials required are available. What is now required is the organizational solution which will link technology, materials and finance to deliver the goods so urgently needed.

We believe that a possible organizational solution could be in the establishment of a large multinational company which would coordinate and establish the extractive and productive units the program must have.

We think that such a company could be jointly owned by several large companies now operating internationally in the oil and chemical industries. It would thus possess, in itself, the expertise necessary to implement its programs which, for example, could require it to develop in a coordinated fashion the production of ammonia in the Persian Gulf, the extraction of sulphur in Iraq and its use in Tunisia for the production of phosphoric acid. It would similarly develop the extraction of potash in Jordan or Ethiopia and, to complete the complex, would set up and invest in downstream plants in India for the combination and blending of these basic inputs to yield the desired complex fertilizer products.

The question is, is a task of this order of magnitude within the capabilities of the type of company we have suggested? There is little doubt that from a purely technical viewpoint it would be feasible, but there are other tasks to be accomplished, a considerable measure of international cooperation must be obtained and very large sums of money must be raised. Can such a company perform, on its own, these latter tasks? What assistance would the World Bank Group give to the concept to ensure its success?

The views of the Advisers are sought on these questions.

JDD
October 9, 1967

(Attachment to Note on Agenda Item 17)

INTERNATIONAL FINANCE CORPORATION

WORLD FERTILIZER POSITION

Our present knowledge tells us that the rate of increase of world population definitely exceeds the rate of increase of the population of the foodstuffs on which their lives depend. As things are today, the world has a population of some 3½ billion and we believe that only about half of these really have enough to eat. If present trends persist, by the year 2000 the world's population will exceed 6 billion, and 5 billion of this total are likely to be living in those areas where present food supplies are deemed inadequate.

If the increased population is to improve its food intake to a sound, even if not lavish, level these areas must plan to quadruple their present food production level. These crude statistics serve only to give a general indication of the magnitude of the crisis which conceivably will exist if concrete actions are not speedily initiated.

In the immediate future, no significant results can be expected to accrue from population control measures. In any case, the size of the world population is less of a food problem than its uneven distribution. On the other hand, we do possess at the present time the knowledge and the necessary physical resources to substantially increase food production in a relatively short period. I have in mind principally the enlargement of specific yield rates by increased use of chemical fertilizer.

It is now widely acknowledged that fertilizers have a key role to play in future increases in agricultural production. A critical factor in the development of fertilizer consumption will be the availability of fertilizer supplies in the required quantities and qualities, at the right place and at the proper time.

Perhaps equally important are other preconditions such as a sound economic incentive for the farmer to use fertilizer, availability of adequate credit to the farmer, the building up of necessary infrastructure facilities for distributing fertilizer and so on.

World fertilizer consumption in 1965-66 reached approximately 44.3 million tons in terms of plant nutrients, nitrogen, phosphate and potash (N.P.K.), or about twice the level of consumption in 1956/57. The share of the developing countries as a whole in world totals of consumption has increased significantly since 1955-56. At that time consumption was 8.5% of the world total, and by 1965-66 the percentage moved up to 14.8%. Despite this considerable increase, consumption levels in the developing countries are still very far from those obtained in developed areas, both in terms of consumption per capita and consumption per acre. India, for example, consumes about 1.8 pounds of plant nutrients per capita or 5 pounds per acre compared to 45 pounds per capita and 40 pounds per acre for the U.S.A. and 36 pounds per capita and 117 pounds per acre for Western Europe.

There are a great many estimates of future fertilizer consumption for regions and individual countries. These are influenced heavily by such factors as the population projections adopted, future nutritional levels assumed and the overall yield relationship between fertilizer use and additional food production. Since yield varies not only according to the crop grown, soil conditions, water availability and management practices but also with the kind of nutrient applied and the rate of application, no universally valid yield ratio can be found and scientifically justified. Even small differences in yield ratio can lead to significant differences in the end result. Of course, all these projections depend on the existence of favourable economic and other conditions mentioned earlier.

