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REPORT TO THE PRESIDENT OF THE INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT AND THE INTERNATIONAL DEVELOPMENT ASSOCIATION

ON

INDIA'S ECONOMIC DEVELOPMENT EFFORT

VOLUME VI

MANUFACTURING INDUSTRY WITH SPECIAL REFERENCE TO PUBLIC SECTOR ENTERPRISE

1964/65 Economic Mission
Headed by Bernard R. Bell

October 1, 1965

PREFACE

i. This volume includes a main report and four appendices, three of which are case studies of important public sector projects and one a discussion of recent developments in the fertilizer industry. It is based principally on investigations carried out in India by Kenneth A. Bohr, Jochen Kraske, Frank H. Lamson-Scribner and Romano Pantanali of the Bank Staff during the winter 1964-65. Dr. I.M.D. Little of Oxford University also made a valuable contribution in the form of a study for the mission of the Heavy Electrical Plant at Bhopal. This appears as Appendix I to the main report.

ii. Kenneth Bohr wrote the main report, in part from notes and papers contributed by other members of the group. He also wrote Appendix II and, with Jochen Kraske, Appendix III. Frank Lamson-Scribner wrote Appendix IV. In its work the mission profited from the assistance of Paul Geli and Harry Phillips of the Bank Staff, who with their associates were appraising the Second Industrial Imports Project while the mission was in India, and, especially, from the cooperation of the Indian officials, particularly those in the plants visited. The conclusions drawn are, of course, the responsibility of the authors.

iii. The report does not attempt to deal with all important aspects of Indian industrial development. Its purpose is rather to focus on some of the major problems encountered in the effort to carry out the industrial program of the Third Plan. A survey of the performance of the sector during this period has led us to place particular emphasis on problems associated with public sector industry.

iv. It should be pointed out that matters of great importance to the performance of the industrial sector are also dealt with in other reports of the mission. We would mention in particular the volumes on Administrative Controls on Resource Allocations and Investment, which deals with the working of the system of physical controls, and Problems of Public Financial Policy in India, which includes an analysis of company taxation.

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I. THE INDUSTRIAL SETTING

1. India has a long industrial history and has achieved a substantial development of manufacturing production. For many years she has been one of the world's major producers of textiles; recently she has become the world's twelfth largest steel producer. The value of her industrial output appears to be roughly comparable to that of a moderately industrialized European country such as Spain. However, within the vast Indian economy the contribution of manufacturing industry to overall output and employment is still relatively small. It is estimated that in 1963/64 factory industry produced only 11% of the national output and employed only a little over 4% of the labor force. 1/

2. Modern factory industry as distinct from traditional handicraft industry, was first established in the latter part of the 19th century. The first modern factories were in the textile industry. By the early part of the 20th century iron and steel, engineering, cement and paper industries had also been developed. By 1911 over 500,000 persons were employed in cotton and jute mills and total factory employment was about 1,300,000. The World War of 1914-18 both stimulated domestic industry and drew attention to the great dependence on imports for vital industrial products. Following the war a more active policy of encouraging industrial development was pursued. The main instrument was the tariff; the main objects of protection were consumer goods and such basic products as iron and steel and cement required for the domestic market. The result was an increasing self-sufficiency in consumer goods and a corresponding decline in their import.

Recent Changes

3. Since the Second World War and Independence a considerable change has taken place in the pace and pattern of industrial development. The emphasis has shifted toward the production of capital goods and basic industrial materials. The first developments came shortly after the War as the result of policies adopted during the war period. Further progress was made in this direction during the First Five Year Plan. In 1955 with the start of the Second Five Year Plan the process was greatly accelerated when the Government undertook to actively promote the development of the metal, machinery and chemical industries. 2/ Of the portion of plan expenditures allocated to industry in the Second and Third Plans (18% and 23% respectively) most of the funds were designated for the metal, machinery and chemical industries (70% in the case of the Second Plan and 80% in the case of the Third Plan).

1/ Traditional handicraft industries excluded; employment figure refers to 1961. See Table 1.

2/ The term "machinery" is used here to include machine tools, electrical machinery and equipment, non-electrical machinery and equipment, and transport equipment; "chemical industries" include oil refining and the manufacture of fertilizer.

4. The heavy emphasis on "basic industries" which has characterized Indian planning has brought about a marked change in the pattern of output. Whereas in 1956 textiles (mainly cotton and jute) and food processing (mainly sugar and tea) contributed 60% of industrial output, by 1962 their contribution had dropped to 40%. The corresponding increases were distributed among industries producing various types of machinery, chemical products, non-metallic mineral products and paper. See Table 2.

5. With this change in the pattern of investment and output there has been a corresponding change in the pattern of imports. The requirements of the industrial programs have resulted in a sharp increase in the import of metals, machinery and equipment. Whereas these categories accounted for 28% of imports in 1950/51, they reached a level of 43% in 1955 and have averaged 50% during the period of the Third Plan. See Table 3. Although an important goal of the Indian programs of industrial development is to reduce future dependence on imported machinery and equipment, this particular prospect appears to be still a long way off. 1/

Role of Public Sector Industry

6. Within the framework of the Five Year Plans which lay out proposed patterns of investment and targets for production, public sector industry has been given a very important role. As the structure of industry has been shifted in favor of the production of capital goods and basic industrial materials, a major part of the investment in these favored fields has been assigned to public sector enterprise. This follows the Government's declared policy of (a) reserving for itself the development of new units in basic "heavy" industries such as those producing iron and steel, heavy forgings and castings, heavy plant and machinery, and heavy electrical plant; and (b) sharing with the private sector the development of new capacity in such industries as those producing machine tools, ferro alloys and tool steels, basic and intermediate chemical products, fertilizer, essential drugs and aluminum. 2/ Whereas prior to the start of the Second Five Year Plan the Government's participation in industrial production was confined largely to the departmental operations of the railway workshops, today public enterprise is heavily involved in the production of steel, chemicals, machinery and equipment.

7. The Third Plan illustrates the role the public sector has been given. In the published plan 54% of the investment planned for industry is assigned to the public sector. Although total planned investment is concentrated on the metal, machinery and chemical industries broadly defined, the public sector portion is further concentrated on the "heavier" of the component industries. It is concentrated on steel (92% of total planned investment in steel), electrical machinery (80%), industrial machinery (60%) and chemicals (50%). These four fields account for 80% of

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1/ For further discussion of this problem see paragraphs 32-38.

2/ Government of India Resolution on Industrial Policy, 30 April 1956.

total planned public sector investment in industry. See Table 4. Although these figures do not represent actual achievement, they do indicate the position given to the public sector.

8. The preliminary figures for the Fourth Plan as it was conceived in late 1964, made available to the mission, continue the same pattern. Again there is heavy concentration of total planned investment in industries producing capital goods and basic industrial materials. This time the proportion of investment allocated to metals and machinery is even greater than in the Third Plan. Again public sector investment is heavily concentrated in metals, industrial machinery, electrical machinery and chemicals. Together with fertilizers these fields account for 80% of the total investment planned for public sector industrial enterprises. See Table 4.

9. The volume of investment of Central Government undertakings in manufacturing industry was Rs. 1250 crores as of March 1, 1964. 1/ This is somewhat more than the government investment in electric power (estimated at about Rs. 900 crores in 1962-3) but perhaps only a little more than half the government investment in railways (estimated at Rs. 2600 crores in 1965-6). 2/ It would appear to be about a quarter the volume of investment in private manufacturing industry. 3/

10. The Government's industrial effort is concentrated in a small number of very large enterprises. Although there are 29 Central Government undertakings in the field of manufacturing industry, the largest, Hindustan Steel, Ltd., accounts for 64% of the total investment and the four largest, Hindustan Steel, Ltd.; Heavy Engineering Corp., Ltd.; Fertilizer Corporation of India, Ltd.; and Heavy Electricals (India), Ltd., account for 85% of the investment. Investments in the four range from Rs. 72 crores (Heavy Electricals) to Rs. 804 crores (Hindustan Steel). 4/ Thus, at the present time, the performance of these four enterprises is for all practical purposes the performance of public sector industry.

1/ This figure does not include Neyveli Lignite Corp., a mixed mining and manufacturing operation, nor does it include departmental undertakings such as the railways' shops for the manufacture of locomotives and rolling stock. See Table 5.

2/ Capital assets of Electricity Boards end of 1962-3: "Report of the Committee on the Working of the State Electricity Boards" October 1964. Investment in railways at end of 1955-66 at historical costs; explanatory Memorandum on Budget 1965-6, Appendix 18.

3/ Based on the estimates made by the Reserve Bank of the net assets of public limited companies, large and small, private limited companies and foreign branches corrected where possible for non-manufacturing activities. Reserve Bank Bulletins Jan., Mar., July and Oct., 1964.

4/ Figures are for 1963-4. See Tables 5 and 6.

Size and Concentration in the Private Sector

11. Large enterprises are also important in the private sector. It has been estimated that about a third of the net assets of all public limited corporations are accounted for by the 51 largest ones. About 5,500 companies account for the remaining two-thirds. 1/ As in the case of the Government's companies, the largest are in steel and engineering. Tata Iron and Steel, by far the largest, accounts for 13% of the total assets of the 51 and together with the second largest, Indian Iron and Steel, accounts for 22% of all assets. Tata Engineering and Locomotive and Associated Cement are next in size. See Table 7. The size of the corporation is not necessarily related to the scale of individual plants as tends to be the case in the public sector. Associated Cement, for example, operates 20 plants. On the other hand, in terms of control of major management decisions the relevant unit is broader than the individual corporation in many cases. If a corporate group is defined as a group of enterprises subject to control by a common authority in matters of important business decisions, it has been estimated that the two largest of such groups, Tata and Birla, control in one way or another companies which account for almost one-fifth of the fixed assets in the private corporate sector. It has also been shown that the concentration of control in the hands of large corporate groups has increased between 1951 and 1958. 2/

12. The concentration of economic power in the private sector has been one of the more frequently articulated concerns of the Indian Government. Although a satisfactory policy on this matter does not appear to have been developed yet, the concern has had its effect, particularly on industrial licensing policy. The 1956 Resolution on Industrial Policy points to the urgent need "to prevent private monopolies and the concentration of economic power in different fields in the hands of small numbers of individuals". 3/ The Third Plan is more explicit though still vague. The conflict between the efficiency of large-scale enterprise and the strains and tensions that "excessive economic power in relatively few hands" would impose on the social structure is pointed out. 4/ An attempt is made to emphasize the desirability of promoting "a pattern of industrial organization which will lead to high levels of productivity and give full

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1/ Economic Times, January 11, 1965 - Based on 1963-4 figures.

2/ R. K. Hazari - The Structure of the Corporate Private Sector, A Study of Concentration, Ownership and Control, Report to the Government of India, Research Programmes Committee, Planning Commission. 1963.

3/ Government of India Resolution on Industrial Policy, 30 April 1956.

4/ Third Five Year Plan, p. 13.

scope, within the framework of national planning to new entrepreneurs, to medium and small-scale enterprises and to cooperative organizations". This objective is to be achieved by the development of public sector enterprises in fields where large-scale and heavy investment are required, by the control of private expansion through a system of licensing, by fiscal measures and by assisting the development of new firms through financial and promotional institutions. The expansion of the public sector is seen as a means of establishing necessary production facilities and also as a means for reducing the scope for accumulation of wealth and large incomes in private hands. 1/

13. The problem is more realistically defined in the recent report of the Committee on Distribution of Income and Levels of Living 2/ which makes the necessary distinction between concentration in terms of the share of the major producers in the capacity of a particular industry - a position which may be strongly influenced by economies of scale in the manufacturing process - and the more generalized concentration of economic power through the unified control of large groups of enterprises. Whereas the former may be affected by industrial licensing policy, dealing with the latter is a much more complicated matter. The committee states the dilemma as follows:

> "Industrialization has its own logic, and neither the economies of scale nor that of full utilization of scarce talent can be ignored with impunity ..... (Yet) the country is pledged to the realization of a socialist pattern of society; and diminution and eventual elimination of concentration of economic power in private hands is a part of that society. The task has to be attempted in terms of harmonious progress toward these goals; and the sooner the Government sets up the necessary machinery for collection, examination and analysis of all relevant data on the subject, the easier it would be for it eventually to formulate the necessary policy that will combine industrialization with social justice and economic development with dispersal of economic power." 3/

1/ Third Five Year Plan, p. 14.

2/ Part I - Distribution of Income and Wealth and Concentration of Economic Power, Report of the Committee on Distribution of Income and Levels of Living, Planning Commission, February 1964.

3/ Committee, page 55.

14. At the time of the Mission's visit a Monopolies Commission had been set up to study the subject further. The policy to be pursued in the Fourth Plan in this matter awaits the suggestions of this commission. 1/

Variations in Size

15. Although large corporations are not synonymous with large-scale plants and the growth of large economic groups does not necessarily imply a growth in the scale of individual industrial operations, there is some evidence that the average size of plant is increasing. 2/ Certainly this might be expected, as the more rapidly growing industries in the capital goods, metals and chemicals fields tend to be relatively large scale in the Indian context for basic economic reasons. It has been estimated that about 60% of the value added by industry is contributed by factories with fixed assets of Rs. 25 lakhs or more. 3/ In 16 of a total of 55 industry groups, factories of this size contribute more than two-thirds of value added, and these 16 industries contribute about three-quarters of all value added. See Table 8.

16. There are also a great number of very small industrial establishments. In addition to the 9,000 factories included in the regular enumeration of the Annual Survey of Industries, there are some 31,000 registered factories of smaller size in the so-called "sample sector". 4/ Taking both groups together it has been estimated that 36,000 factories have fixed assets of less than Rs. 5 lakhs. 5/ These small units are of considerable importance in certain industries such as processing agricultural products and vehicle repair as shown in Table 9.

1/ The report has since been submitted to the Government recommending the establishment of a Monopolies and Restrictive Trade Practices Commission and suggesting how the commission be organized and what its specific functions should be. No action has as yet been taken on these recommendations.

2/ An analysis of 29 industry groups based on censuses of 1953 and 1958 shows a tendency for an increase in average size measured by employment. Raj Krishna, "Changes in the Size Structure of Industries, Analysis of Census of Manufacturers, 1953-58". Economic Weekly, February, 1964.

3/ For 1961, considering only factories in the census sector, i.e., those employing 50 or more workers with power or 100 or more without power. See Table 8.

4/ Registered factories employing 10-49 workers with power, or 20-99 workers without power. Traditional, handicraft or "cottage" industries are not included. Estimate is for 1961.

5/ Development of Small Scale Industries in India. Report of International Perspective Planning Team. Ministry of Industry 1963. See also Table 9.

17. Table 9 also reveals the large number of small-scale units in industries in which most of the output is produced by larger units, e.g., metal products, machinery, chemical products, etc. In part this may be attributed to the broad classifications used which combine very different activities in the same category. However, this is also a reflection of the fact that very small and very large, very old and very new, very efficient and very inefficient enterprises do exist side by side in the same industries. The wide variation in size and performance and costs within the same industry is an important characteristic of Indian industry at this time. 1/

18. The existence of such diversity in industry is not particularly surprising when one considers what is involved in the transition from small handicraft shops to modern factory industry. The size of the country and the difficulties of transport also tend to foster local and regional markets which for certain products may be quite isolated from one another. The extensive protection from the competition of imports, the buoyant domestic market demand and the system of allocating scarce foreign exchange and domestic products so that few receive all they want and none is completely deprived, all tend to perpetuate a system in which the rewards for efficiency are weak and the tolerance for inefficiency strong. 2/

The Location of Industry

19. Another characteristic of Indian industry which has particular relevance for industrial policy is its geographical concentration. The fact that industry is not spread evenly among the regions of the country is to be expected. The total volume of industrial activity is small in terms of the size of the economy and much of it is concentrated about the original and still major centers of industry, Calcutta and Bombay. The jute mill industry grew up in the Calcutta area and has remained concentrated there. Iron and steel and coal are also for the most part concentrated in areas near Calcutta, and there has been a substantial development of engineering industries in the same area. Bombay was and still is the dominant center of the cotton textile industry though its relative importance is less than it once was and a variety of other industries have become established there in more recent times. Other important industrial centers are Delhi, Madras (automotive and textiles) and Bangalore (machine tools). Industries such as paper and cement have tended to spread out from the areas where they were first established in response to the locational attraction of raw material supplies. Certainly manufacturing industry

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1/ This generalization is supported by the industrial studies of the Tariff Commission and the findings of the recent IDA missions appraising the industrial import loan project. It is also supported by the wide range observed in the level of tax payments noted in Problems of Public Financial Policy in India, para. 15.

2/ For a description and analysis of the system of controls, see Administrative Controls on Resource Allocations and Investment.

exists in a great many more localities than formerly but still the great part of it is clustered in and about the great cities which in themselves account for only a small fraction of the country's population. 1/

20. The Government is concerned with the geographical concentration of industry. Its announced policy is to promote "balanced development of industries in different parts of the country". 2/ This theme was expressed in the Industrial Policy Resolution of 1956 and was treated at some length in the Third Plan document. Supporting the general aim for "balanced regional development" is, of course, the pressure of state governments for their "share" in the new industrial development. The affect of this policy can be observed in the location of public sector plants. Frequently plants have been established in areas where little industrial activity existed before. Some of these are also quite far from both existing markets and present sources of supply. The policy is also reflected in the location controls applied to private industry which have prohibited establishment of new plants in the immediate environs of Bombay and Calcutta for good and obvious reasons and have generally favored more dispersed locations. A system of uniform delivered prices for steel and cement has also helped to support the geographical dispersion of industries, in particular those which are heavy consumers of these products.

Summary

21. Indian manufacturing industry is extensive and varied. It is a mixture of the old and new, very large and very small, modern and primitive. It is growing fairly rapidly and it is undergoing a substantial change in structure as it grows. Investment resources are being concentrated in the metals, machinery and chemical industries, and public sector enterprise serves as a major instrument of this policy. The total investment in public sector industry is substantial and may be roughly a quarter that in private industry. The old established industries producing consumer goods from agricultural raw materials for both domestic and foreign markets - the textile and food processing industries - are less important than formerly; imports of metals and machinery and equipment are accounting for an increasing share of imports and of output. These changes reflect a policy aimed at achieving a high degree of self-sufficiency in the future.

1/ The five largest cities accounted for less than 3.5% of the population in 1961.

2/ Memorandum on the Fourth Five Year Plan, p. 53.

II. RECENT PERFORMANCE

22. In this chapter we examine the performance of the industrial sector during the period of the Third Plan. We identify as far as possible the actual course of output and investment and we indicate the nature of the constraint imposed by the limited supply of imports. We also make some rough estimates of the ratio of investment to increase in output over the period as crude measures of the short term effectiveness of the investment program and we compare actual with planned performance where possible. Because information on private investment is lacking, our analysis relies heavily on the experience of public sector enterprise which accounts for about half the planned investment in industry.

A. The Sector as a Whole

Output

23. Industrial output in general has not been increasing as rapidly as planned. For the past 9-10 years the output of manufacturing industry has been growing at an average rate of about 7% a year. For the period of the Third Plan, i.e., since 1961, the rate has been 7.5%; the planned rate was 11%. Although this comparison may be appropriate, both planned and actual rates would appear to have been computed on the same index; it should be pointed out that the index is based on 1956 weights which give a heavier weight to the slow growing textile and food processing industries than the pattern of output in recent years would warrant. 1/ An index based on, say, 1961 weights would show a more rapid rate of growth.

24. Indian planning uses specific output targets as well as a general rate of growth as goals. The two are presumed to be roughly consistent. In terms of specific targets, shortfalls in the Third Plan Period are expected to be quite widespread, as shown in Table 12. The significance of these shortfalls is not readily apparent in all cases. In some cases the original targets were either too low or too high. For example, it may be questioned whether the target for cement, even granting that production is still somewhat short of target, was an accurate reflection of requirements in view of the current shortage and lively black market. 2/ On the other hand, targets may be too high in terms of domestic requirements and shortfalls may not always result in shortages. This may be the

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1/ Table 10 shows the overall index together with that for the various individual industries. Table 2 shows the apparent change in structure between 1956 and 1962.

2/ This raises the question of to what extent requirements can be made to differ from demand by controlling "non-priority" uses particularly where, as in this case, it is not being done successfully.

case with certain grades of paper. Targets are not being met, yet there is no real shortage and the presumption is that requirements were overestimated. A more dramatic case is coal, which is not included in the table. In this case it has become clear that the target was about 30% too high. 1/ The fact that failure to achieve a target does not give rise to a shortage may also be the result of the slower rate of overall growth.

25. Assuming that targets are reasonable representations of requirements, there are further problems of interpretation. Observed shortfalls may understate the importance of the particular shortage to the economy because the targets are not sufficiently specific - a ton of steel slabs will be a ton of target achievement even if slabs are in good supply while there is a critical shortage of certain sections. Then too, shortfalls by the end of the Plan period may not be an adequate measure of the impact of lagging production over the period. This is particularly so where the product in question is an important input in the construction and utilization of capacity in other industries, e.g., steel and cement. In some cases it has been possible to compensate, partly at least, for lagging domestic production with imports. However, this alternative has been severely limited by the tight foreign exchange position which has been further aggravated by the cost overruns and delays in the execution of many of the projects undertaken.

26. In many cases, targets were not achieved because capacity was not built as planned. In other cases, production fell short because the capacity that was built was not fully utilized either because of operating problems or shortages in the supply of necessary parts or materials. Steel, cement and fertilizer are examples of the first. The Third Plan steel target assumed completion of the expansion of the three public sector plants and the production of one million tons from the fourth plant, Bokaro. The expansions have been delayed and construction is just now starting on Bokaro, which will not be producing steel in any quantity until well into the Fourth Plan, if then. 2/ In the case of cement investment licenses issued to various private groups have not been implemented. The same is true for fertilizer and, in addition, the construction of public sector plants in this industry is running well behind schedule. In other industries shortages of steel, pig iron and non-ferrous metals, imported components and spare parts have limited the output of many plants. This is true particularly in various metal-using industries. 3/ On the basis of data collected by the IDA mission studying

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1/ Third Plan target 98.6 million tons, revised target (Fourth Plan Memorandum) 76 million tons.

2/ In the Spring of 1965 Bokaro was estimated to be about 9 months behind schedule.

3/ These "shortfalls" are not all reflected in Table 12 which deals only with a limited number of specific physical targets.

the maintenance requirements of the electrical, automotive and machine tool industries, and fragmentary information from other industries, it would appear that output of a large number of metal-using industries could be increased by 25-30% without additional investment if required supplies of materials and components and, in some cases, minor balancing equipment were available. 1/

27. There is, of course, an intimate relation between the failure to construct capacity on the one hand and the shortfalls in output due to supply shortages on the other. In many cases the supplies that are short were to be produced by capacity that didn't materialize. This is the steel case, where shortfalls in capacity and output have not only limited supplies required for current production in steel-using industries but have also limited supplies of steel and steel products required for construction of other plants. This relationship has been particularly acute because of the overall limitation on imports imposed by the foreign exchange situation. Furthermore, shortfalls in implementation have not necessarily meant a reduction in resources used - which would release foreign exchange for imports to compensate for the shortfalls. 2/ As indicated below, what appears to have happened is that fewer projects have been built but that these have been constructed more slowly and have cost much more than had been planned.

Investment

28. When the Third Plan was drawn up, the industrial program was estimated to require a net investment of Rs. 2,993 crores broken down as follows:

	Public	Private	Total
Industry	1,330	1,125	2,455
Minerals	478	60	538
	1,808	1,185	2,993

Against these requirements the resources available were estimated to be Rs. 2,570 crores, Rs. 1,470 crores for the public sector and Rs. 1,100

1/ If it is assumed these industries represent roughly 20% of output (Table 2), an increase of 25% would increase total industrial output by 5%, whereas on present trends, industrial output by the end of the Third Plan is likely to be 15% lower than projected in the plan. This 25% increase does not include the additional output that might be achieved as a result of increased efficiency.

2/ The reduced rate of growth has, of course, not been balanced in such a manner that shortfalls would be matched by reduced demands.

crores for the private sector - an overall shortfall of Rs. 420 crores. These original estimates were quite rough as project reports did not exist for many of the projects and even where they did, their cost estimates frequently were not realistic.

29. At the time of the mid-term appraisal the estimated cost of the public sector programs was increased substantially to Rs. 2,292 crores. 1/ While this was partly the result of changes in the scope of some projects and of price increases in the intervening period, the major change seems to have been attributable to a substantial increase in the basic cost estimates themselves. While the original cost estimate for the total public sector industrial program was increased by Rs. 300 crores, the new estimate appears to have excluded projects costing more than this amount which were deferred. 2/ Since it does not appear that they were replaced by new projects, the increased cost must relate entirely to the projects retained. 3/ At the same time that the estimate of cost was increased, an estimate of expenditure was made (Rs. 1,754 crores) indicating a shortfall for the plan period of about Rs. 540 crores. Subsequently, the Planning Commission reduced the estimate of expected investment expenditure to Rs. 1,662 crores, resulting in a shortfall or "carry-over to the Fourth Plan" of Rs. 630 crores. 4/ The figures are as follows:

Third Plan Public Sector Program

	Estimated Cost		Estimated Expenditure	
	Original Estimate	Mid-term Appraisal	Mid-term Appraisal	Memo on Fourth Plan
Industry	1,330	1,630	1,225	n.a.
Minerals	478	662	529	n.a.
	1,808	2,292	1,754	1,662

30. There are no estimates of actual investment in private sector industry. As in the case of the public sector, some programs are behind schedule, e.g., the planned capacity has not been built in the cement

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1/ The Third Plan Mid-Term Appraisal, Nov. 1963.

2/ Bokaro Steel Plant Rs. 200 crores, Neyveli High Temperature Carbonization Plant Rs. 25 crores, Heavy Compressors and Pumps Rs. 15 crores, etc.

3/ This is also supported by information on some of the public sector projects themselves. See paras. 47, 48 and Tables 14 and 15.

4/ Memorandum on the Fourth Five Year Plan, Oct. 1964. The category "Organized Industry" used in the memorandum is taken to include industrial and mineral programs. There is no separate mineral category indicated.

and fertilizer industries. On the other hand, there is no doubt that, as in the case of the public sector programs, costs have turned out to be higher than estimated in the Third Plan document. If it is assumed that the volume of investment in private industry is on balance about the volume originally estimated in the Third Plan (Rs. 1,200 crores), then the total investment in industry and mining in the plan period would be about Rs. 2,800 crores - about 6-7% less than the planned amount. On the other hand, the annual rate of growth in output for this sector has averaged 7-7.5% during the first 3-1/2 years of the plan period, and it is not expected to change much in the coming 18 months. Thus, while industrial output would have increased by 68% in the five-year period at the planned rate of 11% per year, the actual increase is likely to be only about 43%. It follows that output will have increased 36% less than projected while investment expenditure was only 6% less than projected. For the sector as a whole these conclusions are difficult to support with detailed evidence; however, as is developed in the following section, the record of public enterprise supports this general observation, and its weight in the sector is very great. Also, it does not appear that other likely estimates of private investment, or possible changes in the investment rate to take into account price changes or more rapid growth in the final 18 months of the plan would much alter the conclusion that the relation of investment to output increases in industry was substantially higher than anticipated in the plan. 1/

31. The observed ratio of investment to output over a given period depends on the pattern of investment, the technical investment-output relationships for the particular industries involved, the time required between the investment expenditure and the realization of output, and the rate of change, if any, in the overall rate of investment (an accelerating rate increases the proportion of non-producing investment "in the pipeline"). The level of utilization of capacity in the sector and changes in the rate of utilization are also important. For the Third Plan period, the ratio should have been expected to be high. Certainly, many of the projects undertaken in the public sector by their very nature required heavy investment in relation to output, and long gestation periods. In addition, there has been appreciable unutilized capacity and an increase in the rate of investment in the sector. The fact that the ratio appears to have been even higher than anticipated is a reflection of the problems of both planning and performance.

1/ Assuming the planned level of investment Rs. 3,000 crores, and the planned rate of growth 11%, and using the value added in industry and mining in 1960 as a base, the ratio of new investment to increased output (net) for the planned period was expected to be about 3 to 1. The actual ratio will probably be well over 4 to 1 and may be closer to 5 to 1.

Imports

32. Intimately related to the program of investment and the targets of production and growth are the requirements for imports. Imports of capital equipment are required for new capacity, and imports of industrial materials, spare parts and components are required to maintain the output of existing capacity. During the Third Plan period about one-half of all imports have consisted of metals, machinery and equipment. It is one of the goals of the industrial program to reduce the economy's dependence on such products so that "the requirements for further industrialization can be met within a period of ten years or so mainly from the country's own resources". 1/

33. The short-term goals of import policy are expressed in terms of estimated import requirements over the plan period. The evidence is that even though output targets have not been achieved, and perhaps to some extent because of this, import requirements have proved to be considerably larger than had been estimated. If the industrial output targets had been met, the additional output would in part have substituted for imports and thus reduced the import bill. On the other hand, the additional output itself would have required some additional imports. A careful analysis, beyond that readily possible with the existing data, would be required to determine the relative weights of these two countervailing effects and to permit a judgment as to whether in the Third Plan period, higher industrial output would have, on balance, increased or reduced import requirements. Our guess would be that on balance the effect in this relatively short five-year period would have been to increase import requirements. In the long run, too, we would judge that gross import requirements must increase with increased industrial output, even allowing for substantial import substitution, but that with proper policies, export of part of the additional output could more than offset that increase so that net imports could in fact fall.

34. Imports during the First Five Year Plan (1951-55) averaged Rs. 720 crores per year. This level was expected to increase during the early years of the Second Plan and then decline as new industrial capacity came into production. The average annual level of imports during the period was projected to be Rs. 868 crores. This proved to be a gross underestimate. Imports increased during the early years of the Second Plan more strongly than expected and the increase was halted during the last years of the plan only by the administrative restriction of imports. The average level turned out to be Rs. 1,072 crores. Total imports in the Second Plan period were Rs. 5,360 crores compared with the estimate of Rs. 4,340 crores. The increase was largely accounted for by capital goods, industrial raw materials and components reflecting both investment and current production requirements. About 45% of imports during the period consisted of metals, manufactures of metals, machinery and equipment. This is in contrast to 28% in 1950.

1/ Third Five Year Plan, p. 48.

35. The Third Plan projected import requirements in the period at Rs. 6,350 crores or an average of Rs. 1,270 crores per year - roughly 20% more than actual level of the previous plan. The estimate was broken down as follows:

Machinery and equipment for Plan projects.....	1,900
Components and intermediate products to increase production of capital goods.....	200
Maintenance imports (components, spare parts, equipment for replacement, raw materials, essential consumer goods, etc.) to maintain production.....	3,650
PL 480.....	600
	6,350

36. The figure for "maintenance imports" was stated to be an underestimate of requirements. "The requirements of such imports for securing adequate utilization of industrial capacity are considered to be distinctly larger." 1/ "An estimate of Rs. 3,800 crores would not be too high." 2/ Similarly, the estimate of Rs. 200 crores for capital goods components appears to be a token estimate "to highlight the fact that the execution of Plan projects requires the import not only of complete machines but also of materials to fabricate equipment in the country. The components and intermediate products of various kinds required for maintaining the production of capital goods at full capacity level add up to a much higher figure, and these requirements will grow as machine building capacity develops." 3/ It would thus appear that the Third Plan's requirements of imports of balancing equipment and maintenance imports were definitely and consciously understated.

37. Midway through the Plan the estimate of maintenance imports and components was revised upwards from Rs. 3,850 crores to Rs. 4,222 crores, partly because of the prospects that targets would not be achieved for a number of products such as pig iron, steel, non-ferrous metals and fertilizer. 4/ Actually the revised figure was still not an estimate of actual requirements either as reflected in planned targets, or of revised

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1/ Third Five Year Plan, p. 134.

2/ Ibid., p. 110.

3/ Ibid., p. 111.

4/ "Report on Maintenance Imports During the Third Plan (Revised June 30, 1964)", Ministry of Finance.

estimates of actual demand. In a number of important instances, the estimates of "requirements" were based on the assumption that imports would be limited by the shortage of foreign exchange. 1/

38. During the Third Plan imports were controlled, and the level of imports was held close to the original financial estimate of requirements, actually below the estimate in real terms. As shown in Table 13, the original estimate of import requirements, excluding PL 480 imports, was Rs. 5,750 crores. This was revised to Rs. 6,122 crores when the estimate of maintenance import requirements was increased. It is now expected that the actual figure will be Rs. 5,650 crores giving a shortfall of Rs. 472 crores. However, in view of the fact that public sector investment is expected to be less than originally planned, the associated import requirements for public sector projects will probably be less than expected. But even if this reduction accounted for all or most of the reduced imports of machinery and equipment, 2/ the shortfalls in metals and fertilizers would still be substantial if measured against requirements to meet plan targets or actual needs. The estimate of 1965/66 metal imports consistent with overall imports of Rs. 5,650 crores is Rs. 68 crores less than the estimate of actual requirements. 3/ Similarly, the level of fertilizer imports for the period is some Rs. 95 crores less than what would have been required if the goals of consumption were to be met. Even if the goals of consumption for the first three years were considered too optimistic, the additional requirements to meet the targets for the final two years would have been about Rs. 52 crores.

39. On the basis of the above evidence it would appear that the requirements for "maintenance imports" were underestimated and that even the underestimated requirements were not forthcoming during the Third Plan. It would appear that the failure of projects to produce as planned, especially in the fields of metals and fertilizers, aggravated the situation and was in part responsible for the overall increase in requirements. The burden of the shortage appears to have been carried by the underutilization of capacity and to some extent by slowing down the implementation of capital projects.

1/ For example, in the case of nitrogen fertilizer, requirements were estimated on the basis that it would not be possible to import more than 300,000 tons in 1965/66 because of the foreign exchange situation. 500,000 tons would have been required to meet Plan targets.

2/ Rs. 256 crores. See Table 13.

3/ Memorandum for the India Consortium, 1965.

Unutilized Capacity

40. The existence of a significant amount of unutilized capacity in Indian industry has been noted for some time by industry groups 1/ and by the Government. 2/ This has been confirmed for a number of specific industries by recent IDA missions. 3/ The amount of capacity that is not being used is extremely difficult to determine as is the question of whether it has become greater or less in recent years. However, regardless of whether or not the underutilization of capacity has become more serious, its importance is unquestionable. To a considerable extent the existence of unused capacity seems to be an inevitable result of a certain set of circumstances and policies. The problem is intimately bound up with the system of industrial licensing, import controls and materials allocation.

41. There are serious technical problems in estimating plant capacity in many industries - questions of product mix, number of shifts and efficiency of plant operations. For these reasons alone, it is not possible to determine capacity in any precise way. On the other hand, the system of controls and, in particular, the licensing of new capacity and of imports depends on the use of some kind of capacity estimates. Leaving aside the niceties of the problem, a rather fundamental issue is whether capacity is measured on a single or multi-shift basis. The past practice for most industries which are not continuous process, as are cement, chemicals and primary metals, was to assess capacity on the basis of single-shift operations. The need for new capacity was assessed on this basis, and this was the basis on which industrial licenses were issued and the basis on which scarce materials were allocated to individual firms. Thus, in a gross sense, the system tended to perpetuate single-shift operations even in cases where the economics of multi-shift operations were

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1/ "At this very moment firms engaged in defense work and on important Government projects ... are operating at only 50% capacity although their order books are full for the next two years or so." President of Indian Engineering Association, March 29, 1963. "Even on a single shift basis 50% of the capacity in most engineering industries /is/ idle." Regional Chairman, Export Promotion Council for Engineering Goods, Madras, October 12, 1964.

2/ An aim of Third Plan: "fuller utilization of existing installed capacity." Third Five Year Plan, p. 458. "There still remain many important sectors of industry in which sizeable increases in production can be quickly secured if more components and raw materials were available." Memorandum for the India Consortium 1965, p. 47. "Maximum utilization of existing plant facilities ... should have the highest priority." Memorandum on the Fourth Five Year Plan, pp. 51-52.

3/ Industrial Maintenance Import Credit, India 1964. Appraisal of a Second Industrial Import Project, India, May 1965.

superior. Recently, the decision was taken to make capacity estimates on a more realistic basis. This is being done, but the process of revision has not yet been completed.

42. In addition to the bias in the control system to create more capacity than estimated requirements and/or more capacity than can be fully employed with estimated availabilities of materials and foreign exchange, there are other more specific reasons why output from the existing industrial plant is substantially less than could be obtained. In some cases the limitations are on the demand side. The requirements have been overestimated in general, or some developments on which demand depends have not taken place. There is now a considerable overcapacity for the production of electric meters and low tension cables. This may be accounted for solely by a shortfall in the development of electric power capacity, but this is not clear. Present overcapacity in tires would seem to be a similar case. On the other hand, the excess capacity in wire glass and hardboard, and in sulphuric acid appears to be more directly related to a slower growth of construction activity (affected by cement shortage) and fertilizer production than expected.

43. In general, however, market limitations do not appear to be a constraint of major importance; the limitations in the supply of materials and components and the generally low level of plant efficiency attributable to various reasons are the more important factors. Furthermore, the supply problem is not simply a matter of an overall shortage in the supply of imported materials, components and spares; it is also a matter of the inability to supply specific types of materials to particular plants at specific times. In short the materials supply problem is seriously aggravated by the operation of the allocation system. The recent difficulties arising from an acute shortage of welding electrodes and of matching steel sections is more a problem of efficient use of foreign exchange resources in the light of current patterns of production than a simple problem of a need for more imports. It is, of course, true that a larger volume of imports of critical raw materials and components could relieve the pressure on the system and make possible, though not insure, easier, quicker and more efficient allocation.

44. The efficiency problem is also related to the control problem. Under the present conditions of a protected seller's market in which important production materials are controlled with the aim to provide a share for all, the pressures for increased efficiency cannot be strong. Material allocations rather than competitive efficiency determine market shares. Effort that might be devoted to management is and must be used to deal with the control authorities. The pay-off from an increased allocation tends to be greater than that from an improvement in plant efficiency. Under these conditions it is not likely that much improvement in efficiency can be expected. 1/

1/ The effect of the control system on plant efficiency is dealt with in greater detail in Administrative Controls on Resource Allocations and Investment.

B. Performance of Public Sector Industry

45. As already pointed out (paragraph 7), more than half the industrial investment projected for the Third Plan was assigned to the public sector. It is now estimated that the actual volume of investment will fall short of the original plan and considerably short of the revised estimate made at the time of the mid-term appraisal. It has been pointed out that what appears to have happened is that fewer projects have been undertaken but these have cost considerably more than originally estimated (paragraphs 28, 29). It has also been indicated that projects have taken longer to construct than planned. These and other points are developed further in this section.

46. The Third Plan documents contain no explicit estimate of the expected growth of output of public sector industry as a category during the Third Plan. Nevertheless, there is no doubt that the growth has been less than was expected. The actual increase in net output for Central Government industrial enterprises has been on the order of Rs. 75 crores in the year 1961/62 through 1963/64. If we assume a continuation of the same rate of growth during the final two years of the Plan, the total increase will stand at about Rs. 150 crores. The estimated investment during this period is Rs. 1,662 crores, indicating the very high ratio of investment to increased output of 11 to 1. Since about half of all industrial investment in the period is accounted for by the public sector, it is to be expected that the ratio for the industrial sector as a whole would be high, as our earlier rough estimates indicated. 1/

47. Part of the relatively low increase in output can be attributed directly to difficulties encountered in the implementation of projects - cost overruns, delays in design, procurement and construction, and problems of getting actual output up to high levels, once operations have actually begun. As indicated below, these difficulties have been substantial and no doubt are responsible for a considerable loss of output during the Plan period. On the other hand, the character of the projects undertaken has also contributed to the high ratio of investment to net output. Most of the public sector investment has been made in capital - intensive undertakings which under any circumstances require heavy investments in relation to output. Perhaps even more important, because of their size and complexity, the need to adapt to the use of local resources (e.g., ore and coal), to train a local labor force in new skills, and to develop effective large-scale organization, they are facilities which require long periods of time for construction and start-up operations. In addition, since many of these plants were started at roughly similar times, there has been a period of very heavy investment coinciding roughly with the latter part of the Second Plan and the early years of the Third Plan during which very little has been produced. This situation has not been materially altered by the increasing output of steel in recent years.

1/ para. 30.

48. The actual costs of public sector projects have frequently exceeded original estimates by substantial amounts. 1/ This is illustrated in Table 14 which reconstructs the changes in cost estimates for projects representing a very substantial part of public sector investment in industry. As noted, some of these increases can be attributed to changes in the scope of the original projects, but after allowing for such changes, the average increase has been 65%. Most of this seems to be attributable to inadequate original estimates. This is certainly true in the case of the Nangal fertilizer plant and the Neyveli lignite project. In neither case were the original estimates based on a serious study of the costs of constructing the project. There are other similar cases.

49. Analysis of the data available for some of these projects indicates that the chief reason for the inadequacy of the original estimates was the omission of important items from the estimates. See Table 15. Among items commonly omitted were: fees and costs of consultants and foreign experts, training expenses, import duties, working capital and costs of township. 2/ Such omissions may be attributable to "lack of experience in project engineering" as the Planning Commission maintains 3/ but it is hard to classify them as "unavoidable".

50. Some of the cost increases are probably the result of unrealistic original estimates of the cost of imported equipment delivered to the site. In some cases the cost of civil works has been substantially underestimated as a result of inadequate site investigation. 4/ In addition there are some cost increases which may fairly be termed unavoidable. Some are attributable to rises in prices between the time the estimates were made and the time, often much later, when equipment was procured; some may be attributable to changes in the source and conditions of supply. A shift from procurement on the basis of international bidding to procurement through bilateral agreements may increase project costs substantially either because the supplying country tends to be high cost in the particular field involved or because the particular

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1/ This experience is not confined to the public sector; the costs of private sector projects have also been substantially underestimated.

2/ Though not all these costs should be included in an economic appraisal of a project, financial provision must be made for them if the project is to be implemented.

3/ Third Five Year Plan, page 455.

4/ The increase in cost of foundation work, at Foundry Forge Plant of Heavy Engineering Corporation was about Rs. 1 crore over the original estimate. In the case of the Barauni refinery the corresponding increase was over Rs. 2 crores.

supplier may be able to charge "monopoly prices". 1/ A shift to domestic procurement may also involve a substantial increase in price paid, not to mention possible extra costs associated with inferior quality of materials or workmanship. Of the total increases observed, it would appear that increases in foreign exchange costs accounted for 30% to 50%.

51. Directly associated with the cost increases and in fact an important element in such increases has been the extended time required to implement projects. Projects pass through a number of stages between the time they are first seriously proposed and the time they reach full production. Some of these are stages of preparation and represent the time required to develop a serious proposal into a specific project ready to be built. The more important stages in terms of their effect on costs are those which follow between the commitment of resources to the project and achieving full production from the project. The actual process has not been uniform for all projects and the stages are not always easy to identify, nor are they completely comparable as among projects. It is often possible to identify the beginning of the process by some action taken by the government such as commissioning a feasibility study or preliminary project report. The date the project was approved can also usually be identified though it appears that approval does not imply the same stage of preparation in all cases. The dates construction and production were started are less ambiguous while the date "full production" of the original project was first achieved is frequently difficult to determine because of changes made in the capacity of the project during construction. However, in spite of such difficulties, the rough estimates it is possible to make indicate the orders of magnitude involved. A set of such estimates is presented in Table 16. The table shows the estimated time required for each of four stages in project implementation. Where full capacity had not yet been achieved at the time of the mission's visit, estimates available at that time were used. The data cover a large number of public sector projects; the details on a project-by-project basis are shown in Table 17.

52. As shown in Table 16, the average time required from first serious proposal or conception to full capacity operation has been ten years, with the larger projects taking somewhat longer. If the period prior to approval is ignored, the time is reduced to eight years and if only the time from beginning of construction to achieving capacity operations is considered, the figure is seven years. For the smaller projects, the time has been much shorter (based on a small sample) and for the more

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1/ It is alleged that the shift of the Trombay fertilizer plant to US procurement increased its costs about Rs. 1.8 crores. In the case of the Gorakhpur fertilizer project the conditions of procurement provided for a single Japanese bid which, the mission was told, resulted in prices well above the level of international competitive bidding.

recent projects the time is also less but only slightly. Even taking into account that the implementation of large industrial projects might be expected to be slower in India than in more industrialized countries, the times actually taken are very long.

53. The excessive costs and time required to construct and place projects in operation are direct evidence of poor performance and strong support for the observation previously made in regard to the sector as a whole. 1/ With a set of very large projects requiring more than 1-1/2 times the volume of resources they were originally estimated to require and taking much longer to become productive, it is not surprising that fewer projects could be undertaken than planned and that the pressure on foreign exchange resources was greater than originally estimated. Not only were project foreign exchange requirements increased but anticipated import saving was delayed.

54. The cost increases and extended gestation periods raise the question of the viability of the projects themselves. In some cases the economics of the original proposals even before the costs increased and the time dragged out were quite poor. This is true of the heavy electrical plant at Bhopal as is brought out in Appendix I. In other cases the prospects for substantial returns indicated in the feasibility studies made at the time the project was approved have all but vanished by the time construction has been completed. This pattern as it relates to the Neyveli Lignite Project is described in Appendix II. In other cases even rough economic appraisals of the original schemes do not appear to have been made at the time of their approval while according to present estimates there is little prospect for any return on the investment unless prices are maintained appreciably higher than the cost of comparable imports. Appendix III describes a case of this sort, the projects of the Heavy Engineering Corporation. In addition to low returns, the foreign exchange savings associated with projects of this sort, an important reason given for undertaking them, appear to be realized only after a fairly long period of time. The heavy initial investment in foreign exchange combined with continuing requirements for current operations produce this result. This is illustrated by some calculations made on the projects of the Heavy Engineering Corporation. 2/ Similar calculations made for the Bhopal plant indicate an even greater delay before any net foreign exchange savings is achieved.

1/ It is highly unlikely that past investment programs assumed project gestation periods of 7-8 years. Preliminary work on the Fourth Plan has been based on the assumption that public sector plants will yield a return of 10% two to four years from the year of initial investment expenditure. Notes on Perspective of Development India: 1960-61 to 1975-76, Perspective Planning Division, Planning Commission, April 1964, page 33.

2/ Appendix III.

55. Perhaps a more systematic way to appraise the performance of public sector industry is to examine the returns earned by enterprises. These may not always be an accurate measure of the value of the investment to the economy since selling prices may be distorted by high protection or price control. In addition the overall record is heavily weighted by investment in projects which are not yet fully in production. Nevertheless, the record of the profitability of public enterprises is a rough indicator of performance that is readily available for many of the enterprises involved.

56. Public policy now favors a return of at least 10% on investment in public enterprises. 1/ As of March 31, 1964, 12 out of the total of 27 industrial enterprises of the Central Government classified as "running concerns" showed gross profits on capital employed of 10% or more. See Table 18. These 12 were all comparatively small enterprises, only two of them having capital investments of more than Rs. 10 crores. Their combined investment of Rs. 55.8 crores was only 3% of the total investment of the Central Government in industrial undertakings. Of the 12, nine are manufacturing enterprises (including processing of minerals), one is engaged in mining, one in construction and one in shipbuilding. The manufacturing enterprises are producing machine tools, light electrical equipment, instruments, antibiotics, insecticides and paper and processing minor minerals.

57. Certain common characteristics of the profitable manufacturing enterprises may be noted. With the exception of Hindustan Machine Tools and Indian Telephone Industries, all have total capital employed of less than Rs. 10 crores, and seven have capital employed of less than Rs. 4 crores. All have been established for at least ten years. In cases where the present enterprise has been established more recently, it has taken over operations set up some years earlier. None appear to be heavily dependent on other projects for supplies or markets, a number are engaged in manufacturing operations which do not represent radical departures from Indian industrial experience, and none are subject to price control.

58. By contrast the largest enterprises which account for most of the Government investment in industrial undertakings are either not yet fully in production or if producing near capacity, with one exception,

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1/ "There is general agreement that public enterprises should yield adequate profits. There also appears general consensus that this rate should not generally be less than 10%." Notes on Perspective of Development India: 1960-61 to 1975-76, Perspective Planning Division, Planning Commission, April 1964, p. 29. "A return of 12% on the invested capital would be an appropriate criterion for determining the price policy of most public undertakings." - Memorandum on the Fourth Five Year Plan, Planning Commission, p. 21.

not yet earning a 10% return. The working results of the 10 largest enterprises are shown in Table 19. Together they account for 95% of investment in public sector industry. Four of them are still considered by the Government as "undertakings under construction", 1/ seven earned some gross profit in 1964 and only one, Hindustan Machine Tools, earned a gross profit of over 10%. Most of these enterprises are not as old as those in the profitable group, they are many times the size of the profitable ones and they are generally engaged in more complex operations, many of which have never before been performed in India (e.g., Neyveli Lignite, Heavy Electricals and Heavy Engineering). In addition those producing steel and fertilizers were subject to price control.

59. It appears it will be very difficult for some of these large enterprises to earn a 10% return on investment unless selling prices are set at levels considerably above those of comparable imported products. It is not surprising that some margin would be required especially when the pressure on the existing exchange rate and its apparent overvaluation is considered, but in cases such as Heavy Electricals, Ltd., the margin required may be very large.

60. We have noted the cost overruns and the lagging implementation of some of the most important projects as contributing factors. In comparison with the more industrial countries capital costs tend to be higher. Lower costs of construction labor do not offset the additional costs imposed by the longer construction times, the special difficulties of procurement and the costs of delivering imported equipment to the site. In addition the terms under which projects are financed frequently result in higher prices for the equipment itself. These disadvantages may not be compensated by lower operating costs. Management is generally inexperienced and the pressure to inflate employment appears to be strong. Any advantage of low wages can only be realized if the labor force can be organized and led so as to produce in the required quantity and quality and if it is not allowed to expand to many times the size of that used for comparable operations in industrial countries.

61. Under these conditions it is necessary to exploit every possible means to more economical operations if industrial projects are to be roughly competitive with imports. Certainly there is room for better design and selection of projects and for improved management of plants. In addition substantial gains may be possible from the more efficient exploitation of domestic raw materials. Easy access is not enough. We have noted this point in connection with the operations of the steel industry. Under present practice the great investment in blast furnace plant yields much less output than would be possible if the raw materials were suitably prepared before charging. While considerable work has been going on in India for some time on raw material preparation, the endeavor to determine the most economic solution for each steel plant, and to translate them into actual installations, still has a long way to go.

1/ Neyveli Lignite Corp., Heavy Engineering Corp., Heavy Electricals, Ltd., and Indian Refineries, Ltd.

C. Summary of Performance

62. During the Third Plan industrial output grew at an average annual rate of 7-7-1/2%. The index used tends to understate the actual increase, but the performance is still well below the rate planned. Although investment in the sector appears to have been maintained at only slightly less than the planned rate, the cost of projects was much greater than anticipated so fewer, more expensive projects were undertaken than planned. In addition it has taken much longer to construct projects and place them in production than expected. Because of this and because many of the projects undertaken, especially in the public sector, were by their nature large and slow maturing in the first place, a large portion of the investment made in the sector produced no output during the period.

63. An important factor limiting the effectiveness of investment has been the restriction on imports during the period. The import requirements of the industrial program were underestimated. The failure of planned output to materialize was partly due to shortages of imported materials and it contributed in turn to further shortages. Since actual imports were limited to about the originally projected level, the deficit was considerable and has resulted in the maintenance of a fairly high level of unutilized capacity.

III. CRITICAL FACTORS IN THE DEVELOPMENT OF THE INDUSTRIAL SECTOR

64. The problems inherent in building a broadbased, integrated industrial establishment in India in a comparatively short time are formidable. The existing industrial experience is thin, the resistance of tradition to change is strong. In forcing industrialization the Government not only must deal with these problems but must also come to terms with the conflicting claims of regions and classes in a nation seeking to achieve development by democratic means. The choice of the public sector for a leading role in industrial development has also created special problems. The pressure from political jurisdictions to divert investment from its most directly productive use is particularly strong in the case of public investment. This is seen most clearly in the desire of each state to receive its "share" of the new industrial plants. Another problem is raised by the need to operate a large and growing industrial establishment with civil servants trained in a tradition which in important respects is foreign to the nature of the task involved. These are problems of Government. The Government has a large measure of direct responsibility for the success or failure of the industrial program. The following comments are focused on particular areas of Government responsibility.

65. Given the factors which militate against an easy solution to India's industrial problems, there are still important areas in which suitable action can greatly improve performance. In this chapter we point out what we consider to be the main areas where improvement must be made, and what sort of action may be possible and effective. There are many factors which have combined to limit the performance of industry during the recent past. Some are associated with the process of planning and appraisal of projects, some with the implementation of plans especially on the project level and some are associated with the Government's general industrial policy. Each is considered in turn.

A. Industrial Planning - General

66. The fact that the goals of the Third Plan industrial program were not reached may be taken to indicate that the Plan was overambitious. The Plan was also incomplete. The targets proved to be too high partly because the necessary planning at the industry and project level had not been done. This deficiency resulted in committing the Government to large projects with inadequate knowledge of the costs involved. In a sense the deficiencies in Plan performance can be attributed to failures of "implementation". The Plan may have been fine but the implementation was poor. However, it should be stressed that implementation cannot be entirely divorced from planning. If planning is to be effective, it must be sufficiently complete to provide real assistance for the implementation stage. Planning that is not closely related to what exists, what has been done and what has to be done makes good implementation impossible.

67. Important features of India's industrial development arise from the particular strategy adopted by the Indian planners. This strategy has also given rise to certain problems. The essence of the approach can be described quite simply. Future demands for industrial products are estimated on the basis of projections of planned income growth. These demands are clearly far in excess of what can be financed by expected export earnings especially when import requirements of industrial materials which can't be produced in India are taken into account. Therefore, India will have to produce a large portion of her own requirements. Furthermore, if the economy is to reduce its dependence on foreign aid by some particular target date (1975), it is necessary to undertake a massive buildup of industrial capacity, particularly in the industries producing capital goods and basic industrial materials. Only in this way can the dependence on imports for future increases in the consumption of industrial products be reduced. Since the market is large, there should be no basic economic reason for excluding any industry; all can eventually be developed in economical sized units. It is this general approach that has led to the heavy emphasis on metals, machinery and chemicals in the Second and Third Plans and to the proposals to continue the emphasis into the Fourth Plan.

68. This approach has also led to a particular way of looking at project selection and appraisal. The emphasis on the need to build industrial capacity to meet present and future requirements and the awareness of the great magnitude of the task have tended to divert attention from the sequence in which projects are undertaken, the choice among alternatives, and other short-run problems involved. Project selection is often considered obvious - simply a matter of meeting requirements. Considerations of costs are often secondary and any detailed analysis of alternatives superfluous.

69. While we hold no brief for the refinement of appraisal procedures for their own sake and certainly recongize that sensible project selection may indeed require a minimum of economic analysis in many cases, we do believe that in general the neglect of apparent short-term problems may seriously endanger long-term goals. It is unlikely India can finance and administer all the industry the planners believe to be necessary by 1975. The limitations of foreign exchange and of domestic skill and experience impose the necessity for choice, and the correct economic choice is not always obvious. While we do not disagree with the aim of developing capital goods industries at this time, we are impressed with the need to be more selective and to give much greater weight to economic considerations. This advice is most relevant to the selection and appraisal of public sector industrial projects.

B. The Selection and Appraisal of Public Sector Industrial Projects

70. The process of the selection and appraisal of public sector industrial projects has been neither uniform among projects nor static over time. Projects have originated and have been sanctioned in different ways in the past and as experience has accumulated and problems attributable to past practice have become apparent, there has been a growing awareness of the need to improve the process. In some of the more recent projects there is evidence of this concern as economic factors have been given more emphasis than formerly. Other evidence of change is the effort now underway to establish a uniform procedure for conducting and evaluating feasibility studies. 1/ However, actual changes in the process have not yet been extensive and we believe the following description, based on the mission's observations at the time of its visit, is still substantially correct.

71. While the process of selection and appraisal tends to vary from case to case, the main lines are fairly clear. Projects generally originate from a consideration of physical requirements and are frequently altered before completed as the estimates of requirements are changed. Alternatives are seldom considered systematically and rarely considered at all. Project reports vary greatly in scope. Technical aspects are usually covered though often incompletely, and the economics of the project are rarely considered. The location of projects is influenced more often by a policy of spreading projects among the States than by an economic appraisal. Approval is often given before a detailed project report has been prepared.

1/ "Feasibility Studies for Public Sector Projects" - Committee on Plan Projects, Planning Commission, January 1966 (Draft).

72. The major emphasis in project selection is on meeting physical requirements. The existence, present or prospective, of a need for certain products seems to be generally considered sufficient evidence of the economic desirability of establishing the necessary production facilities. It appears that little or no account is taken of the fact that the return on investment (basically the value produced in relation to cost) might vary widely from case to case and that consequently, given any particular set of prospective product needs, the investment choices, or, at the very least, their time phasing might be quite different if return on investment rather than physical need were the criterion of choice. In effect, an input-output table in purely physical terms appears to have been the guide to investment planning without reference to the relative values and costs of the inputs and outputs involved. Parenthetically, it is also apparent that given such an implicit or explicit frame of reference, possible export demand or import supply could hardly figure in the choices except possibly as an afterthought.

73. Estimates of requirements are made by special Government committees, ministries, consulting groups and, more recently, by planning groups including members from Government and industry (private and public) set up to work out detailed projections within the general framework of the Fourth Plan. This work has, at least in recent years, been coordinated by the Planning Commission.

74. Long-term projections of specific requirements are difficult to make under any circumstances. This is especially true in a rapidly changing industrial environment, so it is not surprising that estimates have been revised frequently. On the other hand, it is our impression that in the past many estimates were made on a fairly superficial basis. If technique has improved, the necessary information required to make reasonable forecasts is still inadequate. In the case of recent estimates made by Planning Groups for the Fourth Plan we have noted that limited available information about existing capacity often made it virtually impossible to make a rational appraisal of future requirements. As the industrial economy grows more complex, there will be an increasing need for better information on existing and planned capacities on which to base investment plans for individual projects. Particularly where heavy investments with long gestation periods are involved, it will be necessary to consider industry-wide developments with more care than has been the practice if serious misallocations are to be avoided. 1/

1/ An example might be the development of heavy forging capacity to meet specific demands of existing and planned projects as they come into production. The forecast of future demand for flat rolled steel products would be another example.

75. Although some type of project report is prepared for at least the initial stages of all projects, there is no uniform practice. The reports vary considerably in scope and rigor, and decisions to proceed with a project do not appear to depend on any set standards of project appraisal. In some cases only a rough feasibility study is made before embarking on the project; in other cases the decision follows the preparation of fairly detailed though often incomplete reports.

76. The circumstances under which the reports are prepared vary considerably from case to case. In a number of cases detailed reports have been prepared for projects to supply specific patterns of production - the pattern usually being determined by some ad hoc Government committee. This was the case with the Heavy Electrical plant at Bhopal. The Heavy Electrical Equipment Committee (1954/55) surveyed existing capacity and requirements and determined what the proposed State enterprise should produce. The consultants, AEI (UK), then designed a project to meet these requirements. 1/ Similarly the requirements for machine tools were determined by the Engineering Capacity Survey Committee (1954) and a review of this committee's work on heavy machine tool requirements (1961) provided a basis for the design of the heavy machine tool plant of the Heavy Engineering Corporation. More recently the Committee on the Establishment of a Second Central Foundry Forge Plant (1963) determined the need for additional capacity for large forgings and a project to meet this need was designed by a consulting group - in this case Heavy Electricals (Ltd.). In all these cases the need to meet requirements appears to have been the dominant consideration. The costs involved and the alternative of importing at least some of the required products were not seriously considered at the time the projects were drawn up. 2/ Certainly requirements are a valid consideration but not abstracted from costs and alternative means of satisfying them.

77. In the case of fertilizer the requirements had been estimated by a special committee and by the ministry. 3/ The question at issue was the location of new capacity. The Fertilizer Production Committee was established in 1954 to suggest locations for new capacity including estimates of economic capacities at each location and rough costs of production. These rough "feasibility" studies apparently provided the basis for proceeding with the projects recommended. 4/ Subsequently another

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1/ See Appendix I.

2/ This appears to be less true in the recent case of the Second Foundry Forge project.

3/ The Standing Committee on Manure and Fertilizers of the Government of India 1954, and the Ministry of Agriculture.

4/ Nangal, Neyveli and Trombay. Detailed reports on the last two were prepared after projects were approved in principle. In the case of Trombay financing by US aid made a detailed report necessary.

group, the Fertilizer Technical Committee (1959), was given the task of determining the best location for a fertilizer plant within each State. As a result projects were recommended in locations without access to either raw materials or markets. The progress in implementing the projects has been slow and with the growing recognition of the importance of the economics involved it is unlikely that those with poor locations not already started will be built. 1/ The Neyveli Lignite project is another case where a rough preliminary feasibility study provided the basis for approving the project. In this case the consultants, Powell-Duffryn (UK), were asked how best to develop the lignite resources at Neyveli; possible alternatives to Neyveli were not at issue. 2/

78. Just as projects have frequently been selected to fulfill requirements without serious consideration of costs or alternatives, so the location of plants has often been chosen so as to spread public sector industry among the individual states with only a secondary concern, if any, for the costs involved. The studies of the Fertilizer Technical Committee have been cited. The first heavy electrical plant was located at Bhopal rather than at a more economically desirable site because of the preference given to Madhya Pradesh. In selecting the sites for the three new heavy electrical plants, the Technical Committee on Heavy Electrical Projects was directed to conform to the Government decision that "public sector projects should, to the maximum extent possible, be located in areas in which industrial development has been lagging behind and areas which are industrially congested should be avoided." 3/ The location of Hindustan Machine Tools plant III was confined to the State of Punjab. In the case of the Bhopal plant a location study was made by the consultants who estimated that required working capital would be increased 10-20% because of the selection of the Bhopal site. A fairly complete location study was made for Hindustan Machine Tools plant III which showed that a location in the Poona area would have been preferable but that the additional transport costs involved in the location selected at Pinjore were not in themselves very significant in relation to the value of the product to be produced. 4/ In the case of the three new heavy electrical plants the mission is not aware that any economic studies were made of the locations selected. 5/

79. If the reports are limited by intention in some respects, they are often deficient in other respects for reasons not completely clear. Some, including all those we have seen originating in Eastern Europe, are

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1/ For a discussion of recent developments in the fertilizer industry, see Appendix IV.

2/ See Appendix II.

3/ Technical Committee on Heavy Electrical Projects. Report on the location of the two heavy electrical projects and the High Pressure Boiler Plant (1960).

4/ Report on the Selection of a Site for a Machine Tool Factory in the Punjab, Hindustan Machine Tools, 1961.

5/ Hardwar (U.P.), Hyderabad (Andhra) and Trichinopoly (Madras).

purely engineering reports and include no financial analysis. It may be presumed that these have been supplemented by some sort of financial appraisal, but this is not clear. In other cases financial runouts and calculations of return are included and in more recent cases we have noted that some attention has also been given to foreign exchange savings.

80. On the basis of what we have been able to observe we would have to conclude that the standards of project preparation have not been adequate. Reasonable effort has been devoted to the preparation of the technical aspects of projects. Mistakes in this area have been made and must be expected. As experience grows, so will the ability to improve technical evaluation. On the other hand, the managerial, financial and economic aspects of projects have generally been neglected and this has been in part responsible for difficulties subsequently encountered. An inadequate project report does not ensure failure any more than an excellent report ensures success but it certainly makes successful implementation more difficult. When such large sums are involved as in many of the public sector projects, it is only sensible to take all reasonable care to appraise the probable consequences of the investment before making it.