However, for a rough and ready order-of-magnitude type of estimate, one could apply the ten to one grain/fertilizer response ratio to projections of additional grain requirements derived from existing and estimated calorie deficit levels in various regions. On this basis, the additional fertilizer requirements in terms of plant nutrients, N, P and K, are expected to be as follows:

ESTIMATED ADDITIONAL FERTILIZER REQUIREMENTS (Base 1960)

(million metric tons of N.P.K.)

	1970	1980	1990	2000
1. Developing Regions:				
Far East	8.3	18.5	29.6	41.1
Near East	1.0	2.4	4.1	6.0
Africa	1.3	3.2	5.8	9.4
Latin America	1.8	4.3	7.4	11.0
Sub-Total	12.4	28.4	46.9	67.5
2. World	15.7	35.1	57.7	82.6

Put in money terms, and assuming that all of the additional capacity results from new investments, these figures imply that investments of the order of U.S.$30 billion will be required over the next three decades, of which, approximately U.S.$24 billion or 80% will be for plants supplying the developing areas. In theory, these new plants could be located either inside or outside the regions where their products are to be consumed. In fact, the foreign exchange capital cost of a nitrogenous fertilizer plant is approximately equal to the foreign exchange cost of its output valued at prevailing prices over a period of two or three years even after taking into consideration the foreign exchange component of its operating costs. This consideration is of fundamental importance in deciding the most advantageous locations for these new plants. The sums involved, however, remain large. Within this general framework, the location of new

fertilizer projects will be influenced to a significant degree by the availability of raw materials for fertilizer production and the economics of their transport.

The principal raw materials for fertilizer production are (i) hydrocarbons for ammonia production (ii) phosphate rock (iii) potash minerals, and (iv) sulfur. Of these, resources for ammonia production will perhaps be of critical importance in the coming years. Ammonia, which is 82% nitrogen by weight, is the basic intermediate for most of the current production of nitrogenous fertilizer, and it is apparent that the use of nitrogenous fertilizer is growing at a significantly higher rate than phosphate and potash. The differential is changing and is expected to change the N-P-K ratio as follows:

	N	P	K
1955/56	1.00	1.18	1.00
1960/61	1.00	0.96	0.83
1965/66	1.00	0.83	0.69
1970/71	1.00	0.72	0.60
1970/75	1.00	0.63	0.53

Natural gas and naphtha are the preferred feedstocks for ammonia production by virtue of lower plant capital and operating costs than for other feedstocks. Considerable reserves of natural gas have been proved. Taking into account probable and possible reserves, world reserves of natural gas exceed 2835 trillion cubic feet. Sizeable quantities have been found in the developing countries, particularly in the Middle East, Venezuela, Nigeria and the Carribean, and also to some extent in Argentina, the French Sahara and Pakistan. Naphtha supplies, on the other hand, are not as plentiful since it is obtained as one of the cuts in the refining of crude oil. Its availability depends on refinery capacity and such factors as the breakdown of consumption between heavy and light petroleum fractions, the nature of the crude oil input and the existence of a petrochemical industry. For example, while at present India has surplus naphtha, it appears that the situation will be reversed in the next few years. Elsewhere in the world naphtha is in short supply.

Several nitrogenous fertilizer plant configurations are possible. Ammonia can be made from natural gas at the source of the gas, or, from naphtha or imported liquified gas near the point of use. Ammonia, in turn, may be converted into other forms of fertilizer at the point of production or transported as liquid anhydrous ammonia to a fertilizer factory located near the market and there converted to such products as ammonium sulfate, ammonium nitrate, ammonium phosphate and diammonium phosphate (D.A.P.). Other things being equal, the choice will depend upon the relative costs of raw material and fuel, and the costs of transporting ammonia or solid fertilizer to the market.