81. The process of approving a project appears to vary from case to case. As already mentioned this is sometimes done on the basis of only a rough preliminary report; in other cases a detailed report is used though it is not clear to what extent the commitment may have already been made by the time the report is commissioned. On the other hand, the approval in principle to proceed with a project should not imply that there are no important decisions left as to product mix, size and level of costs. In fact, a major criticism of what we have observed of the approval process is that even given the incompleteness of many project reports there has been a failure to make full use of the material that is prepared. In the case of the most complete project report we have seen, the report for the Heavy Electrical Plant at Bhopal, the extremely poor financial results were set down in detail. The need to import a substantial amount of current needs was also pointed out. That the project was not rejected, or at least substantially altered can only mean that the Government was not seriously concerned with financial or economic criteria at that time. 1/

82. Similarly in the case of the Neyveli Lignite project the rough preliminary report prepared by Powell-Duffryn provided the basis for questioning the decision to go ahead with an integrated project on economic grounds. What is more, members of the Technical Committee set up to review this report raised many relevant questions regarding the assumptions used for prices and costs. Yet these were never followed up. 2/ One can only conclude that at least at the time that these and other large projects were being analyzed there was felt to be no need to be concerned about financial and economic aspects. These would

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1/ See Appendix I.

2/ See Appendix II.

apparently take care of themselves given time and the size of the Indian market. The need to reduce dependence on imports was sufficient justification. 1/

83. Some of the difficulty would seem to lie in the nature of the approval process itself. Final approval of new projects or substantial investments must be obtained at the Cabinet level. In some cases approval in principle is given to proceed with the development of a project subject to subsequent approval of detailed project plans. Such an approval may be based on a rough preliminary appraisal. This was the case when the Heavy Industry Committee of the Cabinet approved the proposed plan for development of the Neyveli Lignite Project as described in Appendix II. 2/ Approvals are also given to proceed with projects according to plans and estimates developed in more detail. This is probably the more usual case.

84. The staff work on which these decisions is based appears to be carried out by various ad hoc committees set up for the purpose. Some are composed of technical and industrial experts given the task of assessing the feasibility of specific project proposals. The Standing Panel of Technical Experts which reviewed the Powell-Duffryn report on Neyveli is one example; the Ghandy Committee set up to evaluate the alternative proposals for the establishment of a heavy engineering plant is another. However, perhaps more typical are committees made up of representatives of the ministries involved and the Planning Commission, including some technical members. Such was the Lignite Project Coordinating Committee which reviewed the report of the Panel of Technical Experts on the Neyveli project and approved the plans to proceed with the project. A more recent example is the committee set up in 1963 to review the proposals for establishing a second foundry forge project. In addition to the committee review and possibly in connection with it, it is necessary to obtain approval of the Planning Commission and, recently, the Project Coordination Division of the Ministry of Finance before a project is finally approved.

85. It appears to us that the system is more suited to obtaining consensus among the ministries involved than to analyzing the projects under review in any depth. The secretary members of the committees are very busy officials and the staff support would seem to be rather limited. It also appears that although administrative officials and, to some extent, technical people are well represented in the committees, the economic side tends to be neglected. The Planning Commission seems more concerned about whether projects conform to the plan than with the economics of the projects themselves. It is possible that this aspect is being given increasing attention by the Project Coordination Division of the Ministry of Finance.

1/ Yet the import savings aspect of projects does not appear to have always been considered with particular care. For example, considering gestation time and heavy requirements for current imports of components it will take many years before the heavy electrical plant at Bhopal produces any net import savings. This prospect was not obscure at the time the project was approved.

2/ Appendix II, para. 15.

86. More important than the procedure itself is the fact that as far as we have been able to determine there are no agreed financial or economic standards against which projects are judged. This situation may be in the process of change. Certainly there is an announced policy that projects should earn a return of 10% or more. However, it is our impression that this criterion is not yet being generally applied to investment decisions. In the cases we have observed decisions seem to have been made largely on the basis of the assumed need to manufacture the product in the country and an assurance that the project is technically feasible. There has generally been a minimum of concern with financial or economic aspects. Although economic analysis is certainly no assurance of rational decisions, without a serious appraisal of the economic and financial aspects of projects the weighing of such conflicting considerations as location, size, product mix and efficiency is bound to be done in a haphazard manner and the rational comparison of alternative expenditures is impossible.

87. The emphasis on physical need and the secondary importance given to costs leads to practices that tend to increase costs above the levels that might be attainable under Indian conditions. The role of projects as employers, operators of model communities, carriers of industrialization into the more deprived areas and an obligation of the Central Government to provide for each State tend to conflict with their role as producers. This is not to say that these other roles are not important but rather to point out that any systematically based judgment of their relative importance is hardly possible unless they can be weighed in terms of their effects on the output produced and its costs of production. It is our observation that in the absence of the discipline of the market, or strictly imposed criteria of profitability, the secondary importance given to costs has permitted plants to be designed more elaborately and located more disadvantageously than necessary and to produce a wider range of products than necessary in an attempt to make them fill estimated product needs, save imports and distribute income all at the same time. We would suggest that these purposes can be served more efficiently if greater emphasis is placed on the cost of alternative ways to meet the desired goals.

C. The Implementation of Projects

88. Projects are often approved in principle with their implementation subject to "adequate foreign exchange being available". 1/ The problem of securing finance and arranging for procurement of equipment has often involved prolonged negotiations and changes in the cost and content of the project itself. As already noted, the original estimates of costs are often very rough and it is not until actual procurement is attempted that realistic figures are available; also, as noted, in some cases costs have been increased because of the particular conditions of procurement. 2/ Major changes in the project may also be made at this stage. Designs for the Trombay fertilizer project, for example, had to be substantially revised when it was decided to finance the project through US aid which involved procurement in the US. The recent experience with the Bokaro steel project is another example. In the case of Heavy Engineering Corporation the whole concept of the project was altered mainly as a result of the availability of finance. 3/

89. The delays, cost increases and changes in projects related to the source of finance are largely beyond the control of the Indian Government - but not entirely. An important source of delay is the fact that project reports are rarely up to the standards required by foreign lenders. Also the procedures involved in obtaining import licenses after financing is approved are frequently sources of delay.

90. As noted in the previous chapter a considerable time often passes between the acceptance of the project report and the start of construction. This would seem to be related in part to the time required to arrange for financing but there are no doubt other causes for delay - organization of work force, delivery of equipment at site, possible problems with local clearance, complicated procurement procedures. No doubt better planning could cut the time considerably and in fact it would seem that in the more recent projects the time taken has been much shorter (Table 16). It is the long time required to construct and place in full operation that should be the cause for greatest concern.

1/ For instance, Neyveli fertilizer project (Appendix II).

2/ See paragraph 50.

3/ Although the Ghandy Committee (1957) had recommended acceptance of the UK rather than the USSR plan for the development of a heavy engineering industry, the Government chose the USSR offer. A key factor was the larger amount of assistance the USSR was prepared to give at that time (Appendix III).

91. Inadequate preparation and planning has been responsible for delays in project execution. Reference has already been made to the generally loose standards of project reports. The complexity and size of many of the large public sector projects require thorough preparation and a careful scheduling of activities well in advance if capital and time and manpower are not to be wasted - and in these cases the scope for waste is very large. In the case of the public sector steel plants the deficiency in the preliminary studies of site conditions and raw material sources and in the arrangements for ancillary facilities were causes for delay. 1/ "It was not realized that it takes somewhat longer to develop mines and quarries and to establish fully serviceable traffic links than to construct the steel plant proper." 2/

92. Recent studies made by the Committee on Plan Projects of the Planning Commission have emphasized the need and scope for the more efficient programming of construction activities. 3/ The National Productivity Council has also provided training in modern techniques. There is the beginning of a realization that project implementation is a complex technical problem. It is not clear that this realization has as yet spread very widely.

Changes in Projects During Construction

93. Another factor affecting performance has been the practice of frequently changing the project while it is still under construction. Some of these changes arise from deficiencies in the original project report - items are omitted, raw materials found to be inadequate, limitations of site underestimated, etc. Some arise from material shortages that necessitate redesign - cement is substituted for steel as in the case of the Neyveli fertilizer plant. 4/ These changes are the result of technical and procurement problems and generally do not affect the size and the capacity of the project. Another frequent type of change is the alteration of the stages of construction. It is common practice to plan a facility in a series of stages. In the cases of the Heavy Electrical Plant at Bhopal and the Heavy Machine Building Plant at Ranchi, the original schedules were radically changed after construction was

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1/ Programmes of Industrial Development 1961-66, Planning Commission, page 2 and page 11.

2/ Sir Jehangir Ghandy, "Steel Output Lagging Behind Capacity", Capital - Survey of Indian Industries, 1962, June 28, 1962.

3/ See, for example, the following studies by the management group, COPP, A review of the Trombay Project, December 1964; and Heavy Electricals, Ltd. (India), A review of Programming and Reporting, November 1964.

4/ Changes arising from changes in the sources of supply as in the case of the Trombay fertilizer plant generally take place before the start of construction though undoubtedly there are exceptions.

started. In the first case this was apparently the result of a reassessment of requirements; in the second the availability of additional credit from the USSR was perhaps the key factor. A third type of change and perhaps the most disrupting of all is a change in the product which the plant is to produce and in its capacity to produce it made after the plant is under construction. In the case of the Bhopal plant where such a change was made 1/ it has been estimated that completion of the plant was delayed from six months to a year. 2/ The capacity of the Foundry Forge Plant of the Heavy Engineering Corporation was also changed during construction, as was the capacity of the mine at Neyveli. In none of these cases was a new project report or a reassessment of the economics of the project made. In the case of the Trombay fertilizer plant the product was changed after tenders had been invited.

94. This practice has been strongly criticized by the Estimates Committee and the recently established Committee on Public Undertakings. 3/ The Committee on the Utilization of External Assistance 4/ considered this of sufficient importance to include among its recommendations that "once a project report has been prepared and approval and assistance have been secured it is important that the size of the project should not be altered." 5/ This, it is recognized, requires better appraisal work in the first instance. Indeed, changes can often be attributed to inadequate appraisal of the market in terms of type of product or its quantity - or to inadequate study of the site or of the raw materials as to quantity and quality. They may also be traced in some cases to the general policy of trying to supply a portion of requirements from a given source without particular regard to the conditions of production (Bhopal) and to an effort to "improve the economies" of an expensive project by spreading the overhead (Neyveli).

1/ Original plan was set up in three phases in 1958; in 1959 it was decided to combine three into a single phase, double output and triple the size of the hydraulic turbines and transformers to be produced; in 1960 it was decided to further expand plant and in addition to produce a new product - steam turbines (Appendix I).

2/ Estimates Committee 1962-63. Thirty-fifth Report. Ministry of Steel and Heavy Industries, Heavy Electricals, Ltd. (India), Bhopal, page 23.

3/ For instance, Estimates Committee, op. cit.
Committee on Public Undertakings, 6th Report.
Fertilizer Corporation of India, Ltd., April 1965.

4/ Chairman V. K. R. V. Rao, Report dated March 1964.

5/ Committee Report, page 15.

Procurement Problems

95. Another important cause for delay in the implementation of projects has been the problem of procuring materials and equipment when needed - in particular steel and imported equipment. This is a reflection of the general foreign exchange shortage and the effectiveness of the measures taken to cope with it. It is to be expected that when there is a shortage, someone's requirements must be cut. We have noted cases where the construction of public sector plants was appreciably delayed because of a lack of steel, and cases where lack of a foreign exchange allocation for spare parts has cut output far more than the cost of the spares. These are certainly cases where the value of the use of foreign exchange was very high. It is conceivable that the alternative use to which it was being put at the time of these shortages was even more valuable, but this was certainly not the case, for example, with the foreign exchange used for building up excess inventories of spares at Sindri, Nangal, Bhopal and Indian Airlines. It is no doubt a difficult problem to assess need accurately and allocate scarce resources effectively, but the cost of failure is high. 1/

96. Once a project has been approved, its legitimate requirements of scarce resources are approved in principle. However, with the exception of items directly provided under arrangements for foreign financing, procurement for each item under allocation (generally speaking, steel products and imported items) must proceed through the usual channels. Each enterprise is required to submit to its administrative ministry a list of all items required for the coming six months requiring foreign exchange expenditures. These requests are collected by the ministries and submitted to the Ministry of Finance which has the responsibility for allocating the foreign exchange. The requests are presumably examined to determine (a) whether the items are needed, and (b) whether they can be procured domestically. To some extent it is possible to equate need to the items listed in the Detailed Project Report - if one exists for the project. There may also be some rough inventory norms accepted in some cases, but generally primary reliance will have to be placed on the opinion of the enterprise. The second problem can involve considerable time and is extremely difficult to determine with full regard to delivery time, quality and cost. 2/ In a number of cases that have come to our attention steel was determined to be available from domestic sources, whereas either the particular type of steel was not

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1/ For a discussion of the problems of allocating resources, see Administrative Control on Resource Allocations and Investment.

2/ Clearance from the indigenous angle. Ibid, Chapter 2.

being manufactured or the level of output was not sufficient to supply all demands so that delivery was delayed beyond any reasonable period. 1/

97. When requests have passed this scrutiny, a foreign exchange allotment is presumably made and the enterprise is permitted to seek bids on the items it wishes to import. On the receipt of bids it then applies for an import license against its allocation. Problems of the availability of particular currencies may come in at various stages. Allocations may be made with or without reference to particular currencies. In some cases bids an enterprise has been prepared to accept, e.g., German conveyors for the Neyveli mine, have had to be rejected and new bids sought from another source for currency reasons. 2/

98. In practice it would appear that bids are sought before the allocation is assured although there may be good reason to assume it will be forthcoming on the basis of the need for the particular items. We have also observed cases where the time required to obtain confirmation of allocation was so long that the validity of the original quotations had expired and new bids had to be sought.

99. The requirement for an enterprise to submit the list of items requiring foreign exchange it will need over the next six months may be a difficult one when projects are large and complex, when units are going into production at different times, when difficulties with equipment cannot be anticipated on the basis of experience and when requirements for spares must thus be largely guess work. No doubt project planning has not been of high quality, but it is also clear that the problems have been difficult. To ease the procurement emergencies which initially arise, blanket import licenses were given some public enterprises covering a small portion of their usual requirements. These allocations could be used in emergencies for the import of any type of normally imported items. The usefulness of this type of license at the Nangal fertilizer plant is illustrated in Table 20. The items

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1/ Hindustan Shipyard was forbidden to import a particular steel order because the domestic industry should be able to supply it. After 18 months, it was determined that it would not be supplied domestically after all. The steel was finally received from abroad three years after the date of the original order.

The Neyveli fertilizer plant went through a similar experience. Construction was delayed 27 months because of lack of steel. In addition the company had to make a penalty payment to the contractor of Rs. 72 lakhs (including Rs. 42 lakhs foreign exchange) to compensate for extra costs. Finally permission to import the required steel was given; its cost was Rs. 27 lakhs; the value of the loss in production was many times this. The construction of Heavy Engineering Corporation foundry project and Heavy Electricals, Ltd., Bhopal, was also delayed by lack of steel under similar circumstances.

2/ The US conveyors finally purchased cost 15% more. The case of the Trombay fertilizer plant is similar.

shown were urgently needed for repair of the major producing units in the hydrogen plant. Without the repair, it was impossible to get the units up to full capacity production. In addition they were consuming an appreciably larger amount of imported potassium hydroxide than normal. The foreign exchange cost of the required repair equipment would save many times its value in fertilizer production, and there was no question of getting the Government to issue a license eventually. Because of the inevitable administrative delay involved, the management decided to import against its blanket license. It is our understanding that the practice of issuing such blanket licenses has been discontinued. We would wonder whether the efficiency in the use of foreign exchange could be improved by such a change. If there is fear that this small degree of freedom will be misused by the management of public enterprises by importing what might be procured domestically, or what is not absolutely essential, this only points to the critical nature of the management problem.

100. The procurement problem has definitely slowed the implementation of a number of public sector projects. As noted, there have been difficulties and delays in procuring needed equipment and materials from abroad. Local procurement has also frequently been difficult partly because of the inability of domestic suppliers to obtain imported materials, components and parts when needed. Some of these difficulties may be identified with general shortages of specific products such as steel in the early 1960's and, more recently, cement. Others may be related to the inability of the control system to allow supplies to adjust quickly to specific demands. Recent examples of the latter are pig iron, welding electrodes and, particularly, supplies of specific parts, components and equipment required from abroad for projects or for domestic suppliers of equipment for projects.

Management

101. The various problems encountered in the implementation of the public sector industrial program point to the problem of management itself. To some extent the answer to many of these problems can be put in terms of improving the management of the program - the planning and all that this entails at the level of the Planning Commission and the ministries - and more especially improving the management of the projects themselves. In this section we shall deal with this latter aspect.

102. When major emphasis was placed on industrial investment in the public sector at the start of the Second Plan in 1955, about the only public sector employees with any experience in industrial undertakings were those in the railway workshops and the ordnance factories. The need for the extensive training of engineers and technicians was clear, the pace of technical training was increased and large training schemes were undertaken in connection with the large public projects. A considerable number of young men were sent abroad for training in the shops of the technical collaborators, and large training facilities were set up at the plant sites to train others.

103. The problem of meeting the requirements for administrative and managerial personnel was rather different. With the expansion of the

public sector the needs would grow rapidly and there would obviously be an acute shortage of experienced senior people. This dimension of the problem was no doubt recognized. That the nature of the task of managing large complicated industrial enterprises was in essential respects quite different from the usual administrative tasks of Government does not appear to have been so easily grasped. Whereas the need to train young engineers and technicians was accepted, no comparable effort was made for the senior staff at top and upper middle management levels, and the training of personnel for what might be considered industrial and financial control and cost accounting was completely neglected. Management was not considered so much a technical skill as a matter of "sound judgment and executive ability" and these, of course, can only come from experience. There appears to have been a widespread view that the usual administrative machinery could be stretched to take in the operation of the new enterprises and that all that was needed was a supply of good general administrators. As noted later by the Planning Commission there was a "considerable underestimation of the management implications of large projects." 1/

104. On the other hand, under the existing salary scales, it was and continues to be very difficult to attract experienced managers from the private sector. The higher salaries and the opportunities in an expanding private sector are generally far more attractive to the limited supply of experienced managers in private industry. The problem of employing expatriate managers was also difficult for the same reason in addition to a natural reluctance to use foreign personnel in other than technical capacities. So it would seem that because alternatives were not readily available and because the problem was not considered sufficiently urgent to make the necessary concessions to procure managers from other sources, the burden of managing the public sector plants has been placed in large part on regular senior civil servants of the Central and State administrative services and the Railway Board. 2/ It was recently estimated that "out of about 800 top posts in 54 public undertakings ... over 190 are held by serving or retired officers of the Central Services." 3/ This does not include an unknown additional number of posts

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1/ Third Five Year Plan, page 283.

2/ Recent exceptions have been the appointment of a British general manager for the Durgapur steel plant and a general manager for the Heavy Engineering Corporation from the private sector.

3/ Estimates Committee (1963-64) 52nd Report (Third Lok Sabha), Personnel Policies of Public Undertakings, March 1964.

held by officers of the State Governments. In a significant number of cases the General Manager himself is a general administrative official of the Central Government and 25 public undertakings employ serving officers of the All-India or State Services for the post of Financial Adviser. 1/

105. It is certainly understandable that in the early stages of the development of a great public sector industry the major burden of management is carried by the only existing body of senior officials available. On the other hand, the persistence of the practice of running large industrial enterprises with general administrators subject to periodic reassignment is itself a serious deterrent to the development of a reasonably efficient public sector industry. The idea that managers of large complex industrial projects need special skills and knowledge is just beginning to be recognized and as yet has had little effect on actual practice. There is still little "... professionalism in the (civil) service. The tradition of the intelligent amateur dies hard." 2/

106. The problems created by using general administrators for complicated industrial tasks are increased by the practice of frequently transferring managers. This makes it almost impossible for them to learn enough of each particular job to have at least the chance to become reasonably competent. As was pointed out in the Third Plan:

> "Work in projects as well as in important programmes has frequently suffered because of rapid transfers of officials. For tasks of any importance, it is essential that the responsible officials should not only be selected with care and suitably trained, but should also remain long enough to grow to the full measure of their responsibility. In any major key assignment, a period of less than five to ten years is rarely sufficient for producing large results." 3/

1/ Op. cit., pages 19 and 20 General Managers of Rourkela and Bhilai Steel plants, Barauni Refinery, Kiribiru Project of National Mineral Development Corporation and several units of Fertilizer Corporation of India included (as of March 1964).

2/ H. K. Paranjape: "Political and Administrative Problems of Implementing the Indian Plan", Development Plans and Programmes, Development Centre of OECD, 1964, p. 102.

3/ Third Five Year Plan, page 238.

107. Some idea of the frequency of changes in top officials can be gained from Tables 21 and 22, indicating the average length of service for chairmen, general managers and financial advisers. It should be noted that a great many of the changes indicated in Table 21 took place during periods of construction, when, as noted above, major changes were often being made in the size, nature and scheduling of the projects themselves. In some cases officials were changed on the grounds of lacking efficiency, but it is our impression this is not the general case. Most of the officials involved were on deputation from their own services to serve for limited periods of time. When the very difficult problems faced by many of these enterprises are considered, it is not surprising that the Estimates Committee should complain that "officers are a little casual in their approach to work because, if they are not successful, they can always go back to their parent departments." 1/ We find these views most sensible.

108. The Government recognized the serious problems arising from the shortage of management personnel as early as 1956 when an effort was made to reduce the dependence on deputed officials from the established services. In 1957, an attempt was made to establish an Industrial Management Pool. The effort was not a success. The Pool was to recruit 200 candidates with managerial experience to fill posts in public sector undertakings. From over 18,000 applicants 212 were selected for appointment to the Pool in 1959. Of these, however, only 130 accepted the offer and after further dropouts only 105 actually held jobs under the program. The Pool had difficulties in placing even this number, and no recruitments to the Pool were made after the initial recruitment in 1959. The Pool failed to attract suitable experienced managerial talent from well-managed companies in the private sector because of the low pay offered; as an alternative, offers were made to officers of the central services and even many of these did not accept because the terms of employment frequently compared unfavorably with those of their parent services. The enterprises, on the other hand, were reluctant to accept men who were considered outsiders and who didn't show any particular qualifications. In an appraisal of the experiment, Professor H. K. Paranjape has pointed out that the scheme "suffered from most of the rigidities and other defects of a Government service without providing any of its advantages. On the other hand, it did not have the flexibility that recruitment by individual public enterprises can have." 2/ He recommended placing the "responsibility for recruiting, training, developing and promoting managerial personnel (except at higher levels) ... squarely on the top managements of the undertakings." He also pointed to the need to develop procedures for "recruitment and promotions and basic plans for salary and other remuneration ... laid down of Government (but) modeled mainly on business practice and not on that in the civil service." 3/

1/ Estimates Committee, op. cit. pages 17 and 18.

2/ H. K. Paranjape - The Industrial Management Pool, An Administrative Experiment, Indian Institute of Public Administration, New Delhi, p. 113.

3/ Ibid, page 118.

109. Granted that the system of providing managers is of critical importance, we turn next to the related question of the organization of the management of State enterprises - the system under which management talent is utilized and developed. There is no doubt that the implementation of the public sector industrial program has suffered because of the shortage of experienced and competent managers. This was probably inevitable and even with the best intentions and efforts it will take time to develop the talent needed. However, there is more to the problem than this. It seems clear that the system under which the enterprises are being operated - the way in which authority and responsibility are allocated and performance is judged - is itself partly to blame for the lagging performance. Furthermore, the system tends to inhibit the development of the additional management talent needed now and in the future.

110. The essential defect of the present system is the manner in which responsibility and authority are diffused. Functions are not clearly defined, responsibility is not focused where it can be most effective and authority in many important matters appears to depend on a consensus. Under the system important decisions are made slowly - the authority of managers is circumscribed by rules, regulations and the need for concurrence in many matters. The system, in short, diffuses the functions of management throughout a fair portion of the bureaucracy - a bureaucracy, it might be added, in which technical knowledge is yet to receive full recognition. The system is certainly not one which induces productive efficiency.

111. On the other hand, there is an understandable tendency for public industry to be all things to all men. No doubt the aim to have an "efficient" State industry which can earn even a 10% return is generally accepted - at least verbally. Many of the implications of such a goal are not. The need for favoring more backward regions, the pressure for employing personnel from the State where the plant is located and, in fact, for the employment of a larger work force than actually needed, the desire to build model communities - all these tend to reduce the economic efficiency of the operation. In addition "in matters like recruitment, promotions, purchases and the award of contracts, the emphasis is on maximum fairness to all rather than on quick and effective solutions. There is an insistence on aiming at a vague standard of perfection and justice and this involves procedures which tend on balance to be disadvantageous (to efficient operation)." 1/ It is this confusion about aims - this need to reconcile conflicting goals in a loose compromise that seems to be in part responsible for the features of the system which are most inimical to efficient operations.

1/ H. K. Paranjape "Political and Administrative Problems ...", op. cit., p. 103.

112. The difficulties in achieving successful operation of industrial enterprises under the constraints imposed on plant management by the system of procurement, personnel policy, financial control and audit have been described in detail in public documents over a period of time. Eminent foreign consultants and Indian scholars have expressed grave concern with this problem; special committees have reported on it. The Planning Commission has pronounced what should be, and the Estimates Committee and the recently established Committee on Public Undertakings have strongly criticized what is and chided the Government for not implementing reforms to which it had agreed. Throughout the theme has been the urgent need to strengthen plant management and to place the operation of plants generally on a basis much more resembling commercial operations than those of Government departments. It is not our purpose to go over the ground already covered so completely by others. 1/ However, we would like to draw attention to the following features of the present system which from our observations seemed to have a particularly serious effect on performance.

a. Management has generally not been tied closely enough to the fortunes of the enterprise. The periodic changes of senior officials have already been mentioned. We do not see how it is possible to operate large complex industrial plants with any degree of efficiency if an important part of the management rotates every few years. In addition, it has not been the general practice to involve those who will have responsibility for operating a project with the planning and development of the project for which they will later be responsible. It would seem that the early stages in the development of a project are usually handled by the ministry, and management, with the possible exception of a chairman, is not designated until later. Managers seem often to be handed problems which might be partly avoided if they had at least been consulted when the project was being conceived and designed. In recent years the practice has changed to some extent as existing enterprises have been given responsibility for designing, constructing

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1/ For instance, Paul H. Appleby - Re-examination of India's Administrative System with Special Reference to Administration of Government's Industrial and Commercial Enterprises - GOI, 1956; H. K. Paranjape, "Political and Administrative Problems of Implementing the Indian Plan" ..., op. cit.

and operating new plants. 1/ But even in some of these cases the delay in the appointment of management for a new project has been cause for criticisms. 2/

b. The authority of the general manager in matters intimately concerned with the management of his plant is constrained by rules, procedures and regulations, with regard to personnel, procurement and finance. We have seen instances where an aggressive management has been able to sustain exceptions to the rules in particular circumstances to the apparent benefit of the enterprise. However, the possibility of exceptions is not a sufficient reason for maintaining rules which have the effect of reducing the effectiveness of management. We would point especially to the limitations imposed on the manager by the requirement that any expenditure over a very small amount requires the approval of his financial advisor, who is generally a temporary employee not directly responsible to the general manager and with his own access to the Ministry of Finance from which he has frequently been deputed. Not only does this reduce the authority of the manager in a vital area but it diverts attention from the use of finance as a management tool to a concern with the control of petty expenditures. The requirement of tenders for the procurement of even minor items would appear to increase costs 3/ out of proportion to the possible benefits of such a procedure and may also frustrate the development of indigenous supply of special items. 4/ The limitation on the manager's authority to promote and compensate his staff

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1/ Hindustan Machine Tools appears to be doing this very comprehensively and successfully; Fertilizer Corporation of India and Heavy Electricals (before Bharat Heavy Electrics was set up) have also been responsible for designing new plants.

2/ For instance, in the cases of the Trombay, Gorakhpur and Namrup plants of the Fertilizer Corporation, the time elapsed between Government approval of the project and appointment of a general manager has been 40, 18 and 8 months, respectively. This delay has been criticized by the Committee on Public Undertakings, op. cit., page 65.

3/ At the Nangal fertilizer plant, the mission was told that every purchase exceeding Rs. 25 had to be purchased from the lowest of several bids. It was estimated that this procedure added Rs. 15 to the cost of a Rs. 25 item.

4/ See Appendix I, para. 64-5, for Dr. Little's comments on the tendering system.

and in particular the limitations to the prompt discipline of the work force make the problem of building an efficient operation an extremely difficult one.

c. The system of Government audit is another inhibiting factor. In addition to a normal commercial audit carried out by chartered public accountants, Government enterprises are subjected to a second audit by the Auditor General. This audit is concerned with the propriety of expenditures made, not just the fact that they were made and accounted for properly. In effect it is an evaluation of past business decisions made by the enterprise from a viewpoint which is primarily concerned with the control of expenditures rather than overall performance. Management's concern with this audit and the criticism that can arise from it not only takes valuable time from operations but also diverts attention from essential problems of performance.

d. The level of management salaries in public sector enterprises is appreciably lower than those in private sector plants. This creates a problem in recruiting and holding the talent required to operate these great complex enterprises.

113. In addition to the above points concerned with the organization of management we have noticed in particular that difficulties in the following fields of management activity appear to have had important repercussions on performance:

a. Planning of construction, production and procurement. With the initiation of a great program of industrial investment where past experience is an inadequate guide, problems of anticipating requirements and coordinating actions are bound to occur - and they surely have. Recent work of the Management Group of the Committee on Plan Projects of the Planning Commission is directed to this problem. This is a beginning of a wider recognition of the technical side of the management problem and an attempt to bring modern techniques to bear on it.

b. Cost control. It is commonplace to say that Indian public sector industry is not sufficiently cost-conscious. There are reasons for this which among other things come out of the emphasis on physical targets and some vague distrust of strict business criteria. Related to this is the backward state of cost accounting and general techniques of financial control. Without knowledge of the cost of the resources used and the operations performed in some

detail, it is not possible for a management to act rationally to make the best use of its facilities and labor force.

c. Personnel practice and labor relations. Achieving high levels of productivity requires the development of a well-organized labor force with an incentive to produce. This is more than a matter of pay. It involves the relationships between labor and management, the organization of labor itself, systems for recognizing outstanding performance and disciplines for infractions of working rules. We have been impressed by the difficult labor problems in some public sector enterprises we have seen. There is no doubt that some of the lag in performance can be attributed to them.

D. General Industrial Policies

114. The comments of the previous section have dealt exclusively with public sector industry. In the case of the private sector, Government action is less direct but, nevertheless, very important because of the control exercised over investment, prices (in some cases) and over the allocation of foreign exchange and scarce domestic materials. The system of physical controls is described in detail in another paper. 1/ Our purpose here is to point to specific policies and procedures that we have observed to have a pronounced affect on the recent performance of industry and on the prospects for future performance.

115. The first is import policy. We have already mentioned the problem of unutilized capacity arising from the shortage of foreign exchange for the import of raw materials and components. This has obviously had a considerable affect on performance. Not only have supply difficulties directly curtailed output, but they have also led to the practice of maintaining relatively high inventories because of the uncertainty of procurement. We would consider the shortage of "maintenance imports" as the most important immediate problem of Indian industry. We would also point out that it is not simply a matter of the volume of materials, components and spares that can be imported but also a question of the speed with which the process is carried out. We have been impressed with the complexity and slowness of the procedures, even in cases where the items, components or spares, were small and their value to output extremely great - where failure to obtain the item would keep idle a substantial investment of scarce capital. Even given the limitations of the overall supply position, it is certainly conceivable that more productive use could have been made of the resources in scarce supply.

116. We are very much aware of the difficulty of achieving the most effective use by administrative means. In addition to the limitations arising from inadequate knowledge of capacities and requirements there is the conflict between considerations of equity - allocating each producer his fair share, and efficiency - allocating more to the more efficient. However, even within such constraints, there seems little reason for a concentration on detail out of all proportion to the value of foreign exchange involved. We have noted the frustration of the producer who must devote much of the valuable time of his top people to attempts to speed up the procurement of the nail for the shoe of the horse without which the battle is lost. Certainly the volume of maintenance imports should be increased even if this must be at the expense of reducing imports of capital goods. In any case, higher priority and faster action should be given to minor items of spares and components where procurement frequently appears to be the final step necessary to activate a plant or a machine.

117. The problem of achieving higher capacity utilization is not just a question of supply; it is also a matter of increasing the efficiency of plant operations. There are a number of factors which inhibit

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1/ Administrative Control on Resource Allocations and Investment.

the improvement of efficiency. Management is frequently inexperienced and in many cases simply does not know how to increase efficiency. In addition, enterprises operate in a seller's market protected from foreign competition by import controls and from domestic competition by the system of allocating scarce materials and foreign exchange and controlling additions to capacity. Profits are generally good and taxes are high at the margin. Increased plant efficiency is generally neither necessary for survival nor particularly attractive in the light of alternative uses of effort. A more "productive" use is often to be found in working up the justification for an increased allocation of scarce materials perhaps through the acquisition of more capacity. Although the increased availability of supplies would ease the situation by taking pressure off the allocations system, it is not the whole answer to the problem of achieving higher utilization of capacity.

118. Other factors which have affected both achievement and efficiency have been the manner in which Government anti-monopoly and balanced regional development policies have been implemented. These policies have generally involved limiting the size of plants, favoring the applications of the smaller and newer firms over those of the older and better established ones, particularly those controlling a large share of the output of the industry, and spreading industries about the country with particular attention to the demands of individual states and the need to develop the more backward areas. We would not argue that the underlying aims of these policies are not important and valid, but we would question whether the price has not been high in terms of loss in output. We would also question how effective the actions taken have been in achieving these objectives.

119. These policies have been implemented through the system of industrial licensing. New units have often been licensed with little regard to economies of scale, market requirements, or location. As a result in some cases a number of small uneconomical plants have been constructed, in others, too many plants of economical size have been built. 1/ On the other hand, the effectiveness of the policy in promoting balanced regional development appears questionable, and it seems doubtful whether the concentration of economic power has been reduced. 2/

1/ The aluminum industry provides an example of small uneconomical plants; the Third Plan policy on the paper industry also sought to promote small units. In the case of some automotive ancillaries it appears that the licensing of several plants of economical size to limit market control has resulted in capacity substantially in excess of requirements.

2/ In his study, Professor Hazari concluded that this policy had not been successful in dispersing economic power during the period 1951-58. It seems likely his conclusion would also apply to the more recent period. His measure of economic power is based on control at the corporate level; government policy is directed primarily at regulating the share of individual producers in the market for particular products. R. K. Hazari, op. cit.

120. Another result of this policy has been the failure to meet capacity targets. In some cases the new enterprises which were intended to reduce the share of the market of the existing producers failed to implement their projects. In part, this appears to have been because they were inexperienced and found far greater difficulties than the established producers would have in the same situation. This would be true in the case of cement and aluminum. In the latter case the new producers were to be public sector plants.

121. Another policy which has directly affected the implementation of the industrial program during the Third Plan has been the control of prices in a number of industries where the burden of expansion has been expected to be carried by the private sector. In particular the control of the producers' prices of cement, fertilizer and pig iron has reduced the attractiveness of these industries relative to others and has no doubt been partly responsible for the lag in their expansion.

122. Performance has also been affected by the way in which the general policy of import substitution has been carried out. We have already referred to the general underestimates of import requirements, to the lack of any serious evaluation of import savings in connection with the appraisal of public sector projects and to the general underestimate of the foreign exchange costs of public sector projects. All these factors have had serious repercussions on the availability of foreign exchange for the import of materials, components and spares. In the case of the private sector the situation is similar. There seem to be no clear economic criteria used to judge the suitability of projects which will substitute for imports. The main concern is with physical requirements. There is a bias in favor of reducing dependency on imports regardless of cost. This policy has resulted in higher investment costs, higher prices and less foreign exchange savings than might have been the case if economic criteria had been given more weight in the decisions.

123. As long as India is short of products that can be manufactured economically in India, the development of capacity to produce items that are bound to be far more expensive than corresponding imports for the purpose of not being "dependent on imports" is a very wasteful policy. We recognize that it is necessary to take a long view of the evolving pattern of development. But this is a matter of emphasis. For example, when pig iron, cement and fertilizer are in short supply, the effort to develop the production of bearings, which are bound to be high cost and unlikely to be of high quality, so that a greater proportion of the components for motor vehicles manufactured in India can be procured domestically, does seem to represent a misuse of resources in the face of the existing limitations in foreign exchange. A more discriminating approach to import substitution would have resulted in greater savings of foreign exchange and a more effective use of capital.

124. It should also be added, however, that the Mission did see evidence of change in the application of some of these policies. There has been a change in policy towards plant size in the case of aluminum and cement, and the policy of promoting small-scale paper plants has been abandoned. In the case of cement, the need to expand capacity more rapidly appears to have influenced the Government to strongly support the expansion of the largest producer, whereas the earlier but only partially successful policy favored the development of new producers. 1/ The aluminum case is similar. The need for larger plants has been accepted, and earlier restrictions on the expansion of the major private producers have been lifted. 2/ These changes do not appear to be an abandonment of the previous "anti-monopoly" position but rather a shift in emphasis to give more weight to the need to achieve production goals. How far these changes indicate a general tendency to face industrial problems more pragmatically is still hard to say.

1/ Since the mission's visit, price control has been removed, and the system of distribution has been assigned to the industry itself. Another similar recent action has been the lifting of the price controls on fertilizer produced by private sector projects.

2/ A notable exception is the recent approval of a 10,000-ton aluminum smelter in Madras which is well below the minimum economic size.

IV. CONCLUSIONS AND RECOMMENDATIONS

125. In the preceding chapters we have attempted to analyze the recent performance of Indian industry and to focus attention on factors which we considered to be of considerable importance in limiting this performance. Our emphasis has been on areas where Government action may be most effective in dealing with the problem, in particular where the Government is the operator of enterprise. Our conclusions may be summarized as follows:

a. Output targets were not reached because:

(1) Fewer projects were undertaken than planned. In the public sector, this was because the preparation of projects lagged; in some cases, there were financing difficulties. In the private sector, investment was not undertaken in a number of cases because license holders were not capable of implementing projects. Disincentives, such as controlled prices, were also a factor.

(2) The projects undertaken in the public sector generally cost more and took much longer to construct than expected and also were slower and costlier than they should have been by any standard. The increase in cost and the delays in completion of these projects were also factors in slowing the development of other projects.

(3) Existing capacity was not fully utilized because of shortages of industrial raw materials, components and spares. These shortages arose from an inadequate supply of maintenance imports and were aggravated by the slow implementation of projects which were intended to reduce demand for imports and the higher cost of these projects in terms of foreign exchange. In some cases, under-utilization of capacity can be attributed to the licensing of more capacity than required.

b. In addition to the failure to meet output targets, the overall effectiveness of investment in the public sector as measured by the ratio of investment to output was very low during the Third Plan period. This was due both to the increased cost of projects and, in particular, to the long periods required for their execution.

c. Large investments have been made in the public sector without sufficient attention to their economic characteristics with the result that in some cases investment resources have clearly not been used as effectively as they might have been. In some cases expected savings in foreign exchange as the result of import substitution have been long delayed and will only be achieved at high cost. In other cases, alternative methods of production, not seriously considered at the time the investment was made, would probably have resulted in savings of scarce resources. In still other cases, a high price has been paid for location intended to favor the development of some particular region.

126. The task of developing a full range of modern industry in a relatively short space of time is a formidable one. The accomplishments thus far are impressive. But the cost has been extremely high, and it is imperative that the efficiency of resource use be greatly improved -- that investment be more productive in terms of output -- if the success of the whole effort is not to be jeopardized.

127. A number of reasons can be suggested for the lagging performance. In a general sense, one can say that the task proved to be much more difficult than expected, and that too much was attempted in view of the limitations on trained and experienced technical and managerial talent and on foreign exchange resources. More specifically, one can point to deficiencies in the several steps in the process of planning and execution. At the most general level poor performance can be attributed to poor or inadequate planning in the sense that the process of achieving the targets was not fully incorporated into the plan. The targets were not consistent with the means available for reaching them. Such a consistency requires a certain measure of planning at the industry level and in particular at the level of conceiving, designing and sanctioning projects. At this level and at the level of project implementation itself there were many difficulties.

128. Underlying these problems it is possible to point to certain attitudes and points of view. Here we would mention the emphasis on physical planning with secondary regard to cost considerations, and the relationtionship of return to costs, the focus on specific long-term goals to the relative neglect of short-term effects, a certain confusion between social and economic goals and an exaggerated faith in the competence of "the intelligent amateur" to deal successfully with the problems of industrial planning and management.

129. We certainly do not believe that there is anything inevitable in the record of performance -- that the press of custom and tradition are unchangeable. In fact we have been impressed by the high standard of public analysis given many of the problems with which we have been concerned. The need for achieving greater economic efficiency in the public sector is well articulated by Indian scholars and officials, and many excellent suggestions of how this should be done have been presented. Although argument is generally far ahead of implementation, understanding is a prerequisite for intelligent action.

130. Our recommendations are confined to industrial planning and the implementation and operation of public sector projects. Our emphasis is on the need to carry out certain well defined functions more efficiently. Although we do not raise new issues, a new formulation may have some merit.

A. Industrial Planning

131. Planning at the industry level needs to be greatly strengthened. In fact, in many cases serious planning at this level needs to be instituted. This does not mean that every industry needs equal attention -- the need depends on the industry. In cases where new capacity can be brought in quickly and the market is well defined, orderly growth may be regulated by the market itself and the planning function confined to limiting capacity expansion to the extent made necessary by the scarcity of foreign exchange. In cases where investments are large and lead times long, where future markets and sources of supply depend on complementary developments and where the whole process requires a large amount of foreign exchange, good planning at the industry level is a necessary requirement for achievement.

132. A basic requirement for good planning is good information. There should be detailed knowledge of existing capacity, capabilities, location and ease of expansion. There should be estimates of future requirements by type of product and region. And, there should be estimates of current inputs required to maintain existing capacity and current capital inputs required for expansion to specified levels. There should be detailed analyses of alternative ways to meet requirements. In some cases the choice may be not only among alternative projects, and among alternative project shapes, but also among different repercussions on other producers and on imports. Finally, attention should be given to balance in the overall program -- balance among projects in terms of the time required for returns to accrue and balance in terms of implementation risks.

133. To carry out the industrial planning function, it is recommended that planning groups with permanent staffs be set up for the most important industries. These should work in cooperation with private industry groups, public enterprises and the ministries concerned. The present system of ad hoc working groups is quite inadequate. It is necessary to collect and analyze a substantial body of material and to revise estimates of capacities and requirements constantly. This can only be done with a permanent staff.

B. Preparation and Screening of Projects

134. Within the framework of the industry plans, the necessary supply of projects must be conceived, designed and engineered. Project preparation is at present a bottleneck in the process of industrial expansion. As pointed out by the Planning Commission,

> "The major shortcoming in the public sector is the absence of technical organizations for planning, designing, engineering and constructing complex enterprises in the many fields of vital importance mentioned above. It is difficult to imagine how big tasks in the public sector can be conceived, planned and executed without bringing into position very early the requisite technical institutions and organization on the very large scale and specialization urgently called for. These deficiencies are being made good, but a more determined pursuit of these objectives is necessary." 1/

135. A start has been made with the establishment of development groups in some of the large public sector enterprises, e.g., Hindustan Steel and the Fertilizer Corporation. There are other private firms in the field, some with foreign collaboration, some without. This should be encouraged. 2/ We would suggest that an appropriate way to promote this development would be to set out more clearly and explicitly than heretofore the standards that a project must be required to meet in order to receive financing. This in turn should be enforced by a much more rigorous screening of projects than has been the practice in the past.

136. The above comment refers to both public and private sectors. The existing mechanism for screening private projects is through the various public or semi-public investment institutions -- supplemented in a general way by the licensing procedures and, of course, the market itself. We see no need to make any basic change in this system; at the same time it would be desirable for the industrial licensing authorities to restrict their screening operations to the genuinely public considerations, rather than to the specific internal characteristics of private projects and for the financial institutions (ICICI, IFC, IDB) to play an increasingly responsible role in the screening of projects which require their assistance.

1/ Notes on Perspective of Development, India: 1960-61 to 1975-76, April 1964, Perspective Planning Division, page 25. See also Memorandum on the Fourth Five Year Plan, page 56.

2/ We note that, since the Mission's visit, a committee has been established to investigate the costs and availability of indigenous capacity for design, development and engineering services, under the chairmanship of S. C. Barve, industrial member of the Planning Commission.

137. In the case of the public sector the present procedure seems much less satisfactory. Such screening as exists appears to be done largely by high level ad hoc committees dealing in terms of vague general criteria without the support of sufficient staff work. We think the screening function should be carried out in a more rigorous way, imposing clearly defined rate of return criteria on potential projects. This can only be done effectively if put in the hands of a strong and technically competent staff. The important thing is to enforce the systematic appraisal of public sector projects according to an agreed set of criteria which include technical, financial and economic aspects, and which provide a basis for ensuring that projects have been reasonably well prepared and are economically worthwhile.

C. Management of Public Sector Enterprise

138. It is urgent that everything possible be done to strengthen and improve the management of plants in the large and expanding public sector. Failure to use resources effectively is always serious but in the case of the huge concentration of capital represented by the large public enterprises the consequences of specific failures are very great.

139. There can be no simple prescription for success. Neither can much be added to the advice given on this subject by the numerous experts and expert committees. However, we should like to emphasize several points which seem to us of particular importance in guiding policy action in this fields:

a. In appraising the operations of plants much more emphasis should be placed on overall performance -- the quantity and quality of output, the level of costs and the return on investment, much less on the details of particular expenditures. The role of the auditor in judging the plant's operations should definitely be reduced. Excellence of overall performance should be given greater public recognition.

b. The management of an enterprise, its rewards and its penalties, should be more closely tied to the fortunes of the enterprise. There should be a greater continuity of management. The key members of the management group which will have responsibility for managing a plant should be involved in the early stages of planning and developing the project. Those responsible for making it run efficiently and profitably should have some responsibility in seeing that it is designed to do so. We are aware improvised management was unavoidable during the early stages of public sector

growth; on the other hand, we see little planning for a full transition from this state of affairs. The industrial management pool has apparently not been the answer it was at first thought to be. Perhaps more consideration should be given to encouraging each large public sector enterprise to develop its own managerial talent rather than to the development of a management service or pool.

c. Greater authority should be given to management at the plant level. There is certainly nothing new in this recommendation. We recognize that this involves a considerable departure from the traditional administrative procedures of the civil service. We believe, however, it is of vital importance to break the constraints imposed on management by the existing system if strong and effective management is to develop. Some degree of central planning and control is necessary, along with decentralized authority and responsibility, but the balance, we believe, needs to be shifted further toward the latter.

d. Greater emphasis should be given to the development of special management skills and techniques. We refer in particular to such important management tools as cost accounting and financial control, the programming of construction, production and procurement, inventory control and personnel and labor relations. We are aware of work being done in some of these fields. We believe potential benefits justify even greater effort.

Table 1: NATIONAL INCOME BY INDUSTRIAL ORIGIN

	Percentage Distribution		
	1950-51	1955-56	1962-63/1
AGRICULTURE	51.3	45.3	45.3
Agriculture	50.2	44.0	44.0
Forestry	0.7	0.7	0.8
Fishing	0.4	0.6	0.5
MINING, MANUFACTURING AND SMALL ENTERPRISES	16.1	18.5	20.1
Mining	0.7	1.0	1.3
Factory establishments	5.8	7.8	11.0
Small enterprises	9.6	9.7	7.8
COMMERCE, TRANSPORT AND COMMUNICATION	17.7	18.9	17.0
Communication (Post, Telegraph and Telephone)	0.4	0.5	0.5
Railways	1.9	2.5	2.8
Organised banking and insurance	0.7	0.9	1.4
Other commerce and transport	14.7	15.0	12.3
OTHER SERVICES	15.1	17.3	18.1
Professions and liberal arts	4.9	5.6	5.5
Govt. services (administration)	4.5	5.7	7.6
Domestic services	1.4	1.4	1.4
House property	4.3	4.6	3.6
Net domestic product at factor cost	100.2	100.0	100.5
Net earned income from abroad	- 0.2	-	- 0.5
Net national output at factor cost = national income	100.0	100.0	100.0

/1 Preliminary.

Source: **Estimates of National Income, February 1964, Central Statistical Organisation.**

Table 2: APPARENT CHANGE IN INDUSTRIAL STRUCTURE
1956 - 1962

Industry	% of Net Output 1956		1962	
Declining Shares				
Textiles	45		30	
Food Manufactures	15		11	
Total		60		41
Increasing Shares				
Machinery and Metal Products	8.0		19.1	
Metal Products	1.1		2.2	
Machinery electrical	2.6		3.4	
Machinery non-electrical	1.2		4.4	
Transport equipment	3.1		9.1	
Chemicals and Allied Industries	8.1		16.0	
Chemicals	3.9		9.6	
Non-metallic minerals	2.7		4.2	
Paper	1.5		2.2	
Total		16.1		35.1
Others		23.9		23.9
Grand Total		100.0		100.0

Source: 1956 - Industrial Output Index omitting "mining and quarrying". Monthly Statistics of the Production of Selected Industries, CSO
1962 - Annual Survey of Industries 1962, (Provisional Results), CSO.

Table 3: IMPORTS OF METALS, MACHINERY AND EQUIPMENT
(Rs. crores)

	1950/51	1955/56	1959/60	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66
1. Metals	48.3	92.0	123.1	169.9	157.3	144.2	145.2	157.0	154.0
(a) Iron and Steel	20.0	66.5	84.3	122.5	107.8	89.0	89.6	95.0	90.0
(b) Non-ferrous	28.2	25.5	38.8	47.3	49.5	55.1	55.6	62.0	64.0
2. Manufactures of Metals	4.9	7.8	24.9	22.9	18.0	26.9	15.6	18.0	18.0
3. Machinery and Components	91.4	131.3	208.0	260.6	302.9	315.3	360.8	465.0	565.0
(a) Non-electrical	67.7	93.8	154.8	203.4	237.0	250.6	277.3		
(b) Electrical	23.8	37.6	53.2	57.2	65.9	64.8	83.4		
4. Transport Equipment	40.7	63.5	71.4	72.3	64.6	72.1	60.8	95.0	90.0
Total Metals and Equipment	185.3	294.6	427.4	525.7	542.8	558.5	582.4	735.0	827.0
Total All Imports	659.2	678.8	960.8	1139.9	1107.1	1135.6	1149.0	1540.0	1510.0/1
Metals and Equipment as % of Total Imports	28%	43%	44%	46%	49%	49%	50%	48%	55%/1

/1 Total includes cereal imports consistent with "balance available under current PL 480 agreements". If cereal imports are assumed to be same as 1964/65 total would be Rs. 1677 crores and "Metals and Equipment" would be 49% of total.

Source: 1950-51 to 1963-64 Indian Economic Statistics, Ministry of Finance, Aug. 1964.
1964/65 - 1965/66 - Memorandum for the India Consortium 1965, Ministry of Finance.

Table 4: PLANNED PATTERN OF INDUSTRIAL INVESTMENT THIRD AND FOURTH PLANS

	THIRD PLAN		FOURTH PLAN	
	Total	Public Sector	Total	Public Sector
Metals				
Iron and steel	640	587	1380	1185
Non-ferrous	80		194	89
Total	720	587	1574	1274
% of total investment	29%	44%	34%	49%
Machinery				
Machine tools	40	20	120	65
Industrial machinery & equipment	286	174	707	245
Electrical machinery & equipment	136	108	332	190
Transport equipment	119	35	188	22
Total	581	337	1347	522
% of total investment	24%	25%	29%	20%
Chemicals and Fertilizers				
Chemicals	406	199	657	241
Fertilizer	225	99	364	262
Total	631	298	1021	503
% of total investment	26%	22%	22%	19%
Other				
Cement	60	-	230	160
Paper	106	14	206	34
All others/1	357	89	282	128
GRAND TOTAL	2455	1325	4660	2621

/1 Includes textiles, food processing, timber and miscellaneous.

Source: Third Plan - Programmes of Industrial Development 1961/66 - Planning Commission.
Fourth Plan - Estimates of Industry and Minerals Div. of Planning Commission.
Investments in mining and mineral development excluded; classifications adjusted for comparability as far as possible.

Table 5: MAJOR INDUSTRIAL AND COMMERCIAL UNDERTAKINGS OF THE CENTRAL GOVERNMENT CLASSIFIED BY ACTIVITY

Activity	Investment (Rs.crores)	Percent of total investment
Manufacturing Industry	1253	70.0
Steel - Hindustan Steel (Ltd.)	804	45.0
Engineering	243	13.5
Heavy Engineering Corp. (Ltd.)	101	
Heavy Electricals (India) (Ltd.)	72	
Hindustan Aircraft (Ltd.)	25	
Hindustan Machine Tools (Ltd.)	15	
Other	30	
Chemicals	197	11.0
Fertilizer Corp. of India Ltd.	82	
Indian Refineries	67	
Fertilizers & Chemicals Travanore Ltd.	15	
Indian Drugs & Pharmaceuticals Ltd.	13	
Others	20	
Shipbuilding	9	0.5
Mining	215	12.0
Neyveli Lignite Corp.	113	
National Coal Development Corp. Ltd.	88	
National Mineral Development Corp. Ltd.	14	
Promotion and Development	118	6.5
Oil and Natural Gas Commission	86	
National Industrial Development Corp. Ltd.	11	
National Small Industries Corp. Ltd.	11	
Other	10	
Transport	93	5.0
Air India	31	
Shipping Corp. of India	31	
Indian Airlines	29	
Other	2	
Financial Institutions	81	4.5
Industrial Finance Corp. of India	75	
Others	6	
Commercial and Construction	20	1.0
GRAND TOTAL	1780	100.0

Note: Investment in terms of equity and long-term loans on books of the enterprises 1963-64. The 19 enterprises listed are those with investments exceeding Rs. 10 crores in 1963-64. The total number of enterprises is 60.

Source: Annual Report of the Working of Industrial and Commercial Undertakings of the Central Government for the year 1963-64. Ministry of Finance, Dept. of Expenditure (Projects Coordination Division).

Table 6: NON-DEPARTMENTAL UNDERTAKINGS OF THE CENTRAL GOVERNMENT IN ORDER OF TOTAL CAPITAL INVESTED AS OF MARCH 31, 1964

Enterprise and Date of Incorporation	Category	Investment (in Rs. Crores)
Hindustan Steel Limited (1954)	Steel	804.10
Neyveli Lignite Corporation Ltd. (1956)	M	113.24
Heavy Engineering Corporation Ltd. (1958)	E	100.59
National Coal Development Corporation Ltd. (1956)	M	87.30
Oil and Natural Gas Commission (1956)	D	86.48
Fertilizer Corporation of India Ltd. (1961)	CH	82.31
Industrial Finance Corporation of India (1948)	F	74.82
Heavy Electricals (India) Ltd. (1956)	E	72.47
Indian Refineries Ltd. (1958)	CH	67.26
Air India (1953)	T	31.45
Shipping Corporation of India Ltd. (1961)	T	31.14
Indian Airlines Corporation (1953)	T	28.70
Hindustan Aircraft Ltd. (1940)	E	24.64
Fertilizers and Chemicals Travancore Ltd. (1943)	CH	15.19
Hindustan Machine Tools Ltd. (1953)	E	14.79
National Mineral Development Corporation Ltd. (1958)	M	13.55
Indian Drugs and Pharmaceuticals Ltd. (1961)	CH	12.78
National Industrial Developmental Corporation Ltd. (1954)	D	11.43
National Small Industries Corporation Ltd. (1955)	D	11.04
Indian Oil Company Ltd. (1959)	C	9.72
Bharat Electricals Ltd. (1954)	E	7.18
Indian Telephone Industries Ltd. (1950)	E	6.57
Cochin Refineries Ltd. (1963)	CH	6.14
	C/Fwd.	1,713.39

Table 6 (cont.'d.)

Enterprise and Date of Incorporation	Category	Investment (in Rs. Crores)
b/Fwd.		1,713.39
Hindustan Shipyard Ltd. (1952)	S	6.05
National Newsprint and Paper Mills Ltd. (1947)	E	5.50
Hindustan Photo Films Manufacturing Co. Ltd. (1960)	CH	5.37
Life Insurance Corporation of India (1956)	F	5.00
Central Warehousing Corporation (1956)	D	4.75
Hindustan Cables Ltd. (1952)	E	3.38
National Projects Construction Corporation Ltd. (1957)	Con	2.59
Hindustan Antibiotics Ltd. (1954)	CH	2.47
Praga Tools Ltd. (1943)	E	2.37
Rehabilitation Industries Corporation Ltd. (1959)	D	2.35
Minerals and Metals Trading Corporation of India Ltd. (1963)	C	2.00
State Trading Corporation of India Ltd. (1956)	C	2.00
National Buildings Construction Corporation Ltd. (1960)	Con	1.88
Ashoka Hotels Ltd. (1955)	C	1.77
Mazagon Dock Ltd. (1934)	S	1.73
Hindustan Salts Ltd. (1958)	CH	1.67
Hindustan Teleprinters Ltd. (1960)	E	1.65
Aeronautics India Ltd. (1963	E	1.63
Hindustan Organic Chemicals Ltd. (1960)	CH	1.52
Garden Reach Workshops Ltd. (1934)	S	1.45
National Instruments Ltd. (1957)	E	1.29
Hindustan Insecticides Ltd. (1954)	CH	1.14
	C/Fwd.	1,772.95

Table 6 (cont.'d.)

Enterprise and Date of Incorporation	Category	Investment (in Rs. Crores)
b/Fwd.		1,772.95
Mogul Line Ltd. (1938)	T	1.01
Indian Rare Earths Ltd. (1950)	CH	1.00
Hindustan Housing Factory Ltd. (1953)	Con	0.88
Film Finance Corporation Ltd. (1960)	F	0.60
Pyrites and Chemicals Ltd. (1956)	M	0.54
Travancore Minerals Ltd. (1956)	M	0.50
Export Credit & Guarantee Corporation Ltd. (1957	F	0.50
National Research Development Corporation of India (1953)	D	0.50
Central Road Transport Corporation Ltd. (1964)	T	0.48
Nahan Foundry Ltd. (1952)	E	0.48
National Seeds Corporation Ltd. (1963)	D	0.26
Handicrafts and Handlooms Exports Corporation of India Ltd. (1958)	D	0.12
Janpath Hotels Ltd. (1963)	C	0.09
Rehabilitation Housing Corporation Ltd. (1951)	D	0.06
Instrumentation Ltd. (1964)	E	0.01
TOTAL		1,779.98

Key to Categories

C = Commercial Enterprises

CH = Chemical and Petroleum Industries

Con = Construction Enterprises

D = Promotional and Developmental Undertakings

cont.d.

Table 6 (cont.'d.)

Key to Categories

E = Engineering Industries

F = Financial Institutions

M = Mining Industries

S = Shipbuilding Industries

T = Transport Enterprises

Source: Annual Report on the Working of Industrial and Commercial Undertakings of the Central Government for the year 1963/64, Ministry of Finance.

Table 7: LARGEST PUBLIC LIMITED COMPANIES IN MANUFACTURING INDUSTRY IN TERMS OF TOTAL ASSETS 1963/64

	Total Assets Rs. crores
Tata Iron & Steel	159
Indian Iron and Steel	100
Tata Engineering and Locomotives	57
Associated Cement	56
Delhi Cloth Mills	37
Burmah-Shell	36
Imperial Tobacco	29
Premier Automobiles	27
Esso	26
Orient Paper	23
Dunlop Rubber	22
Indian Aluminum	22
Hindustan Motors	21
Voltas	20
Hindustan Lever	20
Total for 51 largest companies/1	1106

/1 3 shipping companies and 3 power companies included in the 51.

Source: The Economic Times, Jan. 11, 1965.

Table 8: INDUSTRIES IN WHICH OVER TWO THIRDS OF VALUE ADDED COMES FROM LARGE-SCALE FACTORIES [1]

No.	Industry	Number of Factories		Value Added (Rs. crores)		
		Large-scale	Proportion of Total	Large-scale Factories (1)	Total Industry (2)	Proportion of total
207	Sugar	100	.44	33	46.5	.73
220	Tobacco manufacture	10	.03	13.3	19.8	.67
231	Spinning, weaving and finishing textiles	351	.34	239	304.6	.79
271	Pulp, paper and paper board	25	.30	15	18.5	.81
300	Manufacture of rubber products	7	.09	21	26.5	.81
311	Basic Chemical including Fertilizer	44	.34	32	38.4	.84
319	Misc.chemical products	41	.15	31.8	47.3	.67
321	Petroleum refineries	5	.71	18	18.1	.99
334	Cement	30	.94	14.6	14.9	.98
341	Iron & steel, including castings, Forgings, etc.	38	.11	47	72	.76
342	Non-ferrous metals	10	.18	8.5	12.8	.66
381	Shipbuilding	6	.16	4	5.9	.68
382	Railroad equipment	36	.31	33	39	.84
383	Motor vehicles	13	.19	25	27.8	.90
385	Motor cycles and bicycles	8	.16	5	5.9	.82
394	Jewelry and related articles	2	.18	7.5	2.0	.77
	Total "Large-scale Factories"	726		541.7	700.1	.77
	Total for All Industry	8,930		947.7	947.7	
	"Large-scale Sector" as % of Total	8%		57%	74%	

cont'd....

/1 Factories with fixed assets over Rs. 25 lakhs.

Source: Annual Survey of Industries 1961.
The Small, Medium and Large-Scale Sectors of Indian Industry, June 1964, CSO.

Note: In case of the following industries which together represented 8% of value added in industry (1961) the proportion then attributable to large-scale industries, 55-58%, has undoubtedly increased and will continue to increase with the expansion and coming into production of large-scale plants in public sector.