Based on current technology, the lower cost fertilizer will result from the manufacture of ammonia at the gas source to supply regions up to 6000 miles away. However, as it takes only about 0.67 tons of liquified gas to produce one ton of ammonia, any future cost reduction in liquefying and transporting natural gas may well challenge the present advantag

of producing ammonia at the gas source. At distances over 6000 miles, the use of naphtha for raw material becomes advantageous; however, as stated earlier, naphtha supplies are not as plentiful as those of natural gas and other consumers - notably the petrochemical industry - compete for its use.

It may be noted here that one nitrogenous fertilizer of increasing popularity, namely Urea, cannot be produced economically on the basis of imported ammonia because of carbon dioxide requirements.

The world reserves of phosphate rock are estimated at about 70,000 million tons of which about half can be considered economically exploitable. Of these reserves, about 42% are to be found in Morocco, and another 24% in other African countries. Current production of phosphate rock is at a level of about 58 million tons per annum of which about half is from U.S. mines and about a quarter from the U.S.S.R., and by 1970, mining capacity is expected to go up to about 97 million tons per annum. North African countries are expected to account for about 25% of the production.

Currently, a major proportion of the run of mine rock is shipped after minimal enrichment - with a P_2O_5 content of 31 to 35%. With the increasing use of triple superphosphates, containing 46% P_2O_5, manufacture of triple superphosphates at or near the mines could become attractive, provided sulfuric acid is also available.

Another possibility is the manufacture of superphosphoric acid (70% P_2O_5) near the mine, and, in fact, some large phosphoric acid plants essentially aimed at the export market are reported to be under consideration by U.S. companies. Successful and large scale export of such acid from rock phosphate mining regions however will require that problems of handling, transportation and storage are satisfactorily solved.

Where electricity is cheap (say 3 mills per KWh) phosphate rock is decomposed electrothermally at the mine with production of elemental phosphorus. This is the most concentrated form of phosphate being equivalent to 225% P_2O_5, thus giving a shipping advantage of 3:1 over superphosporic acid. It is shipped long distance by rail and marine shipments are now being considered. In Canada, one such project is under implementation.

Although the known world reserves of soluble potash are considerable, of the order of 65,000 million tons, their location is even more restricted geographically than those of phosphate rock. Today, the main potash suppliers are the U.S.S.R., the U.S.A., Canada, France and Germany. In the developing countries, potash is produced almost exclusively in Spain and Israel with minor quantities coming from Chile and Peru. Congo (Brazzaville) is expected to be in production by early 1969 and it is likely that Dead Sea brine in Jordan and deposits in Ethiopia, Morocco and perhaps West Pakistan may begin to be exploited during the seventies.

Generally, potash minerals require only a small amount of processing at the mine, major investments being required for establishing mining facilities. On the basis of recent U.S. experience, an investment of the order of U.S.$70 million is required for extracting about one million tons per annum of potash salt.

The fertilizer industry uses close to half the world sulfur production - mainly in the form of sulfuric acid. Sulfur has been in short supply for some years and prices have almost doubled over the past few years. Indications are that these higher prices are likely to prevail in the future.

Sulfuric acid has two primary uses in the fertilizer industry: to manufacture ammonium sulfate and to render the phosphate in phosphate rock soluble to make it more easily available to plants.

An appreciable tonnage of ammonium sulfate is a by-product of coke ovens. A still larger tonnage is synthesized from ammonia and sulfuric acid. Use of the synthetic product is declining, principally because of its low nitrogen content.

Soluble phosphatic fertilizer may take the form of ordinary superphosphates or, with phosphoric acid as an intermediate compound, triple superphosphates and ammonium phosphates. Phosphoric acid and the phosphates can also be produced from elemental phosphorus.

Nitric acid is also used to treat the phosphate rock in some areas of Europe where sulfur costs are high. Improvements in the process are in the developmental stage, and, if successful, this process could well supplant the use of sulfuric acid as a means of rendering the phosphate in rock into forms assimilable by plants.

A great deal of sulfur is available in widely dispersed deposits of gypsum and pyrites but its extraction is costly. As the price of sulfur increases the use of gypsum and pyrites becomes more competitive.