360 Machinery except electrical
370 Electrical machinery

Table 9: EMPLOYMENT, CAPITAL AND OUTPUT OF SMALL REGISTERED FACTORIES BY INDUSTRY GROUP, 1960

No.	Industry Group	Factories with Fixed Capital Less than Rs. 5 Lakhs				Percentage of all Registered Factories			
		No. of Factories	Persons Employed Thous.	Fixed Capital (Rs. Crores)	Gross Output	No. of Factories %	Persons Employed %	Fixed Capital %	Gross Output %
205	Grain Mill Products	4,255	92.6	16.8	182.8	95.6	86.1	84.1	78.8
209	Misc.Food Preparations	3,715	138.2	36.7	247.7	87.2	49.6	47.0	51.2
231	Textile Spinning, Weaving, and Finishing	3,073	147.0	12.1	108.7	83.3	12.7	5.4	13.7
010	Ginning and Pressing	2,812	104.4	14.8	60.3	95.7	91.9	93.6	88.1
360	Machinery, except Electrical Machinery	2,599	78.9	15.7	55.5	95.0	51.8	35.1	46.4
220	Tobacco Products	2,565	136.2	2.8	51.1	95.3	74.8	34.3	43.0
280	Printing, Publishing and Allied Industries	2,466	68.7	14.2	38.0	96.3	60.5	47.4	50.2
350	Metal Products, except Machinery and Transport Equipment	2,080	61.9	10.6	62.4	97.0	66.2	41.5	60.0
250	Wood and Cork except Furniture	1,574	40.2	4.7	24.3	97.8	81.9	68.7	82.2
384	Motor Vehicle Repair	1,174	38.7	6.6	20.2	94.7	72.5	55.3	73.4
399	Manufactures (n.e.c.)	1,028	30.5	6.9	26.9	96.8	83.5	76.9	82.5
319	Misc.Chemical Products	1,002	42.5	7.2	47.6	89.6	47.1	19.9	28.6

Table 9 (cont.'d)

No.	Industry Group	Factories with Fixed Capital Less than Rs. 5 Lakhs: No. of Factories	Persons Employed Thous.	Fixed Capital (Rs. Crores)	Gross Output (Rs. Crores)	Percentage of all Registered Factories: No. of Factories %	Persons Employed %	Fixed Capital %	Gross Output %
239	Textiles (n.e.c.)	778	26.4	1.9	18.0	98.5	86.7	62.0	77.6
339	Non-metallic Mineral Products (n.e.c.)	727	33.3	3.5	21.4	95.7	76.2	52.0	63.2
341	Basic Iron and Steel Industries	709	43.5	5.3	43.1	84.9	31.3	2.7	16.2
331	Structural Clay Products	604	42.9	10.6	9.6	94.5	70.4	53.2	50.0
370	Electical Machinery	485	25.0	9.0	23.0	83.2	28.8	25.1	21.1
291	Tanneries and Leather Finishing	413	16.1	1.6	39.9	97.4	77.0	63.7	88.8
342	Non-ferrous Metals	267	8.2	2.4	24.7	91.7	36.6	13.9	41.2
300	Rubber Products	257	15.2	7.0	18.2	92.1	38.2	41.5	23.9
332	Glass and Glass Products	211	25.0	1.5	8.2	88.6	67.1	24.8	49.9
311	Basic Industrial Chemicals	207	9.1	2.8	17.6	76.9	18.2	3.4	17.9
	All other manufactures	3,456	113.0	17.0	83.3				
	TOTAL	36,457	1,337.6	211.6	1,232.4	92.1	37.9	17.5	32.9

Source: Annual Survey of Industries, 1960:
Special provisional tabulation on census sector; draft National Sample Survey No. 114 on sample sector.
Material presented in slightly different order as Table 1 - Development of Small Scale Industries in India, Prospects, Problems and Policies, Report of the International Perspective Planning Team, Ministry of Industry, 1963.

Table 10: INDIA: INDICES OF INDUSTRIAL PRODUCTION

1956 = 100

	Weight [1]	1951	1952	1953	1954	1955	1957	1958	1959	1960	1961	1962	1963	1964 Jan.-Sept.
GENERAL INDEX		73.5	75.8	77.7	83.1	91.9	104.2	107.7	116.9	130.1	139.2	149.7	163.9	172.2
MINING & QUARRYING	7.47	87.0	91.9	90.4	93.2	97.1	109.6	116.0	122.7	137.2	147.3	161.3	175.9	169.0
Coal mining	7.09	87.0	91.0	90.6	93.2	96.9	110.3	115.0	119.3	131.3	140.0	153.6	167.0	160.0
MANUFACTURING	88.85	72.9	75.1	77.1	82.5	91.6	103.3	105.7	114.5	127.6	135.2	145.5	158.4	167.2
Food manufacturing	13.99	79.6	84.7	82.3	81.9	93.3	106.4	107.6	109.6	117.4	129.3	127.3	122.3	129.0
Sugar	4.52	59.0	72.6	66.4	55.6	82.7	105.9	100.2	106.6	130.4	143.4	140.4	116.7	117.6
Tea	7.42	93.6	92.9	91.3	96.2	99.2	100.8	106.9	107.1	104.5	116.7	113.2	113.3	115.3
Cigarettes	1.46	81.6	76.5	70.0	75.4	86.8	110.7	113.4	122.9	140.6	150.0	155.7	154.9	171.2
Manufacture of textiles	41.76	78.5	81.5	87.2	90.3	93.4	99.9	98.5	102.1	104.8	108.4	113.5	120.9	128.1
Cotton	32.16	80.1	85.1	91.2	93.4	95.4	100.8	100.1	101.2	103.0	108.5	109.4	115.6	124.3
Wool	1.10	70.7	66.3	76.6	80.0	82.1	103.8	116.4	104.1	101.3	107.3	138.5	165.6	130.4
Silk & synthetics	2.94	64.8	42.1	55.8	70.7	77.2	99.3	98.8	119.3	135.1	144.9	153.9	169.8	211.6
Art Silk (incl. synthetics)	0.36	-	-	55.3	71.8	77.1	97.8	92.3	114.5	126.5	132.7	139.5	150.9	193.3
Rayon (viscose yarn)	2.58	-	-	59.7	67.8	78.6	128.9	180.6	203.1	259.1	289.6	353.7	421.7	493.2
Jute	5.62	78.8	84.8	79.7	84.8	93.5	94.7	97.3	98.3	99.3	89.6	110.4	117.2	122.2
Hessian	2.40	-	-	93.7	93.7	96.8	99.7	98.0	110.4	102.0	84.6	114.6	125.1	128.9
Sacking	2.73	-	-	74.3	83.6	94.9	90.6	96.3	83.2	89.4	78.6	89.6	82.7	81.5
Manufacture of footwear	0.28	91.5	86.3	87.4	84.2	86.3	115.6	114.3	120.2	144.0	166.0	180.4	214.4	215.8
Wood & cork (excl. furniture)	0.24	55.3	70.4	48.8	61.4	87.7	104.1	105.4	137.2	147.8	150.2	162.4	194.8	196.3
Paper & paper products	1.39	66.5	69.2	72.1	81.4	95.9	109.5	127.3	145.4	173.4	181.9	190.6	226.8	238.0
Paper	1.24	-	-	72.2	80.4	95.9	108.7	131.1	152.0	175.6	185.3	197.1	235.7	248.6
Printing & writing	0.88	-	-	77.7	83.6	97.1	102.9	125.4	144.0	172.1	183.5	187.5	245.7	257.9

Table 10 (cont'd.)

	Weight /1	1951	1952	1953	1954	1955	1957	1958	1959	1960	1961	1962	1963	1964 Jan.-Sept.
Wrapping	0.20	-	-	68.3	78.2	91.5	122.9	129.1	179.5	206.5	190.4	240.2	244.0	262.1
Special varieties	0.16	-	-	59.2	82.9	97.2	124.7	109.1	92.3	146.3	153.2	137.1	135.0	108.4
Paper-board	0.15	-	-	57.8	69.7	93.4	114.0	155.0	165.0	165.3	191.5	203.5	229.6	230.2
Leather and Fur	0.18	109.5	87.7	87.1	89.0	93.1	93.2	94.7	101.6	167.1	115.6	125.2	149.1	137.3
Rubber Products	3.04	75.4	68.1	71.3	83.9	92.0	104.1	108.1	118.1	141.3	157.4	169.4	186.9	196.3
Car tires	1.41	-	-	81.9	88.8	94.0	105.6	107.1	121.3	145.0	166.5	182.2	205.4	218.5
Chemicals & Chem. Products	3.56	72.9	78.4	83.1	84.5	96.3	100.5	112.5	128.3	149.1	173.6	183.9	225.4	223.7
Basic Industrial Chemicals	0.97	58.1	54.6	64.8	75.9	91.4	104.0	123.3	152.4	193.2	245.9	278.1	405.9	348.4
Heavy Organic Chemicals	0.18	71.8	76.7	78.7	85.1	100.0	110.7	125.2	142.7	173.0	209.3	240.0	295.7	363.1
Heavy Inorganic Chemicals	0.61	54.5	48.3	60.6	73.7	89.2	112.7	131.0	155.2	207.7	279.1	318.8	512.0	390.1 /2
Synthetic Resins	0.01	20.9	30.2	37.9	47.9	70.9	119.2	167.1	255.4	219.6	308.8	396.0	523.6	581.3
Dyestuff	0.17	-	-	-	-	-	65.1	94.4	146.5	161.0	161.5	165.2	134.8	169.2
Fertilizers	0.60	21.7	56.0	74.5	92.1	98.7	108.1	113.6	128.7	147.1	167.7	185.2	214.9	242.8
Phosphoric (super phosphate)	0.08	-	-	59.6	129.3	91.5	174.9	205.6	305.3	387.0	452.0	544.0	703.0	834.7
Nitrogenous (Ammonium sulphate)	0.52	-	-	82.2	87.6	101.1	97.8	98.8	97.4	97.4	100.1	106.0	112.2	102.7
Petroleum Products	3.79	6.4	6.0	6.3	16.5	77.7	114.3	122.7	132.4	147.7	156.5	169.2	196.6	215.6
Non-Metallic Minerals	2.47	64.4	69.1	70.2	80.0	87.5	114.6	128.7	146.0	168.1	180.8	191.1	204.6	215.0
Cement	1.24	64.8	71.8	76.7	89.2	91.0	113.6	123.1	138.5	156.7	164.7	171.5	186.8	189.8

Table 10 (cont'd.)

	Weight /1	1951	1952	1953	1954	1955	1957	1958	1959	1960	1961	1962	1963	1964 Jan.- Sept.
Basic Metals	9.25	83.5	85.7	80.9	95.0	96.6	99.5	106.7	138.5	183.1	181.6	227.1	259.1	255.6
Iron and Steel	7.48	84.3	87.5	82.5	95.4	96.2	98.8	104.8	140.1	192.1	188.0	236.1	269.5	265.7
Pig Iron	-	93.3	94.0	91.7	99.6	97.6	98.5	107.5	157.3	212.9	254.4	295.6	336.7	329.8
Finished Steel	-	80.5	82.4	76.5	92.9	94.2	100.6	97.1	129.8	163.5	205.8	279.4	314.5	315.1
Copper smelting & rolling	0.23	71.9	70.3	63.7	91.0	89.6	109.4	119.5	111.4	134.8	149.4	148.4	150.5	132.6
Aluminum	0.61	59.2	54.9	52.9	73.4	101.1	96.5	128.1	185.5	177.7	206.3	277.0	382.5	384.0
Brass	0.36	82.9	61.6	73.9	114.7	96.4	130.6	149.8	154.0	196.4	184.7	183.4	187.5	178.9
Manufacture of Metal Products	0.99	54.4	54.3	58.2	86.6	96.5	97.8	102.5	98.3	105.9	152.3	179.1	198.1	218.0
Machinery except electrical	1.10	45.2	35.7	37.7	57.5	83.3	129.5	148.3	185.8	236.7	268.7	290.5	363.5	399.8
Internal combustion eng.	0.27	63.4	37.2	33.3	75.7	99.4	119.0	171.2	254.9	332.2	331.3	291.8	364.8	399.9
Industrial machinery	0.50	43.2	37.4	31.2	42.5	75.9	136.3	132.4	154.3	191.1	240.0	282.0	377.9	441.8
Office & household machinery	0.30	34.1	31.2	47.2	65.5	81.9	125.1	148.6	178.1	224.7	256.1	294.8	327.3	312.7
Electrical machinery	2.41	43.6	49.4	52.2	58.4	71.9	118.6	124.6	133.4	175.9	183.2	211.3	237.7	274.6
Power transformer	0.17	21.1	23.4	33.5	43.4	61.4	132.6	122.6	110.5	139.4	195.4	256.4	287.1	341.2
Electric Motors	0.22	39.6	43.9	45.2	52.3	70.2	130.9	173.7	160.3	193.8	231.1	273.9	329.6	355.7
Cables and wires	0.72	31.4	55.2	61.1	57.3	75.7	116.7	115.8	117.6	182.3	181.2	207.0	238.4	315.4
Batteries	0.37	74.4	63.6	72.0	73.7	83.5	96.1	100.4	117.4	132.3	136.0	149.9	177.5	187.6
Lamps	0.13	52.0	55.4	53.0	64.2	78.7	109.5	101.7	116.0	143.0	166.0	226.9	268.3	275.0
Fans	0.27	60.5	57.8	59.0	70.5	80.5	155.0	187.8	214.4	299.2	317.2	337.4	338.0	312.2
Radios	0.14	45.2	47.0	37.4	37.6	53.9	126.6	131.5	142.0	178.2	216.7	231.5	278.5	305.3

Table 10 (cont'd.)

	Weight /1	1951	1952	1953	1954	1955	1957	1958	1959	1960	1961	1962	1963	1964 Jan.-Sept.
Transport Equipment	2.86	46.1	39.7	41.6	49.5	73.1	105.4	95.5	98.3	119.4	130.8	144.7	151.1	191.4
Railway Wagons	1.04	-	-	-	-	95.4	105.8	84.4	62.7	46.6	65.7	86.9	118.3	151.4
Automobiles	1.28	69.3	47.6	43.3	45.0	71.8	99.3	83.4	113.5	162.2	169.0	179.9	162.4	207.2
Motorcycles	0.01	-	-	-	-	19.9	149.7	139.3	151.6	308.9	489.0	494.3	489.3	624.6
Bicycles	0.49	17.2	29.7	39.8	56.1	74.0	119.1	137.4	149.2	158.1	158.0	168.1	178.7	208.6
ELECTRICITY	3.68	60.9	63.7	69.0	77.4	88.1	112.8	127.4	151.4	171.0	198.8	223.4	257.9	293.9

/1 Weights used in computing general index based on 1956 structure of output.

/2 From 1964 Nitric and Phosphoric acids going into fertilizer production are excluded.

Source: Monthly Statistics of the Production of Selected Industries of India, October 1964, Central Statistical Organisation.

Table 11: PRODUCTION IN SELECTED INDUSTRIES

Product	Unit	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964 Jan.-Sept.
Coal	000 metric tons	3,045.0	3,116.0	3,238.0	3,340.0	3,680.0	3,835.0	3,981.0	4,385.0	4,675.0	5,129.0	5,577.0	5,342.0
Iron Ore	000 metric tons	309.0	334.0	360.0	360.0	391.0	483.0	665.0	890.0	1,023.0	1,112.0	1,232.0	1,216.0
Pig Iron	000 metric tons	140.0	151.8	148.7	152.8	151.5	169.4	253.0	345.0	412.2	483.2	550.3	538.9
Finished Steel	000 metric tons	86.8	105.2	106.7	113.2	113.9	110.0	146.9	185.2	233.2	309.0	354.8	357.0
Aluminum (virgin metal)	metric tons	318.2	413.8	611.6	550.0	658.8	692.1	1,459.0	1,534.4	1,531.8	2,934.3	4,448.8	4,589.4
Copper (virgin metal)	metric tons	416.4	605.8	616.0	645.2	663.0	662.5	646.8	751.3	728.8	815.1	799.4	776.1
Machine tools	000 rupees	367.3	416.9	620.0	1,001.9	2,090.4	3,133.4	3,978.7	5,577.5	7,097.4	9,847.0	14,988.6	19,069.4
Sugar Machinery	000 rupees	-	230.0	160.0	270.0	1,350.0	1,670.0	2,370.0	3,490.0	3,890.0	5,360.0	4,780.0	5,963.0
Power driven pumps	000's	2.1	2.4	2.9	3.9	5.3	6.5	7.1	8.7	10.6	10.7	12.5	13.3
Automobiles	000's	1.16	1.20	1.92	2.68	2.66	2.23	3.04	4.34	4.53	4.82	4.35	5.58
Bicycles	000's	22.01	31.03	40.93	55.33	65.88	76.05	82.56	87.51	87.41	93.04	98.50	115.42
Sewing Machines	000's	5.20	6.68	8.46	10.87	13.96	17.10	21.05	24.77	25.62	28.58	28.82	18.33
Railway wagons	000's	-	-	1.27	1.34	1.41	1.13	0.84	0.62	0.88	1.16	1.58	2.02
Motor Cycles	000's	-	-	0.035	0.085	0.152	0.221	0.270	0.333	0.757	0.736	0.753	1.011
Typewriters	000's	-	-	0.772	1.118	1.283	1.321	1.786	1.963	2.592	3.027	3.533	3.732
Power Transformers	000 KVA	25.7	33.3	47.1	76.6	101.6	93.9	84.7	106.8	149.7	192.2	219.9	261.4
Electric Motors	000 HP	13.5	15.6	21.0	29.9	39.1	52.0	48.0	58.0	69.1	82.2	98.5	106.4
Radios	nos.	4,689	4,717	16,767	12,550	15,891	16,506	17,822	22,360	27,195	28,607	34,955	38,317
House service motors	nos.	6,723	12,407	21,279	19,192	27,545	29,020	31,369	40,036	52,663	73,145	99,469	107,220
Electric lamps/1	000's	1,647.3	1,923.0	2,019.5	2,560.7	2,762.4	2,539.7	2,903.4	3,449.6	3,907.5	4,878.5	5,860.4	6,084.0
Electric fans	000's	16.6	19.9	23.5	28.2	43.7	53.0	60.5	84.4	89.5	94.1	95.3	88.0
Bare copper wire	metric tons	623.0	641.0	714.0	867.0	724.0	634.0	561.0	829.0	636.0	412.0	366.0	500.0
Aluminum Conductors	metric tons	-	464.0	680.0	956.0	1,301.0	1,215.0	1,194.0	1,919.0	1,866.0	2,388.0	2,701.0	3,657.0

/1 Excluding Miniature Lamps

Table 11 (cont'd)

Product	Unit	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964 Jan.-Sept.
Ammonium Sulphate	metric tons	5,406.0	5,755.0	6,650.0	6,575.0	6,425.0	6,505.0	6,405.0	6,400.0	6,590.0	6,968.0	7,376.0	6,766.0
Superphosphate	metric tons	681.0	1,480.0	1,045.0	1,143.0	1,998.0	2,350.0	3,495.0	4,419.0	5,170.0	6,218.0	8,056.0	9,558.0
Sulphuric Acid	metric tons	9,220.0	12,750.0	14,090.0	13,970.0	16,580.0	19,190.0	24,730.0	29,495.0	35,208.0	39,122.0	42,970.0	55,977.0
Soda Ash	metric tons	4,810.0	4,086.0	6,540.0	7,135.0	7,775.0	7,560.0	7,944.0	12,107.0	14,720.0	18,548.0	22,247.0	24,139.0
Caustic Soda	metric tons	1,937.0	2,478.0	2,890.0	3,337.0	3,605.0	4,835.0	5,823.0	8,195.0	9,988.0	10,552.0	12,690.0	14,967.0
Cement	000 metric tons	320.0	372.0	379.0	417.5	474.0	514.0	577.5	653.7	687.1	715.5	779.6	792.0
Refractories	000 metric tons	19.3	20.3	23.2	26.9	31.0	36.7	42.2	45.9	52.2	55.9	54.9	54.1
Paper & paper board	metric tons	11,820.0	13,150.0	15,670.0	16,380.0	17,800.0	21,430.0	24,900.0	28,777.0	30,326.0	32,303.0	38,551.0	40,818.0
Automobile tires	000's	64.0	69.4	73.5	78.2	82.5	83.8	94.9	113.5	130.2	142.5	160.5	170.9
Automobile tubes	000's	54.9	62.4	65.5	76.5	78.0	78.9	93.7	106.8	123.7	136.9	169.1	188.3
Bicycle tires	000's	387.1	435.5	479.0	526.7	596.0	688.3	792.6	902.5	945.5	995.0	1,182.2	1,352.8
Bicycle tubes	000's	383.4	464.8	466.1	531.1	585.6	654.5	829.2	1,056.3	1,070.7	963.5	1,111.9	1,254.0
Footwear (Rubber)	100,000 Pairs	20.0	26.0	29.1	30.1	30.8	30.6	32.7	37.2	37.6	41.5	38.8	38.7
Soap	metric tons	6,950.0	7,430.0	8,370.0	9,320.0	9,450.0	10,440.0	11,000.0	11,900.0	12,417.0	12,625.0	13,263.0	14,168.0
Petroleum Products	000 metric tons	20.6	54.5	252.0	324.2	370.6	397.7	429.4	478.9	507.5	548.7	637.5	698.9
Cotton Yarn	000 kg.	56,880	59,090	61,500	63,220	67,250	63,650	65,000	65,600	71,858	71,630	74,381	79,109
Cotton Cloth (mill sector)	000 meters	371,000	380,000	387,500	404,300	405,000	375,000	375,000	384,200	391,204	380,021	368,571	386,102
Cotton Cloth (decentralized sector)	million meters	118	126	135	139	151	164	173	168	198	201	240	248
Jute Products	000 metric tons	73.5	78.5	86.8	92.5	87.1	89.8	88.9	90.4	80.9	98.9	103.0	106.1
Woollen fabrics	000 meters	1,015	1,047	1,036	1,240	1,228	1,477	1,160	1,163	1,100	1,524	1,700	997
Rayon (Viscose Yarn)	metric tons	369.0	418.0	486.0	618.0	795.0	1,117.0	1,255.0	1,601.0	1,790.0	2,186.0	2,606.0	3,048.0
		1952/53	53/54	54/55	55/56	56/57	57/58	58/59	59/60	60/61	61/62	62/63	63/64(12 mos)
Sugar	000 metric tons	109.2	85.7	134.9	157.0	169.8	169.8	162.3	206.1	252.4	226.3	180.0	214.6
Tea	000 kg.	23,000	24,350	25,300	25,200	25,470	27,000	27,000	26,355	29,424	28,555	28,576.0	29,089
Coffee	metric tons	1,912.0	2,485.0	2,115.0	2,917.0	3,460.0	3,710.0	3,798.0	4,289.0	5,476.0	3,955.0	4,865.0	6,604.0
Wheat flour	000 metric tons	41.0	37.5	41.3	45.5	61.4	69.1	81.3	82.9	83.5	100.2	110.2	147.7

Source: Monthly Statistics of the Production of Selected Industries of India, October 1964, Central Statistical Organisation, Calcutta.

Table 12

Table 12: SELECTED PRODUCTION TARGETS AND ANTICIPATED ACHIEVEMENTS - THIRD PLAN

		Target	Likely Achievement	% of Target Likely to be Achieved
Metals				
Steel Ingots	thous.tons	9,200	7,100	76
Pig Iron for Sale	"	1,500	1,200	80
Alloy, Tool and Stainless Steel	"	200	35	18
Aluminum	"	80	80	100
Copper	"	20	17.4	87
Basic Metal Products				
Steel Castings	thous.tons	200	150	75
Steel Forgings	"	200	150	75
Cast Iron Pipes	"	800	550	69
Steel Wire Ropes	"	40	25	63
Basic Industrial Materials				
Cement	thous.tons	13,000	11,500	89
Sulphuric Acid	"	1,500	1,200	80
Soda Ash	"	450	350	78
Caustic Soda	"	340	300/1	88
Grinding Wheels	"	5.4	4.0	74
Paints and Varnishes	"	140	100	72
Rayon Grade Pulp	"	90	58	65
Paper and Paperboard	"	700	530	76
Newsprint	"	120	30	25
Refractories	"	1,500	1,100	73
Winding Wires	"	24	12	50
Plastics (polyethylene PVC etc.)	"	74	69.5	94
Machinery & Equipment				
Boilers	Rs. Crores	25	1.2	5
Sugar Mill Machinery	"	14	9	65
Passenger Cars	thous.	30	25	84
Commercial Vehicles	"	60	54	90
Motorcycles, Scooters	"	50	50	100
Bicycles	"	2,000	1,700	85
Sewing Machines	"	700	600	86
Clocks	"	200	80	40
Time pieces	"	1,200	500	42
Watches	"	1,200	400	33
Dry Batteries	"	800	750	94
Storage Batteries	"	800	650	81
Fertilizers				
Nitrogenous (in terms of N)	thous.tons	800	300	38
Phosphate (in terms of P_2O_5)	"	400	200	50

/1 Mission estimate.

Source: The Third Plan Mid Term Appraisal, Planning Commission, Nov. 1963. The figures also reflect, in so far as possible, subsequent revisions of achievement estimates made by Planning Commission in Oct. 1964 and Sept. 1965.

Table 13: THIRD PLAN IMPORTS - ESTIMATED REQUIREMENTS AND ACTUAL IMPORTS EXCLUDING PL 480

(in Rs. Crores)

	Estimated Requirements I	Estimated Requirements II	Actual Imports/1	Differences
Maintenance Imports				
Metals				
Iron & Steel	210	698	471	- 227
Non-ferrous	330	313	286	- 27
Total Metals	540	1,011	757	- 254
Machinery & Equipment				
Industrial	493	430	2,008	+ 1,578
Transport	353	317	383	+ 66
Total Machinery & Equipment	846	747	2,391	+ 1,644 /2
Manufactures of Metals	125	87	97	+ 10
Fertilizer	188	171	163	- 8
All Others	2,151	2,206	2,242	+ 36
Total Maintenance Imports	3,850	4,222		
Machinery and Equipment for Plan Projects	1,900	1,900		- 1,900 /2
GRAND TOTAL	5,750	6,122	5,650	- 472

/1 including estimates for 1965/66.

/2 If it is assumed that "Machinery and Equipment for Plan Projects" is included within the import category "Machinery & Equipment", the shortfall for the combined "maintenance" and "project" requirements of machinery & equipment is Rs. 256 crores. From the statistics available, it is not possible to allocate this shortfall between the two categories.

Sources: Estimate I - Overall figures from Third Five Year Plan; detail of Maintenance Imports from estimates of Anjaria Committee.
Estimate II - Estimates of Maintenance Imports as revised by Ministry of Finance, June 30, 1964.
Actuals - 1961/62, 1962/63, 1963/64 - Indian Econ. Statistics, Ministry of Finance, August 1964, 1964/65 and estimate for 1965/66 - Memorandum for the India Consortium 1965, Ministry of Finance.
PL 480 imports excluded in all cases.

Table 14: DEVELOPMENT OF CAPITAL COST ESTIMATES: SELECTED PUBLIC SECTOR ENTERPRISES
(in Rs. crores)

	Original Estimate	Most Recent Estimate	Increase due to Expansion of Project	Net Increase	Net Increase (%)
Hindustan Steel Ltd.	357.8 1/	640.8	-	283.0	79%
Heavy Engineering Corp.	165.3	235.2	-	69.9	42%
Neyveli Lignite Corp.	68.9	144.3	23.0	52.4	75%
Heavy Electricals Ltd. (Bhopal)	35.3	58.6	5.7	17.6	51%
Fertilizer Corp. of India					
Nangal Project	20.9	31.2	2.0 (est.)	8.3	38%
Trombay Project	24.3	37.8	4.4	9.1	42%
TOTAL	672.5	1,148.9	35.1	440.3	65%

Source: Compiled by mission from annual reports, reports of Estimates Committee and information given to mission by enterprises.

1/ Estimates of Rs. 40 crores per plant for off-site facilities were excluded from this estimate.

Table 15: CLASSIFICATION OF INCREASES IN CAPITAL COSTS: SELECTED PUBLIC SECTOR ENTERPRISES

(in Rs. crores)

	Net Increase in Costs /1	Items Omitted from Original Estimates	Increases in Costs of Particular Items
Heavy Engineering Corp.	69.9	51.9	18.0
Heavy Electricals Ltd. (Bhopal)	17.6	15.0	2.6
Fertilizer Corp. of India			
Nangal Project	8.3	2.6	5.7
Trombay Project	9.1	3.8	5.3
TOTAL	104.9	73.3	31.6
	100%	70%	30%

/1 See Table 14.

Source: Compiled by mission from annual report, reports of Estimates Committee and information given to mission by enterprises.

Table 16: TIME REQUIRED FOR IMPLEMENTATION OF PUBLIC SECTOR INDUSTRIAL PROJECTS
AVERAGE TIME BETWEEN VARIOUS STAGES (IN MONTHS)

Period	All Projects		Projects conceived since 1960/61		Projects with Investment of Rs. 10 crores or less		Projects with investment of Rs. 40 crores or more	
From conceiving to project approval by Government /1	24	(15)	21	(5)	n.a.		17	(5)
From approval to start of construction	12	(14)	2	(5)	3	(1)	15	(5)
From start of construction to start of production	32	(19)	25	(6)	17	(4)	28	(5)
From start of production to production at full capacity	52	(20)	54	(6)	23	(4)	79	(7)
TOTAL	120		102		n.a.		139	

Note: Figures in brackets indicate number of plants included in the average.

/1 **From time government approved project in principle and/or awarded contract to consultant to draw up project report to time when project report was accepted by government.**

Source: Table 17.

Table 17: STAGES IN THE IMPLEMENTATION OF SELECTED PUBLIC SECTOR INDUSTRIAL PROJECTS

	Project Conceived[1]	Project Report Received	Project[2] Approved by Government	Start of Construction	Start of Production	Production at Full Capacity
Rourkela Steel Plant	1953			Feb. 1956	Feb. 1959	1964/65
Bhilai Steel Plant	1955		March 1956		Feb. 1959	Jan. 1962
Durgapur Steel Plant	1955		1956		Feb. 1960	1964
Neyveli: Mine	1954	Nov. 1954	Aug. 1956	May 1957	July 1960	Feb. 1966[3]
Neyveli: Power	Dec. 1957	Oct. 1958	March 1959	Jan. 1959	May 1962	July 1964
Neyveli: Fertilizer			Feb. 1958	1960	Sept. 1965	March 1966[3]
Neyveli: Briquetting and Carbonization			June 1959	March 1961	April 1965	Dec. 1965[3]
Heavy Electricals Ltd., Bhopal	Nov. 1955	Nov. 1956		Nov. 1958	July 1960	1967[3]
Heavy Electricals Ltd., Hyderabad	June 1961	Sept.1962	July 1963	Aug. 1963	March 1966	1970/71[3]
Heavy Electricals Ltd., Trichinopoly	Aug. 1961	Aug. 1962	May 1963	June 1963	Feb. 1965	1971/72[3]
Heavy Electricals Ltd., Hardwar	May 1962	July 1963	Sept. 1963	Oct. 1963	Feb. 1966	1972/73[3]
Hindustan Machine Tools Ltd., Bangalore I	March 1949				Oct. 1955	1957/58
Hindustan Machine Tools Ltd., Bangalore II				April 1960	July 1961	Nov. 1962
Hindustan Machine Tools Ltd., Pinjore				July 1962	April 1964	1965/66

cont.'d.

Table 17 (cont.'d.)

	Project Conceived[1]	Project Report Received	Project[2] Approved by Government	Start of Construction	Start of Production	Production at Full Capacity
Hindustan Machine Tools Ltd., Alwaye, Kerela			April 1963	July 1963	Oct. 1964	1967/68[3]
Hindustan Machine Tools Ltd., Hyderabad	Dec. 1963				April 1966	
Hindustan Machine Tools Ltd., Watch Factory				Sept. 1961	Jan. 1963	
Heavy Engineering Co., HMBP	Dec. 1957	June 1959	Nov. 1959	Sept. 1961	March 1964	1972/73
Heavy Engineering Co., CMMP	Dec. 1957	April 1959	Aug. 1959	Aug. 1961	March 1964	1970/71
Heavy Engineering Co., FFP	Aug. 1958	Nov. 1959	April 1960	March 1962	June 1964	1975
Heavy Engineering Co., HMTP	May 1961	April 1962	May 1963	Sept. 1963	1966/67	1971/72
Fertilizer Corporation of India, Nangal	July 1955		Nov. 1956	June 1958	Feb. 1961	Dec. 1962
Fertilizer Corporation of India, Trombay	March 1957		April 1959	June 1960	April - Oct. 1965[3]	
Fertilizer Corporation of India, Namrup	1954	May 1960	June 1960			
Fertilizer Corporation of India, Gorakpur	Feb. 1960	Feb. 1963	Oct. 1961			

Table 17
Page 2

cont.'d.

Table 17 (cont.'d.)

/1 Approval of project in principle by Government or awarding contract to consultant to draw up project report.

/2 Generally coincides with acceptance of project report.

/3 Estimate

Source: Annual reports of enterprises, reports of Estimates Committee and Committee on Public Undertakings and material submitted to Mission by enterprises.

Table 18 : WORKING RESULTS OF CENTRAL GOVERNMENT INDUSTRIAL ENTERPRISES EARNING PROFITS OF 10% OR MORE ON CAPITAL EMPLOYED

(Figures in Rs. lakhs)

Enterprise & Date Incorporated	Year Ending March 31,	Capital[1] Employed	Sales	Gross Profits	Gross Profits as % of Capital Employed
Hindustan Antibiotics (1954)	1963	622.8	407.4	139.9	22.5
	1964	651.3	453.4	144.8	22.2
Hindustan Machine Tools (1953)	1963	1119.9	708.2	233.4	20.8
	1964	1528.6	982.7	327.0	21.4
Indian Rare Earths (1950)	1963	108.9	72.7	12.2	11.2
	1964	122.0	81.4	22.5	18.5
Hindustan Insecticides (1954)	1963	191.8	160.5	44.5	23.2
	1964	211.2	155.7	36.8	17.4
Indian Telephone Industries (1950)	1963	878.2	788.0	121.6	13.8
	1964	1049.8	950.6	171.3	16.3
National Instruments (1957)	1963	110.6	80.0	12.3	11.1
	1964	119.4	97.4	19.2	16.1
Hindustan Salts (1958)	1963	160.6	90.7	15.9	9.9
	1964	181.1	153.9	24.9	13.7
National Newsprint & Paper Mills (1947)	1963	554.6	280.9	55.5	10.0
	1964	554.2	318.1	76.0	13.7
Mazagon Dock (1934)	1963	177.8	281.5	21.1	11.8
	1964	272.8	433.9	32.3	11.8
National Projects Construction (1957)	1963	277.8	240.4	22.9	8.2
	1964	424.4	510.5	47.9	11.3

cont.'d.

Table 18 (cont.'d.)

	March 31,	Capital[1] Employed	Sales	Gross Profits	Gross Profits as % of Capital Employed
Hindustan Cables (1952)	1963	373.1	324.9	48.1	12.9
	1964	387.1	369.3	42.7	11.0
Travancore Minerals (1956)	1963	74.7	70.7	18.1	24.2
	1964	75.1	20.1	2.9	3.9
TOTAL	1963	4650.8	3505.9	745.5	16.0
	1964	5577.0	4527.0	948.3	17.0

/1 Capital employed = gross fixed assets minus accumulated depreciation plus working capital.

Source: Annual Report on the Working of Industrial and Commercial Undertakings of the Central Government for the Year 1963-64, Ministry of Finance

Table 19: WORKING RESULTS OF THE 10 LARGEST CENTRAL GOVERNMENT INDUSTRIAL ENTERPRISES

(Figures in Rs. Crores)

	March 31,	Capital Employed /1	Sales	Gross Profits /3	Gross Profits as % of Capital Employed
Hindustan Steel Ltd. (1954)	1960	512	12.2	-1.19	-
	1961	558	41.0	-0.54	-
	1962	605	70.9	-18.90	-
	1963	632	124.4	-6.04	-
	1964	664	181.1	13.12	2.0
Neyveli Lignite Corp. (1956)	1960	29) /2	-	-	-
	1961	49)	-	-	-
	1962	76)	-	-	-
	1963	95)	-	-	-
	1964	113)	-	-	-
Heavy Engineering Corp. (1958)	1960	2) /2	-	-	-
	1961	7)	-	-	-
	1962	24)	-	-	-
	1963	62)	-	-	-
	1964	101)	-	-	-
National Coal Development Corp. (1956)	1960	33	9.1	0.52	1.6
	1961	48	12.8	1.39	3.1
	1962	52	14.2	0.43	0.8
	1963	62	17.2	2.04	3.3
	1964	78	19.7	1.03	1.3
Fertilizer Corp.(1961) /4	1960	32	9.5	0.52	1.6
	1961	32	11.5	0.83	2.6
	1962	62	18.6	0.76	1.2
	1963	64	22.6	2.38	3.7
	1964	64	22.9	2.93	4.5

cont.'d.

Table 19 (cont.'d.)

	March 31,	Capital Employed[1]	Sales	Gross Profits[3]	Gross Profits as % of Capital Employed
Heavy Electricals Ltd. (1956)[5]	1960	-	-	-	-
	1961	-	-	-	-
	1962	23	1.8	-0.97	-
	1963	32	3.0	-3.53	-
	1964	40	4.5	-3.65	-
Indian Refineries Ltd. (1958)[6]	1960	-	-	-	-
	1961	-	-	-	-
	1962	-	-	-	-
	1963	18	8.5	-0.96	-
	1964	23	24.1	0.74	3.2
Hindustan Aircraft (1940)	1960	16	8.8	0.5	3.2
	1961	18	8.3	0.6	3.3
	1962	21	8.8	0.8	3.8
	1963	22	10.9	1.1	5.0
	1964	23	12.0	1.4	6.1
Hindustan Machine Tools (1953)	1960	7	2.2	0.5	6.8
	1961	7	3.4	0.8	11.4
	1962	10	4.8	1.4	14.0
	1963	11	7.1	2.3	20.9
	1964	15	9.8	3.3	22.0
Fertilizers and Chemicals Travancore (1943)	1960	-	-	-	-
	1961	-	-	-	-
	1962	-	-	-	-
	1963	9	4.8	-0.1	-
	1964	10	5.3	0.4	4.0
TOTAL[7]	1960	600	41.8	0.85	0.1
	1961	663	77.0	3.08	0.5
	1962	773	119.1	-16.48	-
	1963	850	198.5	- 0.89	-
	1964	917	279.4	19.27	2.1

cont.'d.

Table 19 (cont.d)

/1 Gross fixed assets minus accumulated depreciation plus working capital.

/2 Figures for Neyveli and HEC not completely comparable as they represent investment (equity and loans). These two enterprises are still under construction and are not included in the figures for the total.

/3 Profits before interest and taxes.

/4 Figures for 1960 and 1961 refer to Sindri only.

/5 Figures for sales refer to output; capital employed estimated to exclude work in progress.

/6 Figures refer to Gauhati refinery only; excise duties not included in gross profits.

/7 Figures for Neyveli and HEC excluded.

Source: Annual Reports on the Working of Industrial and Commercial Undertakings of the Central Governments for the Years 1960-61, 1961-62, 1962-63, 1963-64, Ministry of Finance.

Table 20: NANGAL FERTILIZER PROJECT - STATEMENT SHOWING DELAYS IN PROCUREMENT OF REPLACEMENT PARTS FOR ELECTROLYZERS

Item	Amount (in 000 Rs.)	Date of Indent Note	Date of Order	Date of Application for Import License	Status as of November 25, 1964
Electrolyzer Frames	186	-	May 31, 1963	June 24, 1963	No import license has been granted; management decided to import Rs. 8,000 worth against blanket license.
13,000 Gaskets	780	May 7, 1964	Oct. 16, 1964	Oct. 6, 1964	Management decided on November 15, 1964 to import Rs. 75,000 worth against blanket license.
Stainless Steel Strips	157	May 11, 1964	Oct. 16, 1964	Aug. 24, 1964	Rs. 82,000 of foreign exchange released on September 22, 1964 but import license not yet granted.
Machine Screws, stainless steel	6	June 15, 1964	Oct. 22, 1964	Oct. 16, 1964	Management decided on November 24, 1964 to import against blanket license.
Bolts & Nuts, stainless steel	126	May 11, 1964	Not yet finalized	Not yet applied	-

Table 21 : CHAIRMEN AND GENERAL MANAGERS OF SELECTED CENTRAL GOVERNMENT INDUSTRIAL ENTERPRISES
NUMBER AND AVERAGE TENURE SINCE INCORPORATION

Enterprise	Date of Incorporation	Chairmen		General Managers	
		No.	Average Tenure (Months)	No.	Average tenure (Months)
Fertilizer Corporation	Jan. 1961	2	19	2	19
Heavy Electricals, Bhopal	Sept. 1956	3	30	3	30
Heavy Engineering Corp.	May 1959	2	59	-	-
Hindustan Antibiotics	April 1954	4	30	3	35
Hindustan Cables	1952	3	48	2	72
Hindustan Insecticides	March 1954	7	19	2	60
Hindustan Machine Tools	Feb. 1953	5	27	2	44
Hindustan Salts	April 1958	4	18	5	14
Hindustan Steel	March 1954	6	20	-	-
Rourkela		-	-	7	17
Durgapur		-	-	3	27
Bhilai		-	-	4	27
Indian Oil Company	1959	2	30	2	26
Indian Rare Earths	Aug. 1950	1	164	1	27
Indian Refineries	Aug. 1958	4	17	2	34
Indian Telephone	Aug. 1948	6	31	4	48
Mazagon Dock	May 1960	2	24	2	22
National Coal Dev. Corp.	Sept. 1956	5	18	1	45
National Instruments	June 1957	4	20	2	35
National Newsprint & Paper	July 1947	2	100	5	35
National Projects Construction	Feb. 1957	3	29	4	22
Neyveli Lignite Corp.	Dec. 1956	3	29	2	44

Source: Estimates Committee (1963-64), 52nd Report, Personnel Policies of Public Undertakings.

Table 22: DURATION OF TENURE OF FINANCIAL ADVISORS IN PUBLIC SECTOR ENTERPRISES

Duration of Tenure	Number of advisors
6 - 12 months	6
1 - 2 years	15
2 - 3 years	8
3 - 5 years	10
5 years and over	5

Note: Information does not cover all enterprises.

Source: V.V. Ramanadham, The Control of Public Enterprises in India, Asia Publishing House, 1964, p. 142.

Table 23: COMPARISON BETWEEN INVENTORIES AND PRODUCTION FOR SELECTED PUBLIC SECTOR ENTERPRISES, 1963-64

	Value of production (excluding depreciation)	Inventories at the end of year	Inventories in terms of number of months' value of production
	(Rs. crores)		
Hindustan Aircraft Ltd.	10.61	35.36	40
Hindustan Shipyard Ltd.	3.26	10.00	37
Travancore Minerals Ltd.	0.11	0.24	27
Bharat Electronics Ltd.	4.41	8.43	23
Indian Telephone Industries Ltd.	6.91	7.82	14
Praga Tools Ltd.	0.93	1.10	14
National Coal Development Corp. Ltd.	17.07	18.08	13
Fertilizers & Chemicals Travancore Ltd.	4.73	4.15	10
Hindustan Salts Ltd.	1.14	0.82	10
Hindustan Antibiotics Ltd.	2.64	2.23	10
National Instruments Ltd.	0.67	0.49	9
Hindustan Steel Ltd.	130.32	95.29	9
Nahan Foundry Ltd.	0.22	0.14	8
Hindustan Machine Tools Ltd.	5.91	4.08	8
Garden Reach Workshops Ltd.	2.56	1.80	8
Fertilizer Corporation of India Ltd.	17.79	9.76	7
Hindustan Insecticides Ltd.	1.06	0.55	6
Mazagon Dock Ltd.	3.97	1.88	6
Hindustan Cables Ltd.	3.25	1.63	6
Hindustan Housing Factory Ltd.	1.31	0.55	5
National Newsprint & Paper Mills Ltd.	2.26	0.72	4
Indian Rare Earth Ltd.	0.57	0.17	4
TOTAL	221.70	205.29	11

Source: Annual Report on the Working of Industrial and Commercial Undertakings of the Central Government for the Year 1963-64, Ministry of Finance.

VOLUME VI

MANUFACTURING INDUSTRY WITH SPECIAL REFERENCE TO PUBLIC SECTOR ENTERPRISE

APPENDICES I - IV

Note on Appendices

i. Support in terms of specific examples for some of the observations and recommendations made in the main report may be found in the following Appendix papers. They represent a part of the investigations on which the mission has based its report. The performance of other projects and other industries was also studied. However in these cases the relevant findings were incorporated in the main report without developing a supplemental paper.

ii. The first three papers deal with the selection, appraisal and implementation of three large public sector projects. The papers differ in scope and approach but all deal with the process of the investment decision and some of the subsequent problems of implementation. Although each of the projects selected for inclusion has encountered severe difficulties and none have very bright prospects from an economic point of view, it should be pointed out that this is not characteristic of all public sector industry. Nevertheless, we believe the problems described are sufficiently widespread to warrant the attention we have given them.

iii. The last paper deals with the performance and problems of the fertilizer industry. Although there have been important changes in the Government's policy in regard to this industry since this piece was written in the Spring of 1965, many of the observations are still valid.

APPENDIX I

REPORT ON THE BHOPAL HEAVY ELECTRICAL FACTORY [1]

I. M. D. Little

Oxford University

[1] This report was prepared for the use of the mission while Dr. Little was working under the auspices of the M.I.T. India Project.

APPENDIX I

REPORT ON THE BHOPAL HEAVY ELECTRICAL FACTORY

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REPORT ON THE BHOPAL HEAVY ELECTRICAL FACTORY

I. THE DECISION PROCESS

(a) Early History

1. A heavy electrical industry was first proposed in 1948. Project reports were obtained from several consultants, but further consideration was deferred in 1950 for financial reasons. The idea was revived in 1952. There followed a long drawn-out argument between the Ministry of Production and Ministry of Commerce and Industry, mainly concerning the capacity of the private sector, and its ability to grow to meet the demand. (It was not until the Industrial Policy Resolution of 1956 that new investment in heavy electricals was reserved for the public sector.) This was all based on almost ludicrous underestimates of demand.

2. The Estimates Committee of 1962-63 which reported on Bhopal, severely criticized the long delays after 1948. The point is not well taken. The issue for capital investment at any time is how much to do, and what particular things to do. One cannot say that Bhopal, or something similar, should have been decided on earlier, except in the light of the total resources and other investment opportunities from 1948-55. This the Committee did not investigate. It may be added that it seemed to labor under the naive illusion that the whole value of the output would represent a saving in imports.

3. The history from 1948-55 is thus not directly relevant. But a few remarks are worth making about the attitudes towards economic choice which seemed to have prevailed. It was evidently thought by most that if it was established that there was sufficient internal demand, then the case for a factory was made out. It was recognized that heavy equipment manufacture would be unprofitable. But, with some demur from the Ministry of Finance, and Ministry of Commerce and Industry, it was evidently not thought that this might be a reason to deploy India's limited resources for other purposes. Self-sufficiency was raised as an argument: but no one explained what particular reason there could be to want to be self-sufficient in heavy electrical equipment (one would have thought that if a war interrupted communciations with supplying countries, investment goods of this type would be one of the lowest priorities - that is, one of the last things in which one would want to be self-sufficient).

(b) The Heavy Electrical Equipment Project Enquiry (Iyengar) Committee

4. The effective fountainhead of Bhopal, as it now stands, was the Iyengar Committee which reported in March 1955. This Committee reassessed the demand. Despite the fact that its estimates were not, at that date, based on the kind of macro-economic projections and derived demands which began with the Second Plan, and were in consequence far too small, nevertheless it showed that there was sufficient demand for a factory, and that the private sector would not manufacture the heavier equipment because of its unprofitability. The Committee drew up a bill of goods (or "output-mix") which the factory should produce.[1] For heavier equipment these outputs were based on the principle of keeping well within their highly conservative projected demand.[2] Lighter equipment, which would be more profitable, was included to reduce the losses which were regarded as inevitable on heavy equipment in the first decade (this judgment was evidently based on A.E.I.'s earlier and discouraging project report of 1953). No thought appears to have been given to the question whether the inclusion of the lighter equipment with the heavier constituted a real economy (there is no merit to including profitable items with unprofitable within the same accounting unit, unless there are real economies). In fact, I was informed by the consulting engineers that, although probably there are always some technical economies in lumping things together on the same site, they would not be very significant in this case.

5. Although it does not emerge from the Report of the Committee or from any other documents I have seen, I was told that management considerations had, at some stage, been important. It was felt that India had only a few good managers, and that therefore it was believed that productive activities must be gathered together into relatively few units. Quite apart from the inclusion of lighter equipment, it also appears that there are few economies to be obtained from including heavy rotating equipment, as well as transformer and switch gear, in the same factory.

6. The output-mix produced by the Iyengar Committee is of great importance, because it has been closely stuck to until recently at least, and has thus dominated the development. Looking back one can now see that it was based on a series of doubtful arguments, and mistakes. Since demand was seriously underestimated, it was evidently felt that a rather large number of items of equipment must be produced to make a large enough unit (there is no suggestion in the Report that more than one unit was contemplated by the Committee). This multi-product conclusion was reinforced by the doubtful argument that lighter equipment must be produced to offset the anticipated losses on heavier equipment. Finally, at some stage

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1/ The Iyengar Committee referred always to "the factory" or "a factory". However, in the subsequent technical consultants agreements with A.E.I. it was specifically stated that the term "the factory" might be taken to mean one or more factories, and that A.E.I. should advise on whether one or more factories would be best.

2/ The amount of actual generating equipment included was indeed the same (175,000 kw) as that suggested by the Exploratory Committee of 1948.

in the decision process, the management argument apparently played some part in determining that the Iyengar Committee's specified products be all produced in one factory.

7. That demand was grossly underestimated, and that large enough units with more product specialization could have been planned, is undeniable. But the argument that management should be concentrated, is more controversial.1/ Some people would argue that Bhopal is so difficult to manage as it stands, that it is virtually unmanageable except by an experienced team of the highest caliber to be found anywhere in the world, and then only provided that the management does not suffer under the constraints which beset the management of public enterprise in India. The same people would argue that Indians (probably of a younger age-group than the experienced railway men which seem to form the core of the present top managerial cadre in India) could have been found to manage, with reasonable efficiency, a number of much smaller units - and that the slight loss of some economies of scale would have been much more than offset by having units which were quite literally much more manageable. I have quite inadequate experience to judge the merits of this argument: but, for what my impressions are worth, being derived from the obviously very great inherent difficulties of management at Bhopal, and from the views of several people with a closer acquaintance with management problems in India than myself, I would be strongly inclined to agree with this school of thought. Where economies of scale are not of great importance, at least it is true that one is taking a much greater risk in concentrating too much under one management.

8. The intrinsic difficulties of managing efficiently an engineering enterprise of the size of Bhopal, with its complex of more or less tailor-made outputs can hardly be exaggerated. It would be very difficult anywhere. Of course, the output-mix suggested by the Committee did not, in itself, determine that a unit with such high overheads as Bhopal should be set up. But, although the waste of capital would be less if a less capital-intensive factory had emerged, and could not be efficiently managed, nevertheless the managerial problem was largely determined by the bill of goods decided on by the Committee. To use this very capital-intensive setup at a high level of efficiency, some 10,000 (so I was told) different inputs have to be brought together into a phased series of engineering and assembly operations, which somehow merge into a smooth flow of production. In a country where the quality and regularity of indigenous inputs cannot be relied on, where imported inputs are inevitably subject to very long time lags between order and delivery, and may also suffer from exchange control, and where the labor force is and must remain for many years insufficiently skilled and disciplined, the managerial task becomes unenviable.

1/ But, as mentioned, this was not the argument of the Committee. Their Report simply takes it for granted that there should be a single unit. Thought appears to have run in terms of "the heavy electrical project" since 1948. This thinking was little questioned, nor was the dynamic development of the industry to meet a rapidly expanding demand considered at all.

9. I had not previously appreciated, and was very much struck with, the greater managerial problems that arise in multi-product capital-intensive engineering industries than in "processing" industries (like steel or fertilizers) where relatively few inputs are combined, in ways which are largely governed and predetermined by the machinery itself, into relatively few outputs. It is at least clear that the full implications of the argument for concentrating a lot of production under one management team, which could have no experience of managing an enterprise of this kind, were not appreciated.

10. The output-mix determined by the Committee had another consequence. Few firms in the world produced most of this equipment, and none all of it. Partly at least as a result of this, the number of acceptable firms which showed interest in acting as consultants dwindled to two, A.E.I. and Siemens. It has subsequently emerged that A.E.I.'s designs were far from competitive for all the items of equipment. If the output had been split between several factories and several consultants, there would have been more chance of selecting one of the leaders in each main field of activity - traction equipment; generating equipment; transformers; switch gear and control gear.

11. While the choice of outputs (and the implicit choice of a single factory to make them) was the most important lasting influence of the Committee (apart from providing the basis which led to an effective decision to go ahead), another of their recommendations was noteworthy as being a departure from previous thinking. This was not to require financial participation by the consultants, on the ground that it would limit the field. Financial participation on an equity basis would certainly have helped to ensure that the consultants designed an economical factory - and this is undoubtedly a very real problem. But effective equity participation by foreign capital is not likely to be the answer to this problem for much of public industry in India, and does not appear to have ever been in question for Bhopal. A small fixed-interest participation would seem to be virtually pointless, and the Committee was surely right not to insist on this.

12. As already noted, it was remarkable how closely A.E.I.'s eventual project report stuck to the Iyengar Committee's outputs. In brief, the approach can be summed up as follows, "we are sure that there is demand enough for the following things: so let us select a consultant and tell him to design us a factory (or, possibly, factories) to make them, and help us technically for some years". An approach on the following lines might have been better: "we are sure there is going to be plenty of demand for a very wide range of heavy and medium equipment. Prima facie there is a strong case for getting into this industry. Let us get a consultant or consultants to advise us what goods, in what sizes, in what sized productive units, would be likely to be the lowest cost way of

embarking on production in this industry".[1] But even this approach would not have dealt with the problem that several specialized consultants might have been better than one. This question could only have been investigated by an Indian team. Since it had been clear for many years that a heavy electrical industry in India was on the cards, a team or committee might have been formed to acquire a thorough knowledge of the products of such an industry, of the economics of production of such equipment, and of the merits and demerits of the many producers in more developed countries. Many subsequent decisions might then have been taken from a much more fully improved basis. It is the low importance apparently attached to the economics of production that is most striking in the whole long drawn-out decision process which eventually led to Bhopal.

(c) The Choice of Consultants

13. After the Government had decided in favor of the project in March 1955 another committee (the Khera Committee) was set up to select consultants and further examine the scheme. One member of the Committee (K.N. Ranga Rao) proposed a number of units each with a specialized consultant. But he seems to have been overruled on the ground that the Iyengar Committee had considered the question in great detail, and had come down in favor of a single consultant.[2] Eleven firms were approached, and a further committee (the Electrical Experts Committee) set up to evaluate their replies. Of the seven firms which offered to collaborate, four were eliminated for one reason or another (I have seen no account of this process of elimination), leaving only A.E.I. and Siemens as candidates for the Khera Committee to decide between.

14. The Committee recommended A.E.I. and produced a draft consultant's agreement. The Ministry of Production concurred. S.S. Khera has produced a fairly detailed account of the reasons for the Ministry of Production's preference. [3] The choice was not made on the basis of what might

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1/ This latter approach seems to have been much more closely followed in the abortive approach of 1953, when the Government "invited firms of international repute to submit project reports, on the understanding that the firms should themselves propose a manufacturing program which in their opinion would constitute an economic proposition and in which they would be prepared to participate financially as well as technically" (S.S. Khera).

2/ Cf. S.S. Khera, "The Establishment of the Heavy Electrical Plant at Bhopal," p. 65. However, there is no account whatever in the report of the Iyengar Committee of the merits or demerits of this alternative proposal, which was said to have been considered in great detail.

3/ loc. cit., pp. 74-78

be termed a hard-headed detached economic comparison. This would very probably have been impossible without getting both to produce detailed consultants' reports, and might have been impossible even then, for there were probably no Indians available who could have examined the two sets of estimates from a sufficiently well-informed critical basis. As it was, the investment cost and output estimates produced for the Committee were only rough. Prima facie these were favorable to Siemens (a capital/output ratio of 1:1 against A.E.I.'s 4:3). But S.S. Khera writes "the differences between the two firms in the cost of constructing the factory and the cost of output of the factory were important considerations in selecting the A.E.I." S.S. Khera's attempts to reconcile these statements are confused and unconvincing.

15. A.E.I.'s consultancy terms were evidently more favorable than Siemens' - but whether significantly so does not emerge from S.S. Khera's book, for Siemens evidently improved their terms compared with those detailed in the book.

16. Other reasons given seem rather unconvincing - e.g. A.E.I.'s link with atomic energy; A.E.I.'s superiority in traction equipment (this reads oddly to one who had heard stories of A.E.I.'s performance in producing equipment for British Railways); that A.E.I. had constructed a Government factory in Russia.

17. Reading between the lines, as well as on the basis of some of my interviews, one suspects that the real reason was that A.E.I. was known in India, and that British business methods and ethics were more trusted than Germany's. The former reason is given by S.S. Khera. He could not very well have given the latter.

18. The choice of A.E.I. may well have been right. I cannot tell. But the manner of choosing seems to have been amateurish. Given that rough estimates may be a shaky basis for choice, one would have thought that those responsible might have done well to acquaint themselves with the reputation for design and competitiveness of the firms concerned. This could have been done by enquiries within the industries, and from consumers of their products, in England and Germany; and possibly third markets. I found no awareness of the fact that, so far at least as some products were concerned, A.E.I. did not have a high reputation so far as costs went. 1/ Of course, the Bhopal management has since become aware of the fact that some of the A.E.I. designs were very costly. I suspect this might have been discoverable, by shrewd enquiry, at the time. (I hasten to add that, in the last year or so, A.E.I.'s reputation and performance has greatly improved.)

1/ To be fair, A.E.I.'s profit rate on both capital and turnover fell from 1953: but they did not plunge until 1956, continuing to fall until 1962.

(d) The Project Report

19. An uninitiated and non-technical reader such as myself could not but be impressed by the great thoroughness and detail of A.E.I.'s report. They certainly appear to have done everything that was asked of them. No one could complain that there was anything slipshod in what they presented to the Indian Government. Also, even allowing for the fact that this was their third approach to the problem, they produced the report quite rapidly.

20. But it is possible to criticize (1) the site selection, and (2) the manner in which projected losses and profits were laid out.

21. So far as site selection goes, there seems to have been very little calculation of the effect of different sites on operating and selling costs. The selection criteria, while sensible, appear rather impressionistic. Secondly, the site chosen was not, apparently, thoroughly inspected from a technical point of view - and had to be abandoned in favor of another nearby site. But this does not appear to have affected costs materially.

22. So far as losses and profit go, no internal rate of return on capital was calculated. Discounted cash flow would, perhaps, have been too much to expect at the time. But a break-even date, which is all that could be seen at a glance from the calculations, is not very adequate. But it should be remembered that A.E.I. was not asked for any specific economic calculation.

23. However, no nicety was really required. It needed little more than a glance at the figures to see that Bhopal was going to be an uneconomic project, even if all expectations were fulfilled (as they seldom are, anywhere). I shall go further and say that the project, as laid out in the report, was unacceptable by any possible economic criterion, and should have been rejected. I have seen no record or account of the discussions which led to the Report being accepted (in March, 1957).

24. The agreed value of output was Rs.12.5 crores, and it had been required first that the factory be designed so that this could be achieved with single-shift working, and secondly that the layout be such that buildings and facilities could be extended to give double the output (presumably still on a single-shift basis, though this is not clear from the Supplementary Report on which the above sentence is based).

25. The single-shift requirement is astonishing. That anyone should anywhere plan to operate such expensive facilities at single-shift intensity is shocking to an economist; and should be doubly shocking in an economy where capital is so scarce as in India.

26. The consultants actually presented their figures on three bases:

(1) single-shift working, as requested - Rs.12.5 crore output;

(2) a compromise, with some machine tools worked double shift, so that the Rs.12.5 crore output could be produced with fewer machine tools;

(3) double-shift working for an output of Rs.22 crores.

The compromise solution was accepted. The economics fall, naturally, between (1) and (3). I have done various calculations on alternatives (1) and (3): the initially accepted solution thus lies between the two sets of figures arrived at below.

(e) Profitability

27. For a project with a very long gestation and running-in period, no simple concept of "the annual rate of return on capital" is applicable. It is essential to discount all expenditures and receipts.1/ I have accordingly calculated an internal rate of return, using the figures of the project report, with one exception. The depreciation figures of the project bear little relation to actual replacement needs, so I have made guesses in order to approximate to a cash-flow basis. First, for single-shift working, I have each year allowed 2 percent of the cumulative expenditure on buildings for repairs and replacement: and, similarly, 1 percent of the cumulative expenditure on tools and equipment. In the 26th year it is assumed that the buildings are as good as new: that stocks and work in progress can be sold at cost; and that the equipment is worth 40 percent of its cumulative cost. For double-shift working, I have allowed annually 2 percent of both building and equipment expenditure for replacement. In addition, 25 percent of the expenditure on equipment is allowed for replacements in the thirteenth year (as against 2 percent). In the twenty-sixth year, the building is again assumed to be as good as new, while equipment is assumed to be worth 30 percent of its cost. It is believed that these allowances are on the generous side (I arrived at them after consulting A.E.I.'s resident chief engineer). The upshot is that the project report showed a "yield" (including, of course, profits and interest) of 2.7 percent on a one-shift basis, and 4.5 percent on a two-shift basis.2/ With the strong risk that everything would not go smoothly according to plan, and so reduce these yields and perhaps make them negative, it is clear that the project was totally unacceptable on a profitability criterion. A private firm would probably require about a 20 percent return to be shown by such a proposal, and expect rather less to be achieved in practice: and the Indian Government has since then said that a 10 percent return on capital should be expected in public enterprise.

28. But it is rightly argued that profits are not in themselves an acceptable criterion for public industry in India. Economists must agree, for the price mechanism plainly fails to reflect the underlying scarcity of resources.

1/ It is equally true, of course, that the usual concept of "the capital-output ratio" is meaningless.

2/ The estimated cash flows for the first twenty-six years on a one-shift and a two-shift basis are given in Table 1.

29. I have accordingly estimated the contribution which Bhopal was projected to make to the National Income. In other words, I have estimated the net value added at factor cost instead of the profit, and combined this with capital-outgoings and recoupments, to form a "value added minus capital" stream (instead of a cash flow stream).[1] This, as we shall see, gives an estimate of the capital/output ratio.[2]

30. To arrive at an estimate of net value added I have adjusted the project report figures as follows:

(1) Output value is reduced by 15 percent to allow for an average tariff of this magnitude, thus roughly accounting for output at c.i.f. prices, it being assumed that A.E.I. valued output at competitive prices within India (so far as I could check, this was the case). For an import-substitution project like Bhopal it is obvious that the rise in price resulting from import-substitution is no real contribution to national income, and so the output must be measured at the old, or c.i.f., prices.[3]

(2) The cost of materials and components brought in are reduced by 20 percent, again in order to approximate to c.i.f. prices - whether or not such components etc. are bought overseas.[4]

(3) Replacement is reckoned as before.

(4) Working capital is reduced by 17½ percent, again in order to approximate to c.i.f. values.[5]

(5) Expenditure on building is reduced by 10 percent, to allow for a zero shadow wage for site labor (the whole point of using an adjusted value added criterion, rather than profits, is that labor is thereby not reckoned as a cost).

(6) No adjustment was made to equipment costs, since the project report already excluded tariffs (despite the fact that it did not exclude tariffs from components and materials), and almost all the equipment was imported.

1/ These estimated flows are also given in Table I.

2/ We have already remarked that when capital expenditure is spread over many years, and outputs also rise with time, there is no valid capital/output ratio to be ascertained from any single year's figures.

3/ See also I.M.D. Little, "Notes on Public Sector Project Selection in Relation to Indian Development" (M.I.T. mimeographed).

4/ The justification for this is that the use of these indigenous inputs by the project will result in some other enterprise increasing its import of them or possibly, but less likely, in their not being exported. See also I.M.D. Little loc. cit. Here it may be noted that it is an immense simplification, for one does not have to worry about the changing import content over time, and the reduction over time in value added which would otherwise be occasioned by shifts to higher-cost Indian sources of supply.

5/ Ibid.