Shortage of sulfur supplies is not therefore expected to affect fertilizer output seriously (except for temporary dislocations) for the long term, although the higher cost of alternative processes for producing phosphoric acid will tend to increase the price of the final product.

To sum up:

(i) raw material resources are adequate to support world fertilizer needs during the foreseeable future,

(ii) an increased proportion of phosphate rock will be processed into concentrated P_2O_5 materials such as elemental phosphorus or phosphoric acid, near the mine,

(iii) Potash will continue to be imported by most consumers,

(iv) Demand for ammonia, mainly in the form of nitrogenous fertilizer, is likely to increase sharply in the coming years and the key questions will be (a) the source of the hydrogen - natural gas or naphtha - and (b) the location of the plant - at the hydrocarbon source or in the vicinity of the market.

As implied in the foregoing, a significant factor in fertilizer projects for the future will be the manufacture of nitrogen fertilizer - either from gas near the source, or from naphtha, imported liquified natural gas (L.N.G.) or imported anhydrous ammonia close to the fertilizer market.

As an example illustrating this question one might consider the use of associated natural gas from the Persian Gulf oilfields for the nitrogen fertilizer requirements of India. Similar reasoning, however, applies to other regions such as, for instance, the use of Caribbean gas to supply fertilizer markets in South America.

It has been estimated that, for self-sufficiency, India must increase food-grain production from the 1965-66 level of about 88 million tons to a minimum of 125 million tons by 1970/71 and 132 million tons by 1975/76. The corresponding fertilizer requirements have been estimated at 2.4 million tons and 5 million tons of nitrogen by 1970/71 and 1975/76 respectively. Existing production capacity together with capacity of plants under construction and projects for which financing has so far been arranged will be sufficient to produce only about 1.8 million tons of nitrogen. On this basis, it is not unreasonable to assume that an additional 5.0 million tons of nitrogen capacity will be required by about 1980/81.

Now, manufacture of 5 million tons of nitrogen fertilizer requires about 6.1 million tons of ammonia or 5.2 million tons of naphtha or 4 million tons of L.N.G. As presently foreseen, the maximum availability of naphtha in India is unlikely to exceed 4 million tons during the mid 1970's. Allowing for naphtha requirements for motor gasoline production and the petrochemical industry, the balance available for ammonia production will be barely sufficient to meet the projected 1972 needs of the Indian fertilizer industry. To meet an additional 5 million ton demand for nitrogen, naphtha production would have to be several times the foreseen 1975 level.

Installation of additional refinery capacity of the existing type to produce more naphtha is, of course, possible but unlikely to be economical as it would lead to significant surpluses of other refinery cuts such as kerosene and diesel oil. Developments in refinery technology may, however, change this situation.

On a world wide basis, availability of the large tonnages of naphtha required cannot be taken for granted. Dependence on imports of naphtha as an alternative would, therefore, be imprudent. Setting aside strategic and political considerations, the most economically attractive future sources of ammonia

for India would seem to involve imports of either liquified natural gas or anhydrous ammonia from the region of the Persian Gulf. Imports of solid nitrogenous fertilizers, though they might be useful as a transient solution to deal with emergencies, cannot, for the reasons outlined previously, be significant as a substantial element in the long-term, steady-state, solution to this problem.

As a notional demonstration of the magnitude of the sums likely to be required the approximate estimates given earlier can be taken as bases for calculation. In simple terms, we can consider that an additional 5 million tons of nitrogen will be required and, notionally, assume that the N-P-K ratio of 1.0 - 0.63 - 0.53 can be satisfied by the appropriate proportion of urea, D.A.P. and potash. Their requirement would be:

Urea	8.6	million tons
D.A.P.	6.6	" "
Potash	4.4	" "
Total Mixture	19.6	million tons

The corresponding raw or intermediate material requirements would amount to:

Ammonia	6.6	million tons/year
Rock Phosphate	11.4	" "
Potash Salts	4.5	" "
Sulfur	3.1	" "

A point of immediate interest is the enormous quantity of sulfur required on the basis of traditional manufacturing techniques - more than a third of current U.S. production.