The resultant adjusted "net value added less capital expenditure" figures are given in Table I for single and double shifts. The discount rates required to reduce these streams to zero present value are about 7 percent and 8.5 percent respectively. The true (adjusted) capital/output ratios are the inverse of these figures, i.e., about 14 and 12 respectively. These, of course, are very high figures indeed, despite my having placed what might be regarded as a rather high value on the factory after 25 years' operation (certainly a value which allows nothing for obsolescence), and despite our ignoring township costs.1/

31. Import-savings is sometimes used as a criterion, or at least as an argument in favor of a project. I have argued elsewhere that the above (adjusted) value added calculation also provides a good approximate estimate of the import-saving potential of the project.2/ The Indian Government might have done nearly as well so far as saving foreign exchange goes by portfolio investment abroad, and with far greater assurance that the foreign exchange savings would actually materialize. Looked at in another way, money saved by not building Bhopal could have been used to reduce foreign borrowing - and borrowing abroad at the margin has almost as high a "cost" (and a certain one if default is not intended) as the projected "benefit" of Bhopal. I do not suggest that this would have been a good alternative policy. On the contrary, my belief that the project report should have been rejected derives from the belief that many better ways of spending money for development could have been found in India.

32. Thus whether the Bhopal project was looked at from the point of view of profits (its contribution to public revenues and savings), or of its contribution to National Income, or to making the balance of payments more viable in the long run, there seems to me to be only one possible conclusion. It should have been rejected. I know of no end or object of economic activity to which it could be held to contribute sufficiently. This conclusion does not imply that heavy electrical goods cannot be made to advantage in India. It implies only that they could not be made to advantage by the means devised by the GOI and A.E.I. at Bhopal.

(f) History after Acceptance of the Project Report

33. Almost immediately after the project was accepted in March, 1957, the foreign exchange crisis of 1957-58 resulted in a decision to replan the construction in three phases to be implemented as finance became available. Phase I (transformers, switchgear, controlgear, and capacitors) was approved in July, 1957. Phase I was still at an early stage of construction when, in early 1959, it was decided to revert to the original plan (Rs.12.5 crores output, single-shift working for most of the factory). In December 1959, it was decided to double the output to Rs. 25 crores. This, in itself, would have

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1/ I also ignore "External Economies". (The most significant such economy which I can think of is the trained labor force existing at the end of the twenty-five year period. A rough calculation suggests the value of this might be Rs.3-4 crores. Its inclusion, discounted to the present, would make no significant difference.)

2/ I.M.D. Little, loc. cit.

presented little difficulty since it mainly meant tooling up for double-shift working throughout, which had already been planned. However, at the same time, the output-mix required was considerably changed. The maximum size of turbines, generators, and transformers was trebled; and the required output of traction equipment was quadrupled. This caused considerable modification to the factory. As a result A.E.I. estimated that output value would rise to Rs. 32 crores. But there was no new project report at this stage, and no reassessment of the economics of the project.

34. It appears that the above decision had scarcely been taken before A.E.I. was asked to prepare a supplementary report on extending the factory to achieve an output of Rs. 50 crores. This was in response to a new and greatly increased estimate of demand on the part of the Central Water and Power Commission. The supplementary report was produced in August 1961 (in the 18 months since end-1959 work had been progressing on the Rs. 32 crore basis), and actually presaged a production value of Rs. 52½ crores. The growth in the proposed output is detailed below (it is not clear whether constant prices are used, or not).

OUTPUT VALUE (Rs. crores)

	Decided in March, 1957	Decided in December, 1959	Proposed in August 1961
Turbines	1.85	3.70	7.50
Generators and Motors	3.10	6.20	10.00
Transformers	2.15	4.30	13.50
Switchgear	3.10	6.20	10.40
Traction	1.30	8.80	8.80
Controlgear	0.75	1.50	2.00
Capacitors	0.25	0.25	0.30
	12.50	30.95	52.50

35. The supplementary report sounded a warning note:

> "It is again emphasized that the rate of growth of output desired for this project has probably never before been achieved for an industry of this character involving such a diverse range of products, and that its achievement will depend more upon the ability of H.E. (India) Ltd. to recruit and mature management and supervisory personnel of a caliber capable of driving the development along, than on the actual possession of buildings and manufacturing equipment."

The report also pointed to the interference occasioned to the existing development. It stated that this report "sets out how this expansion can be most economically and expeditiously achieved, while avoiding to the maximum possible extent destruction or changes to work already done or in hand for providing a factory for an output of Rs. 25 crores."

36. It was apparently not until September 1963 that the Government approved part of the above expansion to Rs. 52½ crores /Block VI for the manufacture of thermal turbines - see H.E. (India) Ltd. 8th Annual Report 1963-64_7, raising the planned output to Rs. 38 crores. I am not clear what further decisions have been taken since. So far as current operations at the site go, at the period when I visited it (March 1965), it can be taken that the plan accepted in December 1959 is operative. But the target output on the basis of decisions taken by March 1965 was apparently Rs. 43 crores.

37. No economic reassessment appears to have been undertaken since 1957. The 1959 decision can be regarded as based on the 1957 report, except for the disproportionate increase in traction equipment. I have seen no evidence that the economics of this large extension of traction equipment was assessed at all. The Supplementary Report of 1961 contained no fresh economic assessment, and so it is difficult to see how economics can have been taken into account in the final decision to proceed with part of the enlargement to Rs. 52 crores. It is furthermore, prima facie, strange that decisions to expand greatly should have been taken in view of the very serious managerial and labor relation problems known to exist at Bhopal, and in view of some inevitable disruption to development in progress. I was told that the alternative possibility of concentrating the product-mix at Bhopal, and setting up another unit "got lost".

II. A COMPARISON OF PROJECT AND PERFORMANCE UP TO END 1964

38. My interest has been primarily in seeing what information was available to the decision-makers, and the grounds on which decisions were taken, and whether they seemed sensible. I shall therefore treat the project as a reality rather briefly, trying to confine myself to matters which may hold lessons for future decisions on project-selection and implementation.

(1) The Factory

39. Blocks III and IV (transformers, capacitors, switchgear and controlgear) and V (the Foundry) were complete, and virtually fully equipped for double-shift working, and had been complete about three years. Block I was complete as to buildings and services, and about two-thirds equipped for double-shift working. Block II was only half-completed.

40. The above comprises the original plan (including the changes required for a Rs. 31 crore output), so that some comparison can be made with the project report, which adumbrated completion by January 1962, at which date the first phase was in fact completed. (It should be remembered that Blocks I and II were not approved until end-1959, under the "phasing" decision, instead of in January 1957, as the project report assumed.) Block II had been delayed for a long time by a lack of structural steel, dating back at least until 1961, the required sections being obtained only in 1963-64.

(2) Expenditure

41. The project report anticipated expenditure of Rs. 50 crores (for double-shift working) by end 1964, of which Rs. 42 crores represented fixed capital and cumulative loss (interest charged at 4 percent), and Rs. 8 crores stocks and work in progress.

42. Actual expenditure at this date seems to have been about Rs. 83 crores.1/ But of this about Rs. 12 crores would be on account of the township, plus tariff charges on imported equipment - which items were not allowed for in the project report. So the comparable figure is Rs. 71 crores (interest charges are comparable, since H.E. Ltd. has obtained capital at an average cost of approximately 4 percent.)

43. Since the Rs. 50 crores of the project report allowed for completion of Blocks I-V for double-shift working, it is apparent that the project has proved much more costly than anticipated.

44. The following factors must all have contributed:

(1) The phasing, which meant that some capital expenditure was bearing interest, without return, for longer.

(2) The decision of December 1959 to change the output-mix, which entailed both additions and alterations.

(3) Delays in completion of Block II, leading to capital being tied up, and over-employment of trained labor from the training school, whose output ran ahead of requirements.

(4) Higher prices for equipment than those of 1955 on which the project report was based.

(5) Lower output than anticipated (see below).

(6) Losses on the township (I have excluded capital costs of township, but not the running loss).

(7) Much larger inventories than allowed for.

(8) There may also have been some expenditure in anticipation of Block VI - but this cannot have been large.

I have made no attempt to analyze the contribution of these factors to the excess expenditure, or to find out whether simple plan underestimation of capital costs by A.E.I., was also a significant or large factor. But the

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1/ I could not obtain exact figures, but I do not think this and the following estimates can be far out.

effect of delays, whether due to changes of decision by New Delhi, or to lack of foreign exchange leading to lack of steel, etc., must be emphasized. Not only do they result in additional costs owing to other capital being uselessly tied up, but they also appear to have had a very serious effect on industrial relations, and hence output, as a result of the factory completion and therefore work availability lagging behind the output of the training school.

(3) Output

45. The value of output, expected by the project report, for the end of 1964 was Rs. 7 crores (this is the average of 1964 and 1965), on the basis of a final output of Rs. 22 crores by 1973. The prices on which this was based would be as far back as 1955.

46. This prediction (and the bottleneck was assumed to be trained labor, which has not in fact proved to be the limiting factor) is, of course, subject to various modifications. It should in principle have been increased by rising prices, and by the change in the output-mix: but reduced by the failure to complete Blocks I and II in accordance with schedule. In fact the output expected for 1964-65 is between Rs. 6 and 7 crores; and this was affected by a month's lock-out following very serious labor difficulties.

47. I find a sound comparison of expectation and performance in terms of the value of output impossible to make (anyway in the time available), if only because the prices of the items produced are too difficult to compare. On the one hand, the project report was supposed to be based on the prices of comparable imported items: the small sample of sales effected, which I saw /but which the Commercial Manager (Mr. T.V. Parthasarathy) claimed were not untypical/ suggested that the prices obtained were close to double the actual prices which would need to have been paid for comparable imported items:1/ Bhopal could obtain the prices it did only as a result of the highly protective effect of exchange control. As against this, the Commercial Manager told me, in conversation, that prices obtained were only about 12½ percent above those of the original project report. (A report of his to the board of directors suggests that A.E.I.'s sales values in the supplementary project report were overestimated - these would be at 1961 prices. Unfortunately I have no record of the sales predictions given in the supplementary report.)

1/ It is unlikely that A.E.I. would have reckoned on such low prices for imported items. The lowest tenders I saw were never from the UK. The supply of heavy electrical equipment has clearly become more competitive in the world market than when A.E.I. reported. Remarkably low prices have recently been quoted from such countries as Sweden, Japan, and Poland. If such prices continue, any earlier calculation of the comparative cost of making heavy electrical equipment in India, would have been bound to be upset.

48. Probably, a firmer basis of comparison is A.E.I.'s own report of November 1964 in terms of outputs as a percentage of target (it is not quite clear what "target" they refer to - but I presume that of the Rs. 31 crore plan of December 1959). These suggest that transformers and capacitors were running at about three-quarters of A.E.I. scheduled output, and traction equipment and switch and controlgear at about two-thirds.

(4) Profitability

49. The following table compares the project report figures for 1963 with actuals for 1963-64. Some figures for Kirloskar Electric Co. Ltd. are also given.

	Bhopal				Kirloskar Electric Co. Ltd.	
	Project Report 1963		Actuals 1963-64		1963-64	
			(Rs. lakhs)			
Output		405		529		567
Costs - Materials and Components	311		363		376	
Wages and Salaries	175		274			
Interest	166		168			
Misc. (net)	27		64		94	
Consultants	21	700	46	915		470
Profit (before depreciation)		- 305		- 386		+ 97

This comparison is not really worth much, for I do not know how actual prices compared with those of the original project report (see above). But the very much higher figure for wages and salaries is notable. (Interest is no higher despite the higher capital expenditure.) Kirloskar Electric only makes the light end of the Bhopal range.

(5) Value Added 1963-64

50. The gross value added at actual prices, both according to the project report and in actuality, is very small (36 and 56 lakhs respectively). The net value added is, of course, still negative. The real gross value added, arrived at by valuing outputs and imported inputs (at least) at c.i.f. prices, would certainly be negative.

51. So long as the sum of materials and components, other purchases from outside, and the payments to the consultants, come so close to the value of output the contribution of Bhopal to India's national income must remain small.

(6) Import-Saving

52. The output figure of Rs. 529 lakhs greatly overstates the direct contribution this output makes to a reduction in imports, for the prices obtained are greatly in excess of c.i.f. prices. It is very doubtful whether the import-saving effect of output exceed Rs. 300 lakhs.

53. On the input side about half of materials and components are imported (say Rs. 180 lakhs). If we reduce by 20 percent for tariffs, the direct import cost of materials is Rs.144 lakhs. Most of the consultant's fees, royalties, etc., must be transferred abroad, say Rs. 30 lakhs. Then the indigenous inputs of components themselves have an import content, and their use at Bhopal may well result in increased imports elsewhere (this will happen except if they would not have been produced except for the demand from Bhopal). Without being able to put a figure on it, it is apparent that the import-saving effect of even current operations alone cannot be much - probably not more than about Rs.1 crore.

(7) Conclusions concerning comparison of project estimates and performance

(a) It is evident that the project has proved much more costly than anticipated. I cannot apportion the extra cost (around 40 percent) between the various contributing factors.

(b) It is also evident that the output continues well below the expectations of the consultants - despite the fact that they allowed for a build-up to full capacity working which would rank as very slow in a more industrialized country.

(c) I have suggested that the project should not have been accepted even on the assumption that everything would go according to plan. The economics were not good enough. It is plain that the actual economics are significantly worse than what was predicted, both because performance has been worse, and because import prices of similar items are probably considerably lower than might reasonably have been anticipated.

III. IMPRESSIONS ON VISITING THE PROJECT

54. The dominating impression is that of an excessively expensive set-up, in which far too little is happening. It is like a Rolls Royce being used only to go a couple of miles to church on Sundays. Plainly such lavishly provided overheads have to be run at high pressure to be justified.

55. I know nothing of the production of heavy electrical equipment. But such questions as the following are obvious. Could not at least the light products have been moved about without such an all-pervasive system

of overhead cranes?1/ Was so much work space required (it is not the floorspace itself that is costly: but, literally, the overheads)? Was so much height really necessary? If output of transformers and switchgear is really at two-thirds and three-quarters of target, why are there quite so many idle machines?

56. While stressing that I am not an informed observer, the impression is of an engineer's dream come true. My hunch is that a board of directors in an industrialized country would not have allowed the engineers to get away with it (one knows of course that A.E.I. themselves possess nothing so grand - probably no firm in the world does).

57. If the overheads are excessive, as I suspect, for a new project even in a very high labor cost country, they are trebly so in India. First, there has clearly been no attempt whatever to adapt production, where possible, to more labor intensive methods. Secondly, it surely cannot make sense to provide such overheads from the beginning when a running in period of ten years, between virtual completion of capital expenditure, and anticipated full capacity working was allowed. The whole conception seems to me to have been completely wrong. To get a reasonably economic development, it would have been necessary to plan to build up a less lavish set-up more slowly as the working skills and management ability built up, even if this meant some improvisation, some make-shift arrangements for moving semi-finished products, some crowding, some treble-shift working, etc. It was not as if India could not find many excellent ways of using the foreign exchange that would have been released by a slower capital build-up.

58. I realize that production was not going as planned when I saw the factory. Nevertheless even if it had been as planned, I think one impression would still have been that one was nearer to standing in a gothic cathedral than an operating factory.

59. I do not think that blame attaches to A.E.I. except insofar as one can blame them for giving the Indians what they wanted, instead of what they should have wanted. One says "the Indians". But this means "New Delhi". If a management board, who knew they were going to be responsible for making a profit out of what was provided, had been in existence when the project was being designed (and had been given ample opportunity at that stage to study the economies of the production process abroad), I believe that a much more economical project might have emerged.

60. Of course, I had and was given many other impressions - but these are more concerned with the present problems of running the project.

1/ Even making the most exaggerated allowance for the difference between balance sheet and replacement values, it appears that Kirloskar Ltd., who manufacture the light end of the Bhopal range, have a capital output ratio of well under 1:2. Bhopal's at full production would be around 2:1. It is clear that a notional separation of the heavy product bays at Bhopal could not begin to account for such a difference.

IV. ON RUNNING THE PROJECT

61. I have little or nothing fresh to add to the good deal of advice already given by A.E.I. and others. Clearly it is a very difficult enterprise indeed to run well, and the management is not experienced enough.

62. But good management is also very seriously hampered by external factors, most notably labor legislation which gives the workers excessive rights. Lack of delegation also seems to give middle and junior supervisory staff little authority.

63. Although the project in principle has a free run on current imports, in practice the operation of exchange control can still cause delays. Perhaps, more serious than exchange control at present, is the civil service spirit. I got the impression that, even where a manager was not bound by instructions, he felt his career would be endangered by any attempt to move away from the civil service precedents which are much in evidence and quite incompatible with efficient management of such an enterprise. (Every observer, I think, makes this comment. It is long since Professor Galbraith accused India of Post-Office Socialism.) Civil service precedent has certainly left such marks as excessive clerical staff, the tendering system, inadequate delegation, triple audit, and a general fear that the rewards of enterprise are very small and the penalties for error very great.

64. Comment on the tendering system may come best from an economist. One of the important disturbances to smooth production, and to excessive stocks, is the unreliability as to delivery date and quality of Indian suppliers. I think the best way of overcoming this may be for Bhopal to establish close relations with one or a few suppliers of particular components, thus putting itself into a position to watch closely the latter's design, quality control, and likely deliveries. Costs should also be reduced, for the supplier could be sure of a secure and rising demand if he performed adequately, and could plan accordingly; and also because Bhopal can exercise strong "countervailing power". (The above is, I believe, roughly the manner in which Marks & Spencer - perhaps the most efficient clothing supplier in the world - operates.)

65. This desirable manner of operation, by which Bhopal would do most to effect "external economies" elsewhere, appears to be precluded by the tendering system. So also is the most efficient buying of variable price inputs like copper. Finally tendering inevitably results in delays, and hence in excess stocks. I am aware of some of the arguments for tendering. But dishonesty is not always prevented by a tendering system: and it should be possible to keep it under reasonable control by other, less costly, means.

V. A FEW GENERAL CONCLUSIONS, AND RECAPITULATION OF CHIEF PROBLEMS RAISED

I. I have not discovered any rational approach to project selection in the public sector in India.1/

II. There seems to be quite insufficient cost-consciousness. This goes for the choice of projects, the design of projects, and also the running of projects.

III. If Indian decision-makers become more cost-conscious, there will be the problem of getting consultants to design with more of an eye to India's scarcities. I think an important contribution to this might be always to assemble at an early stage a small top-management team (say the future managing director, works manager, chief engineer, and commercial manager) to be associated with the project design, and to learn about their future products.

IV. Insufficient thought seems to have been given to the management problem (the workers for Bhopal were trained to produce heavy electrical goods: so far as I could ascertain only middle-level management directly concerned with production had any special training) and to the closely related problems of industrial discipline in the public sector. I cannot believe it is right to pay labor far more (even excluding the large "fringe" benefits) than in the private sector, and management far less. Good pay and working conditions for labor do not, sad to relate, have much to do with good industrial relations. Good management undoubtedly has.

V. I was impressed by the damage caused by delays in construction and changes in design. This is likely to be far greater than the mere increase in capital cost. Production is held back both directly (e.g., Block I was still being used as a store for equipment for the unfinished Block II), and because lasting damage may be done to the morale and work-habits of workers and management. This may be especially a problem in a less developed country where reasonable industrial discipline is not a habit of mind. The damage of delays (both in construction and current production), loaded as this will sound, is a strong argument for not taking on more than the foreign exchange position permits - and, of course, for more realistic estimates of foreign exchange availability. It may also, in some cases, be an argument for giving a high priority to essential non-importable inputs - power and transport.

1/ I have enlarged on this in another paper intended as a contribution towards getting an agreed basis of appraisal (see I.M.D. Little loc. cit.).

Table I

Rs. lakhs.

Year	Cash Flow		Valued Added less Capital Expenditure	
	Single Shift	Double Shift	Single Shift	Double Shift
1	- 174	- 175	- 169	- 170
2	- 361	- 362	- 323	- 324
3	- 579	- 580	- 508	- 509
4	- 757	- 761	- 647	- 651
5	- 861	- 878	- 708	- 725
6	- 578	- 587	- 404	- 413
7	- 762	- 774	- 550	- 562
8	- 386	- 400	- 185	- 199
9	- 409	- 425	- 182	- 198
10	- 109	- 130	+ 79	+ 61
11	+ 181	+ 153	+ 341	+ 321
12	+ 241	+ 76	+ 393	+ 258
13	+ 305	- 306	+ 457	- 101
14	+ 305	+ 187	+ 457	+ 404
15	+ 305	+ 299	+ 488	+ 627
16	+ 305	+ 381	+ 499	+ 620
17	+ 305	+ 678	+ 499	+ 893
18	+ 305	+ 678	+ 499	+ 893
19	+ 305	+ 678	+ 499	+ 893
20	+ 305	+ 678	+ 499	+ 893
21	+ 305	+ 678	+ 499	+ 893
22	+ 305	+ 678	+ 499	+ 893
23	+ 305	+ 678	+ 499	+ 893
24	+ 305	+ 678	+ 499	+ 893
25	+ 305	+ 678	+ 499	+ 893
26	+3202	+3634	+3202	+3634
Discount Rate for Zero Present Value	2.7%	4.5%	7%	8.5%

APPENDIX II

THE DEVELOPMENT OF THE NEYVELI LIGNITE PROJECT

Kenneth A. Bohr

APPENDIX II

THE DEVELOPMENT OF THE NEYVELI LIGNITE PROJECT

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THE DEVELOPMENT OF THE NEYVELI LIGNITE PROJECT

Introduction

1. This account is based on discussions with officials of the Neyveli Lignite Corporation, consultants from the United Kingdom and Germany working with the Corporation in the mining project, officials in the Planning Commission and the Ministry of Fuel and Mines, in New Delhi, and on material made available to us by the Corporation. We are aware that it is not complete in detail and that at certain points our interpretation of the evidence available to us may not be the only plausible one. However, we believe that by and large this account gives an accurate picture of the main events in the evolution of the project.

2. As is widely known the Neyveli Lignite project has encountered many problems. Its costs have been much higher than originally estimated and its pace of implementation has been much slower. In these respects the project is typical of the large public sector industrial projects of the Second and Third Five-Year Plans. We have been concerned with these aspects of performance but more especially we have been concerned with examining the basis on which the investment decisions have been made and, particularly, the extent, if any, to which they have been responsive to the changing economic prospects of the project.

3. Our account focuses on the steps by which the original idea to develop a source of thermal energy in Madras evolved into a Rs. 120 crores multi-purpose project to produce power, fertilizer and carbonized briquettes exceeded only in size by Hindustan Steel and the Heavy Engineering Corporation among public sector industrial undertakings. Although this is largely the past history of a single project, it does not represent a unique experience 1/nor is it irrelevant for the present. The purpose of this account is to focus attention on the real need for improved project preparation, and, in particular, improved appraisal criteria and procedures.

Initiation of the Project by the Madras State Government

4. The occurrence of lignite in the region around Neyveli in Madras State was first noted while drilling wells for water supply in the 1930's; the existence of a large deposit was confirmed by the Geological Survey of India in the years 1943-46. In spite of the fact that the deposit lay far beneath the surface and the evidence that it was associated with considerable water pressure, the State of Madras turned attention to its possible exploitation in the immediate postwar period. The State's interest in the development appears to have been based on the following factors: (a) the absence of any source of fuel in the State, (b) the distance from the coal fields in the north and the difficulties of transporting coal from that source, especially those experienced during World War II, (c) the limited potential for the further development of hydroelectric power in the State and the irregularity of stream flow which

1/ For example see Appendices I and III.

limited the amount of firm power from this source, and (d) the apparent belief that the industrial development of the State would be greatly enhanced by a local source of energy and, in fact, would be hindered without such a source. The cost of energy does not appear to have been given as serious consideration as the mere existence of a local supply. In fact, at no time during the development of the original project did we find evidence of any serious comparison of the economies of developing this source of fuel with the economics of transporting coal from the north or importing oil from abroad.1/

5. In 1954, the State of Madras, with aid from the Technical Cooperation Mission of the United States, undertook development of a pilot mine to test the feasibility of mining the lignite. On the basis of this work, it became evident that a detailed study of the ground water problem would be necessary. At about the same time, the Government of India arranged for the services of Powell Duffryn Technical Services, Ltd., of the United Kingdom, under the Colombo Plan, to prepare a feasibility report on a project to mine and utilize the lignite. Also, at about this time, it became evident that the project as it was developing would be considerably beyond the capacity of the State of Madras to carry out, and the Central Government agreed to take it over. This was done officially in September 1955, and involved a transfer of administrative and financial responsibility. The part-time Chief Executive Officer of the Lignite Investigations, under the Government of Madras, became the full-time Chief Executive of the Project under the Government of India.

The Powell Duffryn Report of 1954

6. The report prepared by Powell Duffryn2/ presented a rough assessment of the probable economies of a number of possible alternative schemes for the development of the lignite deposits. A description of these

1/ The cost advantage of the lignite may have been considered to be obvious and not requiring serious investigation. At present the price of coal delivered in Madras is reported to be Rs. 55/ton from Bengal and Rs. 49/ton from the Singareni coal fields in Andhra Pradesh: the price when the project was initiated was not substantially different. Two tons of lignite are roughly equivalent to one ton of coal and the cost of lignite was originally (and erroneously) estimated to be less than Rs. 10/ton. Such comparisons do not, of course, take into account whether costs have been calculated on a comparable basis, in particular, whether realistic costs of capital and foreign exchange have been used. It should be added, however, that in contrast, the feasibility of a recent proposal to open a second mine to supply thermal power station is apparently being judged by the Government in the light of alternative schemes to supply power to the area (see paragraph 30).

2/ The Mining Utilization and Processing of the South Arcot Lignite, Powell Duffryn Technical Series Ltd. 1954.

in terms of output is presented in Table 1. As shown, they differ from one another in terms of the size of the mine and the variety and volume of products produced from the mined lignite. It should be noted that although a number of alternative schemes are presented in association with mines with capacities from 1 to 1.6 million tons of lignite per year, only a single pattern of final output, is combined with each of the two larger mining schemes. Thus, it was not determined whether the larger schemes could be made economically more attractive by concentrating on fewer final products. It is possible and likely that such alternatives were not considered because it was estimated that the demand would not be sufficient to absorb a greater output of power or fertilizer.1/

7. The report was produced in a short period of time. It was based on the company's experience and the work already done by others on the size, quality and location of the lignite deposit. It did not involve any extensive new investigations. However, although the estimates were necessarily very rough, they did indicate that the cost of mined lignite was strongly related to the size of the mine. (It was estimated that the cost at capacity operations would range from 12.7 down to 5.4 rupees per ton as the mine capacity was increased from 1 to 6.3 million tons per year.)2/ It was also shown that the larger schemes involving mines with annual capacities of 3.3 and 6.3 million tons per year and the production of power, fertilizer and briquettes would yield a distinctly higher return than the schemes involving smaller mines and fewer end products. The highest return (annual net profit on original investment at full production) was shown to accrue to the mine of 3.3 million ton capacity associated with the production of power, fertilizer and briquettes. No doubt a considerable measure of the superiority of this scheme was attributable to the economies of scale in the mining operation. As noted, whether this initial advantage was aided or hindered by the addition of facilities for the production of fertilizer and briquettes in addition to the associated power station never seems to have been determined.

8. It does not appear that there was any formal review of the report until 1956, two years later. In the meantime, thought was being given to the planning of the project. Finally in April 1956 the report, together with a "Note on Forward Planning of Construction of the Lignite Project" by the Chief Executive Officer of the project, was reviewed by

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1/ If this was the reason it did not turn out to be a valid one, the implied estimate of power requirements in the 1954 report was much too low. The original planned capacity of 200 MW was increased to 250 MW in 1956 and 400 MW in 1962, at about the time the project was originally planned for completion. An expansion to 600 MW was approved in principle in 1963 and a second mine to serve an additional 600 MW was proposed in 1963 (see Paragraphs 28-30).

2/ In computing costs, depreciation was charged on the basis of a 30-year sinking fund and an interest rate of 4% was used.

a Standing Committee of Technical Experts set up for the purpose.[1] Written comments on the report were circulated among the members prior to the meeting. The review appears to have been taken seriously and many pertinent points were raised by members of the Committee. The need for the above ground storage of lignite was raised -- a need that has finally been recognized and on which action is now being taken.[2] Concern that the output of fertilizer be consistent with the estimates of requirements made by the Ministry of Food and Agriculture was expressed, and questions were raised concerning the technical process suggested for its production -- which was, in fact, never used. Generally speaking, no strong opposition was expressed to the conclusion of the consultants that the types of schemes suggested were technically feasible given adequate investigation and suitable treatment of the ground water problem. No strong reservations were expressed to the view that this last could be done effectively.

9. Questions were raised, however, concerning the economics of the proposed development. The consultants had estimated that the cost of mining lignite from a mine with an annual capacity of 3.3 million tons would be Rs. 6.6 per ton. The chief mining engineer of Bengal (A.B. Guha) doubted that this was possible considering the ratio of overburden to lignite estimated at about 5 to 1. He also pointed out that the cost of water control had not been included in the consultants' estimates and suggested this in itself might run up to Rs. 1 per ton. He thought it would be more reasonable to assume a cost of Rs. 10 per ton for mined lignite.[3] In addition, Dr. A. Nagaraja Rao, the convenor of the Committee, questioned the prices used in the report to represent the values of the various outputs. These prices, together with the alternatives suggested by Dr. Rao and with his reasons for them, are shown in Table 2. With the exception of the price for electricity which had been set by the Madras Electricity Board, he considered that all the prices used were too high.

10. It would not appear that much weight was given to these economic arguments. At least we found no record that the economic feasibility of the scheme suggested by the consultants nor its superiority over the alternative schemes was seriously questioned. In fact, alongside the questions raised concerning costs and values of the output, there was discussion of whether briquettes or fertilizer should have the "highest

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1/ Dr. A. Nagaraja Rao, Chief Industrial Advisor to Government of India, was the convenor. Members included the Chief Mining Engineer State Colleries, Bengal, the Director of Fuel Research Institute, the Director of the Geological Survey, and representatives of the Central Water and Power Commission, and the Ministry of Food and Agriculture, and the Chief Electrical Engineer, Madras.

2/ This issue is not quite as simple as it would appear at first. There is a danger that stored lignite will be subject to spontaneous combustion and the design of a storage scheme involves a certain amount of testing.

3/ This figure turned out to be much closer to experience than Rs. 6.6 per ton, but was still an underestimate.

priority" in Madras in terms of a vague concept of "need" which completely ignored the question of costs. The committee concluded that, although the report needed substantial revision, the feasibility of proceeding with an integrated project (lignite, power, fertilizer and briquettes) based in a mine with an annual capacity of 3.3 million tons was accepted. The report, together with the findings of the Standing Committee of Technical Experts, was then considered by the Lignite Project Coordinating Committee[1/], composed of representatives of the ministries involved. The committee met two days later on April 4th, 1956 and promptly approved the plans to go ahead with the project.

11. If the economics of the project had been taken more seriously and if the return on the schemes had been recalculated, using the price assumptions suggested by Dr. Rao, the attractiveness of the scheme selected would have been greatly reduced. As shown in Table 3, the 15% return estimated by the consultants for scheme 3, the one selected, would have been cut in half and its relative superiority would have been markedly reduced. Under these circumstances, considering the small advantage of scheme 3 over scheme 2b, with its much smaller mine development, the possibility of improving the return of scheme 3 by reducing the number of products would certainly appear to have been worth investigation. If, in addition, the increased cost of mining had been used as suggested by Guha, the economics of the projects would have been further altered. In the case of scheme 3 (Guha's suggested cost of Rs. 10 per ton referred to a mine of this size), the return would have been reduced to below 6%. The price estimates suggested by Dr. Rao were not necessarily the correct ones to use, nor could Guha's estimate of mining costs be taken without question; however, the sensitiveness of the economics of the project to the use of prices and costs which had been questioned would seem to have been worth investigation if a serious economic appraisal had been intended.

12. The project as approved by the two committees consisted of a mine with a capacity of 3.3 million tons of lignite, a 200 mw thermal power station, a fertilizer plant with an annual capacity of 200,000 tons of ammonium sulphate, and a briquetting plant to produce 380,000 tons of carbonized briquettes and assorted by-products. The cost of the entire project was estimated to be Rs. 57.8 crores (excluding housing and common facilities for staff and families).