These simple statistics clearly demonstrate the magnitude of the problem which confronts us all.

For example, the quantities of ammonia involved clearly would not permit local Indian manufacture from indigenous naphtha alone. Bearing in mind our notional concept for supplying the NPK needs of the country, a first logical solution would be the importation of liquified ammonia from the Persian Gulf area to strategic coastal points where mixing plants would be established. It is expected, however, that the techniques and economics of the liquification and transportation of natural gas will be so much improved that it will ultimately be feasible to import LNG as an ammonia feedstock.

Phosphorus can be supplied in various forms, either as rock phosphate, phosphoric acid or elemental phosphorus. In the example we have chosen, we have assumed, perhaps unrealistically, that phosphorus will be imported in the acid forms, and that phosphoric acid plants will be located near the source of the raw materials.

It is only possible now to expound broad ideas and projections. However, it is worth, even at this stage, making some estimates, however rough, of the sums of money involved. Calculations show that for all practical purposes the investment in fixed assets is the same, about U.S.$37 million, for a 1,000 ton per day ammonia plant, including transportation and port facilities, whether it is based on natural gas and located in the Persian Gulf area, or whether it is based on naphtha or LNG and located in India. The cost of an ammonia plant can be fairly accurately estimated, and also the cost of a phosphoric acid plant, and related facilities and these have been used in preparing estimates of capital cost. Figures, for the longer term possibility of using elemental phosphorus, have not been prepared.

Assuming that all the urea and the ammonia required for its manufacture, will be produced in India, that D.A.P. will be produced in India from imported ammonia and phosphoric acid, it is estimated that the total investment in India to provide the facilities described would, at today's prices, amount to $1,600 million. A further investment of $225 million would be required at locations near the Persian Gulf and an additional $500 million would be required near the phosphate mines for the erection and operation of the phosphoric acid facilities. For reasons of transport economies, it seems probable that these investments would also be in the developing countries, in the Mediterranean or in the Middle East. Furthermore, approximately half of these sums would be required in foreign exchange.

FERTILIZER

Fertilizer (Nitroganous) Plants and Output:

	Number	Capacity (Metric Tons)	Output in terms of nutrients (Metric Tons)
In Operation	12	710,000	540,000 (Est. for 1968-69)
Being Built	8	1,320,000	---
Agreed to, but not begun	6	1,095,000	---
Now being negotiated	4	(Capacities under negotiation)	---

Fertilizer Consumption:

	Nitrogen	Total in terms of nutrients
1947	4,3000	7,000
1966-67	838,700	1,203,048
1967-68	1,070,000	1,575,000
1968-69 (Revised targets, Min. of Food & Agri.)	1,700,000	2,650,000
per yr. growth	350,000	
'73-74	3,750,000	

[Prepare a brief summary of consumption & production by yr & area & plant capacity, by plant not yet built]

Fertilizers - N Sector

Plants in operation as of April 1 1969 = 11

of which - Public sector 8
Private sector 3

Plants under construction by April 1, 1969 (est.) 8

of which New plants 5
Major expansion 3

all are in public sector
(one with foreign private collaboration)

Projects pending involving foreign collaboration (Private Sector) = 11

In advanced stage (all Private) 6
of which decision in hands of promoters 3
Govt of India sanction or approval required 3

In early stage (3 Private; 2 Public) 5
(Letter of Intent issued but details not apparent)

all in advanced stage are Private sector
Public 2 of the 5 in early stage may become public sector
than originally they were private sector. (Haldia - Mangalore)

Other Pending Projects - 2 (Public) 2

2 coal based public sector projects are being given some consideration for start in 1970.

32 20 Public 12 Private

Requirements - 3 more plants started this year
plus 2 new starts each succeeding year

Rough costs - @ 50 million per plant
of which ~ " 20 " " " in foreign exchange