1/ This committee included representatives of the Ministry of Production and the Ministry of Finance of the Central Government, and of the comparable ministries of the Madras State Government at the level of secretary and joint secretary. It also included Dr. Rao, Convenor of the Technical Committee, a senior advisor to the Planning Commission, the Superintendent of the project and representatives of Powell Duffryn. Four of the 6 secretaries involved were I.C.S. as was the advisor to the Planning Commission.

The Powell Duffryn Report of 1956

13. Subsequent to the approval of the integrated project by the two committees, Powell Duffryn prepared a detailed project report for the mine alone.1/ In this report the capacity of the mine was increased from the original 3.3 to 3.5 million tons of lignite per year, and its capital costs were increased from Rs. 14.7 crores to Rs. 16.9 crores, and the estimated cost of mining lignite was increased from Rs. 6.6 to Rs. 6.8 Rs./ton, excluding the cost of ground water control.2/ In addition to a detailed treatment of the mine, the report indicated in a general way how the mine construction should be phased with the construction of the power, fertilizer and briquetting plants. This is as far as it went in dealing with the project as a whole. In fact, subsequent to the very preliminary 1954 report, no report was made for the entire project. Although the details of individual plants were not always worked out along the lines originally suggested, the original conception of the project was an integrated project involving production of power, fertilizer and briquettes never appears to have been seriously questioned.

14. There was no over-all consultant for the project. Powell Duffryn apparently would have liked the job, but they were retained for the mining project only. The Central Water and Power Commission acted as consultants for the power project which was designed and built by the USSR. The Neyveli Lignite Corporation itself developed the plans and designs for the fertilizer and briquetting plants in collaboration with several foreign engineering firms.

Government Approval of the Integrated Project

15. On August 27, 1956, the same date as the project report on the mine, the Heavy Industry Committee of the Cabinet approved in principle the integrated Neyveli Lignite Project as a whole and also sanctioned the immediate implementation of the mining part on the basis that the other component parts would be taken up at the appropriate time in full consultation with the Ministry of Finance. At that time realistic cost estimates were available only for the mining scheme. These, combined with current rough estimates for the other component schemes, came to a total of Rs. 68.9 crores for the cost of the whole project, excluding costs for common services and housing. This represents an increase of about 20% over the cost estimates of 1954 on which the original appraisal was based.

1/ Project Report on the Planning of the Mine Development and Production Phases - Powell Duffryn Technical Services, Ltd. August 1956. It seems likely this report was under way before the committee met in April.

2/ An interest rate of 4½% was used in these calculations. Use of a more realistic rate, say, for example, 9%, would have increased capital costs to Rs. 17.9 crores and mining costs to Rs. 9.5 per ton.

16. These estimates did not stand for long. In May 1957, nine months after the original project report on the mine, a supplementary report was issued by Powell Duffryn increasing the estimated cost of the scheme from Rs. 16.9 crores to Rs. 20.2 crores. This increase was attributed largely to higher prices for equipment than had originally been assumed, as well as some changes in the types required in the direction of more specialized and expensive items. The revised estimate of the cost of mining lignite was Rs. 7.5 per ton, excluding the cost of ground water control.[1/] Some details of the cost estimates included in the two reports are shown in Tables 4 and 5.

17. By 1960, after sanction had been given to proceed with the construction of the power and fertilizer plants, and a project report had been prepared for the briquetting plant, the estimate for the cost of the entire complex -- the first serious estimate available -- had reached Rs. 94.7 crores. This increase was attributable largely to an increase of over 80% in the estimated cost of the briquetting plant, large increases in the cost of the fertilizer plant and the mine and the inclusion for the first time of costs for housing and common services. Some of the increased costs of the fertilizer plant are probably attributable to a change in product from ammonium sulphate to urea and an increase in capacity (in terms of nitrogen content). The capacity of the power plant was also increased (from 200 MW to 250 MW) but in this case the increase in the estimated costs were less than 10%. Table 6 presents a comparison of the various costs estimates plant by plant.

18. Although these changes in costs would obviously affect the economics of the project and although they were known before final sanction was given to proceed with all of the component plants,[2/] we found no evidence that the economic feasibility of the project was reexamined at this point. The possibility of altering the original concept of the project does not appear to have been considered even though the costs of the briquetting plant were now estimated at nearly double the figure on which the original appraisal was made and consideration was being given at about the same time to substantially increasing the capacity of the power plant.[3/] The individual project reports for the fertilizer and briquetting plants appear to have given some attention to the problem of selecting the most economical among alternative methods but the suitability of the expected level of return for the plant itself does not appear to have been a serious concern.

1/ Again, if a 9% rate of interest had been used, the figure would have been Rs. 21.5 crores for the investment and Rs. 10.7 per ton for mining costs, excluding the cost of ground water control.

2/ The approval of funds for the briquetting plant did not take place until March 1961.

3/ An expansion of the power plant from 250 to 400 MW was finally proposed in 1961 (see Paragraph 28).

Increase in Costs and Delays in Implementation

19. Since 1960 the estimated costs have increased by another 25% to a level of Rs. 121.2 crores. Some of these increases can be attributed to increases in import duties and excise taxes and are costs to the enterprise though not to economy. Others are attributable to increases in the costs of equipment - in some cases aggravated by limitations on the sources from which they could be procured.1/ Other increases have been due to increases in the cost of housing and common facilities, increased costs of developing the mine because of delays in implementation, and penalty fees to contractors because of the inability of the corporation to procure the required steel within a specified period.2/ (See Table 6.)

20. In addition to the substantial increases in the cost of the projects which were clearly evident by 1960, the pace of implementation was well behind the schedule proposed by Powell Duffryn in their 1956 report when the over-all project was approved. It had been proposed that mining should commence in the fall of 1959, with the other projects of the scheme being brought into production by stages and the entire scheme reaching full operations by the end of 1961. By April 1961 the estimated completion dates for the various projects had been pushed back two to three years and the entire scheme was not expected to be in full operation until mid-1964.3/

21. Much of this delay can be attributed to the foreign exchange crisis which started in 1958 and the difficulties of procurement which have existed since then. The power project had to be financed through a credit from the USSR and agreement was not concluded until May 1959. The fertilizer plant was approved by the Government in December 1957, subject to "adequate foreign exchange being available". There were a series of changes in the project. It was originally planned to produce ammonium sulphate using gypsum from nearby Trichinopoly. This plan was abandoned when it was found that the gypsum supply was inadequate in both quantity and quality. Next, it was proposed to produce a double salt; finally, it was decided to produce urea. Then, after extended negotiations, contracts were concluded with a West German and an Italian firm in October 1959. The construction of the plant was thereafter seriously delayed by procurement problems. According to the corporation the construction time was increased by more than 2 years because of the delay experienced in the procurement of steel.4/

1/ Recently the cost of a conveyor for the mine was increased by 15% because it had to be purchased in the U.S. rather than West Germany.

2/ A penalty fee of Rs. 72 lakhs (including Rs. 42 lakhs of foreign exchange) was paid to the contractors of the fertilizer plant at Neyveli as a result of the failure to provide 3,429 tons of steel within a specified time. The steel was eventually imported at a cost of Rs. 27 lakhs.

3/ Estimates Committee - 125th Report, 2nd Lok Sabha - April 1961. At the present time full operation may be possible by the end of 1965 but is not likely to be achieved until 1966.

4/ See also footnote 2, par. 19.

22. Following the experience gained from a pilot project, a project report was prepared for the briquetting plant and approved by the Government in April 1959. Approval was given to issue global tenders for the project in June 1959, but the final approval to proceed with the project was not given until March 1961. The reason given for this delay was the tight foreign exchange position. Under these conditions it is not explained why approval for tenders was given in 1959. It is possible that the delay was partly attributable to an understandable hesitation to commit funds to what should have appeared to some officials as a marginal project.

The Economics of the Scheme, 1963

23. There is evidence of a growing concern with the continued increases in the estimated cost of the project. This appears to have reached an acute stage in 1963. In January of that year an official of the Ministry of Mines and Fuel, the project's administrative ministry, visited Neyveli to discuss with the management the reasons for the latest increase. Then in June 1963 the Planning Commission requested, through the Ministry, that the economics of the project be worked out in view of the many changes in the estimated cost. This is the first time as far as we have been able to determine that an attempt was made to examine the economics of the project as a whole since the rough calculations of the 1954 Powell Duffryn report. By this time the original estimate of cost had grown from Rs. 57.8 crores to Rs. 117.6 crores, an increase of over 100%, and the major investment decisions had been made.

24. At the time this request was made it appears that neither the Corporation nor the Ministry were prepared to make a quick answer. In fact the request seems to have raised certain questions as to how such an analysis should be made - in particular, how the element in the cost of production attributable to capital should be handled and what rate of interest (and/or return) should be used. These questions were particularly important in determining the cost of lignite to be charged to the using plants. Some calculations made by the Corporation at this time show a range of estimated lignite costs of from 11 to 16 rupees per ton depending on the interest rate used, and the way capital was treated. In its calculations the Corporation thought it necessary to keep the interest payable on loan capital separate from the return earned by equity even though the distinction between loan and equity capital seems to be a purely formal one in this case. The lowest of the costs noted was obtained by charging 5½% interest on loan capital and omitting any return to equity, the highest resulted from a 6% interest on loan capital and an 8% return on equity. All were computed on the basis of full capacity operations.

25. The calculations finally submitted to the Government at this time took the form of runouts of annual receipts and expenditures from 1962-63 through 1970-71 showing annual and cumulative surplus or deficits, after charging 5½% interest on the loan portion of capital, a contingency reserve of ½% of total capital and an unspecified amount for taxes.

The surpluses were treated as returns to equity. The equity was assumed to be Rs. 80 crores out of the total of Rs. 117 crores, or about 70%. The prices used were Rs. 13 per ton for lignite, Rs. 670 per ton for urea, Rs. 160 per ton for briquettes including by-products and 5.2 np (Rs.052) per kwh for electric power.

26. On the basis of these assumptions, it was estimated at that time (1963) that the project as a whole would earn its first annual surplus over interest payments in 1965-66 and its first cumulative surplus in 1967-68. The annual return on equity would increase from .6% in 1965-66 to a maximum of 4.3% in 1968-69. This is equivalent to a return on total capital of a little over 5%. The returns on the fertilizer and briquetting plants were slightly higher and that on the power plant was about 7%.1/

27. A return of 5% is clearly not sufficient to justify an industrial project in India. Furthermore, there are reasons to believe that the estimates underlying even the 5% return tended to overstate what can be achieved in terms of output and also to overstate its net value to the economy. For one thing, the rate of achieving full capacity operations was unrealistic, as was the estimate that output could be maintained at that rate steadily.2/ The calculations are crude for purposes of an economic appraisal. Items of costs such as housing, taxes and duties, are included where they should be omitted. On the other hand, capital costs are undervalued because of the low interest rate used in capitalizing the operating costs required to open the mine and in computing interest during construction for the several plants, if indeed this item was included at all. Also, the price of imported machinery and equipment - roughly 45% of the total capital cost - has been valued at the existing rate of exchange which definitely undervalues its real cost to the economy, while at the same time the prices used in valuing the outputs of fertilizer and briquettes include a substantial element of protection. On balance we would expect that a calculation of the economic return which took into account all relevant factors would turn out to be appreciably less than 5%.

Plans for Expansion

28. At the same time that the cost estimates were increasing and implementation was falling continually behind schedule, plans were undertaken to expand the capacity of the project. During the year 1961

1/ This would indicate the return on the mine itself to be below the average of 5% for the project, on the basis of the price used for lignite (13 rupees per ton).

2/ We can now see that the estimates were too optimistic. We would also wonder whether the capacity of the project on an annual average should not be taken to be less than estimated here for purposes of economic appraisal. (See paragraph 32.)

in which the lignite seam was first exposed in the mine and before the installation of the first unit of the power station was completed, plans were initiated to increase the planned capacity of both the power plant and the mine. It was arranged with the USSR for a detailed project report to be prepared for the expansion of the power plant from 250 MW to 400 MW. The corporation itself prepared a report for the expansion of the mine to an average annual capacity of 4.8 million tons of lignite, with the capability of a maximum output of 6.0 million tons.1/ This report was reviewed by a Standing Panel of Technical Experts which recommended planning for an average capacity of 5.5 million tons in event power requirements would increase as result of an improved load factor. Apparently, this change did not involve any change in the equipment required. In the following year, 1962, both expansions were approved in principle by the Government of India and their implementation awaited the specific sanction of the investment and the release of the foreign exchange required.

29. Shortly thereafter, a proposal was made to expand the power plant still further by adding two 100 MW units, increasing the total generating capacity from 400 to 600 MW. This proposal originated in the Ministry of Steel and Mines, and the management of Neyveli was asked to comment on the feasibility of the scheme. At this stage, the total lignite requirements of the project were estimated to be slightly less than planned mine capacity (5.3 and 5.5 million tons, respectively) and peak capacity was still higher (6.0 million tons). The management of the Corporation was attracted to the proposal. It appeared to provide an opportunity to convert the margin between present lignite requirements and full capacity of the mine to a useful product which would tend to improve the economies of the mine. Actually, the additional lignite requirements were greater than the margin. They were estimated to be 1 million tons bringing total requirements to 6.3 million tons, which would require some additional investment in the mine and increase its capacity to beyond the original maximum of 6.0 million tons.2/ However, the Corporation proposed that this expenditure be charged to the power plant since it would be undertaken entirely to facilitate the expansion of the plant. This presumably would strengthen the case of maintaining or increasing the price for power obtained from the Madras Electricity Board. This expansion was approved in principle by the Government in 1963. Sanction to proceed with the investment had not been given by February 1965. It is not known whether the proposal to charge costs of the mine expansion to the power plant has been accepted.

1/ The original mine project was designed by Powell Duffryn so that its capacity could be expanded to 6 million tons.

2/ One would think that consideration would have been given to a power expansion of 100 MW instead of 200 MW (there would already be one 100 MW machine after the previous expansion to 400 MW), bringing the total to 500 MW and leaving lignite requirements within the original maximum capacity of the mine. (See paragraph 32.)

30. More recently a proposal has been made to open a second mine in connection with a new 600 MW power station. This project has not been approved as of February 1965. The reasons given by the Planning Commission are that alternative means of supplying the power appeared more attractive. Not only were the estimated costs of the lignite based plant higher, but the time taken to develop it and the need to operate it at high load factor (base load) to keep costs down were also against the project. The decision had been taken to increase thermal capacity near Madras (Ennore). This plant would burn coal or oil. The oil would come from the refinery to be built in Madras. It might have been cheaper, we were told, to increase generating capacity on the coal fields at Kothagudem in Andhra Pradesh and transmit power at high voltages to Madras but such transmission would have represented a new development and would also have taken more time.1/

The Development of the Mine

31. The case for the expansion of the original mine has been largely based on the need to spread the overhead of what had become a very expensive project. On the face of it the argument has merit. On the other hand, the relation between mine output and the demands of the consuming plants is quite critical for the economics of the integrated project. There have been problems in achieving the expected output in the mine thus far. These may be expected to continue in the future and there will probably be difficulties in achieving and maintaining output at the level of 6.3 million tons, which is beyond the maximum capacity originally envisaged for the mine.

32. The development of the mine has encountered many difficulties. Initially the equipment had to be modified because the overburden proved harder and more abrasive than anticipated. Then in 1961 the initial cut had to be enlarged because it became evident that it would be too small to supply the required output. Next it was found that the capacity of the equipment was not sufficient to achieve the projected output and a rectification of this situation was included in the first expansion program. Currently the problem is to increase the rate of utilization and the productivity of the equipment towards the levels necessary to achieve the output for which the mine is designed. Production in 1964 was expected to be almost 1.5 million tons at the time of the mission's visit and though the 1965 output was expected to be substantially higher as the result of the installation of new equipment it would still be far below the planned capacity of the mine. Although it may be possible to eventually produce 5.5 to 6 million tons of lignite annually, in the view of some of the consultants on the project there is real cause for doubt whether the mine can be made to produce at a rate of 6.3 million tons as planned.

1/ Interview with Adviser on Irrigation and Power, February, 1965. No account of the comparisons was available. It is not made clear to us what price of oil was used in computing costs of thermal power at Ennore.

The mission was told that this level of output could only be achieved by utilizing the equipment more intensely than was the practice even in Germany where experience was far greater and maintenance far easier because of the proximity to equipment manufacturers.

33. The production problem is intimately related to the cost problem. Because of the very high level of fixed costs involved in the mine operation the cost of producing lignite is very sensitive to the level of production. The official estimate of lignite costs is 13 rupees per ton for the 6 million-ton mine but it is admitted that some believe 16 rupees to be more accurate.1/ These figures probably understate costs because of the tendency to understate the true cost of capital. In addition, and perhaps even more important, they would be increased substantially if realistic levels of production were assumed.2/

Concluding Remarks

34. In the preceding account we have described the steps by which this project has evolved from a strong regional interest in developing a local fuel source to a great integrated multi-product operation involving an investment of Rs. 120 crores ($250 million) which is unlikely to earn even a modest return. It cannot be denied that in certain respects the accomplishments at Neyveli are impressive. A great mine has been opened, a severe ground water problem has been controlled, and lignite has been mined in quantity for the first time in India. When the fertilizer and the briquetting and carbonization plants join the power plant in operation these, too, will be pioneers of their kind. All these has been accomplished without the assistance of foreign consultants for the overall project and with the heavy participation of Indian engineers in planning, design and construction. On the face of it this is no mean accomplishment. However, considering the resources employed and the project's present and likely future output, the project cannot be judged successful. Investment costs have been high, implementation has been slow, a great deal of capital has been tied up for a long period without earning any return and the project is unlikely ever to earn an adequate return.3/ In other words, the same resources could undoubtedly have made a greater contribution to the production of needed goods and services for the Indian economy in some alternative use.

1/ Interview with Joint Secretary, Department of Mines and Metals, Ministry of Mines and Fuel. February, 1965.

2/ On the basis of some rough calculation based on the Corporation's 1963 estimates of mining costs we would guess that production at 25% below capacity levels might increase lignite costs over those estimated at capacity levels by as much as 3 rupees per ton.

3/ See paragraph 27.

35. Criticism after the fact is easy. Certainly the project has not turned out as originally expected. This is not unusual, - especially in recent Indian experience. In part the original expectations themselves were unrealistic as is frequently the case. Certainly a more thorough initial appraisal might have helped to anticipate and possibly avoid some of the problems subsequently encountered. Certainly a more serious emphasis on economic factors might not only have led to a more careful evaluation of the alternatives but might also have set the stage for subsequent reevaluation of the project by emphasizing the basic economics involved and in particular, the effect of changes in costs and markets on those economics. On the other hand, early appraisals must necessarily be crude and it may be too much to expect costs and markets to have been estimated very accurately at the time this appraisal was first made in 1954. However, one important general point seems to have been overlooked. The great size of the project and its inherent complexity in terms of the close interrelationship between the different parts involved a risk in implementation that does not seem to have been sufficiently taken into account. Given the problems of procurement and implementation typical of the Indian experience and add to these the pioneering nature of most of the component projects, there was bound to be great difficulty in coordinating the parts of the project sufficiently well so as to realize the full potential of the investment. Inherent in the very nature of the project was a considerable risk that substantial amounts of capital would be idle over periods of time, either because lignite was not available to the consuming plants, or the consuming plants could not use the lignite that could be produced. This characteristic of the project in itself should have led to a heavy discount of the expected results.

36. This integrated characteristic of the project should also have led to a continual review of the economics of the project as a complex. Although the original appraisal was certainly not adequate, in our opinion the main criticism of the appraisal procedure used was its rigidity. Both estimated investment costs and market prospects changed substantially before investments had been committed for all component projects. In the face of these changes which obviously affected the economics of the project as a whole and in particular the relative economics of its component parts, no attempt was made to alter the planned pattern of investment in order to improve the potential performance of the project. The changes that were subsequently made were made in a piecemeal fashion and leave questions whether the project as a whole has been brought into a workable balance between mine capacity and the requirements of consuming plants.

37. Finally, it should be pointed out that many of the problems of appraisal we have noted can be related to a general vagueness as to criteria. Specifically there has been a reluctance to give sufficient emphasis to the most specific and most useful of criteria -- return on investment. There was some deference shown to return considerations at the time of the original appraisal - though, as we have pointed out, the analysis was not very rigorous. However, once the pattern of output was selected, in which the vague concept of physical need played an important part, the question of costs and returns was apparently closed, and no basis remained for judging the desirability of making subsequent changes to the project as costs and requirements developed differently than expected.

Table 1: NEYVELI LIGNITE PROJECT - OUTPUT OF ALTERNATIVE SCHEMES CONSIDERED IN POWELL DUFFRYN 1954 REPORT[1/]

Annual Output		Schemes 1	2a	2b	2c	3	4
Lignite: in millions of tons		1.07	1.37	1.63	1.46	3.273	6.268
Power: in millions of kwh		728	825	910	862	995	1248
Fertilizer: in thousands of tons of:	ammonium sulphate	---	100	200	100	200	100
	urea				20		20
Briquettes and by-products: in thousands of tons of:	briquettes, raw					714	714
	briquettes, carbonized					380	380
	char dust					43	43
	motor spirit					6.4	6.4
	tar					51.3	51.3
	phenol					1.0	1.0
	motor spirit						85
	diesel oil						15
	tar						1.2
	sulphuric acid						7.3

1/ The Mining Utilization and Processing of the South Arcot Lignite, Powell Duffryn Technical Services Ltd., 1954.

Table 2: COMPARISON OF PRICE ASSUMPTIONS USED IN POWELL DUFFRYN REPORT AND THOSE SUGGESTED BY DR. A. NAGARAJA RAO IN THE STANDING COMMITTEE OF TECHNICAL EXPERTS

Product	Unit	Price Assumptions		Difference
		Powell Duffryn 1/	Dr. Rao 2/	
Electric Energy	As/unit	0.8	--	
Raw Lignite Briquettes	Rs/T	40	30	- 25%
Carbonized Briquettes	Rs/T	150	75	- 50%
Char Fines	Rs/T	40	30	- 25%
Tar	Rs/T	100	50-60	- 45%
Phenols	Rs/T	445	should be somewhat lower	- 10%
Motor Spirit	Rs/gallon	1/8/9 (1.55)	0/9/11 (.62)	- 40%
Diesel Oil	Rs/gallon	1/3/- (1.19)	0/9/3 (.58)	- 48.7%
Ammonium Sulphate (using gypsum)	Rs/T	280	250	- 10.7%
Ammonium Sulphate (using sulphur)	Rs/T	280	250	- 10.7%
Urea	Rs/T	560	450-500	- 15.2%
Sulphuric Acid	Rs/T	140	100	- 28.5%

1/ The Mining Utilization and Processing of the South Arcot Lignite, Powell Duffryn Technical Services Ltd. 1954.

2/ Suggested to Standing Committee of Technical Experts by Dr. A. Nagaraja Rao, Chief Industrial Advisor to Government of India and Convenor of Committee, April 2, 1956, accompanied by following comments:

(a) Raw lignite briquettes: To give price incentive and reasonable margin for alterations to furnaces, etc. price should be lower.

(b) Carbonized briquettes: Price differentiation between industrial and domestic users is not possible. Therefore the price of coke - Rs. 75/T - has to be taken as a guideline.

Table 2 (continued)

2/ (continued)

(c) Char fines: Price should not be higher than the price for raw lignite briquettes.

(d) Tar: At present sold by Iron and Steel companies at Rs. 50-55/T by merchant coke ovens at Rs. 90-95/T. Since the latter is too high anyhow the former should be applied.

(e) Motor spirit: c.i.f. price is 0/9/11 gallon to which excise of 0/15/9 gallon has to be added. Ex-factory price cannot be assumed higher than c.i.f. price.

(f) Diesel oil: The same applies to diesel oil. c.i.f. price is 139/15/7 per ton, 0/9/3 gallon for high speed diesel oil.

(g) Ammonium sulphate: As it is government's policy to bring down the prices of nitrogenous fertilizers Rs. 250/ton should be asumed a maximum selling price.

(h) Urea: The fertilizer price should be based 10-20% lower than ammonium sulphate on nitrogen basis to encourage use of alternative fertilizers.

(i) Sulphuric acid: Likely to be little demand for some time to come. Will be used primarily as raw material for manufacture of superphosphate or ammonium sulphate. Ex-factory price should not be assumed higher than Rs. 100/ton.

Table 3: OUTPUT AND RETURNS FOR VARIOUS SCHEMES AS ESTIMATED BY POWELL DUFFRYN TOGETHER WITH EFFECTS ON ESTIMATES OF USING PRICES SUGGESTED BY RAO 1/

Scheme 2/	Powell Duffryn		Rao	
	Value of Production in Rs. lakhs	Return on Investment in %	Value of Production in Rs. lakhs	Return on Investment in %
1 Mine (1 M.ton/yr.) Power	352	4.8	352	4.8
2a Mine (1.4 M.ton/yr.) Power Fertilizer	632	6.4	602	5.6
2b Mine (1.6 M.ton/yr.) Power Fertilizer	912	8.5	853	7.2
2c Mine (1.5 M.ton/yr.) Power Fertilizer	744	7.2	697	6.0
3 Mine (3.3 M.ton/yr.) Power Fertilizer Briquettes	1581	15.1	1148	7.7
4 Mine (6.3 M.ton/yr.) Power Fertilizer Briquettes By-products	2120	13.8	1458	6.1

1/ For actual price assumptions used, see Table 2.

2/ For further description of schemes, see Table 1.

Table 4: CAPITAL COSTS OF DEVELOPING MINE AND EQUIPPING IT FOR FULL PRODUCTION

(in lakhs of rupees)

	1956 1/	1957 2/
Operating cost of specialized equipment (including depreciation)	163	71
Operating cost of conventional equipment	180	342
Ancilliary operations	8	8
Site overheads and supervision	44	44
Capital cost of specialized equipment	634	769
Spares		65
TOTAL	1029	1300
Miscellaneous costs at 6% of above Total	62	78
Working capital	16	16
Interest during development at 4½%	90	100
	1197	1495
Total expenditure on site to April 1956	211	211
Housing, additional pumping equipment, etc.	290	346
GRAND TOTAL	1698	2052
Figures in Original Reports	(1690)	(2033)

1/ PDTS - Project Report on the Planning of the Mine Development and Production Phases, August 1956.

2/ PDTS - Supplement to the Project Report, May 1957.

Note: If an interest rate of 9% had been used, the total capital costs would have have been increased to Rs. 1788 lakhs and Rs. 2152 lakhs, respectively.

Table 5: ESTIMATED COSTS OF PRODUCING LIGNITE FROM A MINE WITH A CAPACITY OF 3.5 MILLION TONS PER YEAR OPERATED AT FULL CAPACITY

(in rupees per ton)

	Powell Duffryn Report of 1956 [1]	Powell Duffryn Report of 1957 [1]
Mining Operations		
Cost of stripping overburden	2.6	2.8
Lignite loading	.6	.7
Ancilliary operations	.4	.4
Site overheads and supervision	.4	.4
Total	4.0	4.3
Capital Costs [2]	1.9	2.3
Other than Mining Costs	.9	.9
Total Costs	6.8	7.5

1/ See Table 4.

2/ Interest at 4½% on approximately 70% of capital costs (see Table 4) representing that financed by loans. Remaining 30% "amortized" via sinking fund at 1.6% per year.

Note: (i) If interest of 9% were charged to total investment calculated using 9% interest during development (Table 4) the total costs would be Rs. 9.5 and Rs. 10.7 per ton, respectively.

(ii) Both sets of estimated costs exclude cost of ground water control.

Table 6: THE NEYVELI LIGNITE PROJECT: THE DEVELOPMENT OF THE ESTIMATED CAPITAL COSTS
(in Rs. crores)

Project	Estimates of Capital Costs						
	1954[1]	1956	1960	Jan. 1962	Jan. 1963	Mid-1963	Mid-1964
Mine	14.7	16.9[2]	20.3	24.3	24.6	24.7	24.7
Power Plant	19.1	20.0[2]	21.7	28.1	28.2	28.5	29.3
Briquetting Plant	10.2	11.0	20.0	25.8	25.8	28.2	29.1
Fertilizer Plant	13.8	21.0	26.1[3]	34.2	35.5	36.2	38.1
Housing and Common Services		6.5					
TOTAL	57.8	68.9	94.7	112.4	114.1	117.6	121.2

1/ Powell-Duffryn 1954, op.cit.

2/ Capacity of mine and power plant increased from 3.3 million tons per year and 200 MW to 3.5 million tons and 250 MW respectively.

3/ Fertilizer plant changed from capacity of 200,000 tons ammonia sulphate to 152,000 tons urea.

APPENDIX III

THE DEVELOPMENT OF THE PROJECTS OF THE HEAVY ENGINEERING CORPORATION

Kenneth A. Bohr and Jochen Kraske

APPENDIX III

THE DEVELOPMENT OF THE PROJECTS OF THE HEAVY ENGINEERING CORPORATION

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THE DEVELOPMENT OF THE PROJECTS OF THE HEAVY ENGINEERING CORPORATION

1. The Heavy Engineering Corporation (HEC) at Ranchi, Bihar was incorporated in 1958. The company was established to produce heavy machinery and equipment for basic industries, especially steel production and coal mining. It has been entrusted with the execution and management of four different projects:

the Heavy Machine Building Project
the Foundry Forge Project
the Coal Mining Machinery Project
the Heavy Machine Tools Project

A plant for the fabrication of heavy structurals is also proposed for the near future.

2. Next to Hindustan Steel, the Corporation will be the largest industrial undertaking of the Central Government. The total estimated cost of the projects is around Rs. 207 crores with a foreign exchange component of about Rs. 84 crores. This cost estimate does not include the cost of townships estimated at about Rs. 39 crores.

3. With the exception of the Coal Mining Machinery Plant which is located at Durgapur, West Bengal, the projects are all at Ranchi. When the four projects are completed it is estimated that the employment may be about 23,000 : 18,000 at Ranchi and 5,000 at Durgapur. Eventually 90% of the accommodation required will be provided in two townships with 16,000 houses.

4. It is expected that the annual output of the four projects at full production will be in the order of Rs. 135 crores. Annual net profit at this stage has been estimated by the Corporation at about Rs. 30 crores.

5. In the following four sections each project is described in turn. Each description includes a brief history of the project's background, the progress of its implementation to the time of the Mission's visit in January 1965 and the Corporation's estimates of the future development of its costs, output and sales. In the fifth section an attempt is made to appraise the economic feasibility of the projects as they appear today. In the final section a number of observations suggested by our study are presented. The data used in this paper were supplied to the Mission by the Heavy Engineering Corporation. In some cases it has been necessary to break down the totals given us in a more or less arbitrary way as, for example, in allocating expenditures on investment over the early years of project construction. The interpretation of the data is, of course, ours.

I. Heavy Machine Building Project

(a) History

6. As early as 1954 the Government of India was concerned about the forthcoming requirements of the country for heavy machinery, especially steel plant equipment, and began to consider the possibility of setting up an indigenous heavy engineering industry.

7. In the fall of 1956 a team of British experts headed by Sir Eric Coates visited India under the joint aegis of the Colombo Plan and the Federation of British Industries to "advise the Government of India on the further heavy engineering capacity required and its most efficient division among new manufacturing units and extensions of existing units." The team submitted its report in January 1957 and recommended building the following plants:

	Capacity (tons)		Investment in Rs.crores/1
	Single shift	Double shift	
1 Heavy structural plant (2 bays)	11,000	19,000	1.9
2 Heavy plate and vessel plants	22,000	38,000	10.4
2 Heavy machine shops	-	-	6.7
1 Medium and heavy machine tool plant	4,000	-	4.7
			23.7

/1 1 crore = 10,000,000

8. At about the same time a Russian team led by Mr. N. I. Babich came to India to make a similar study. The terms of reference of the Russian team were, however, more specific, calling primarily for an assessment of the feasibility of producing steel plant equipment indigenously. The Russian team presented a preliminary project report for a Heavy Machine Building Plant in January 1957. The proposal was for a plant with 80,000 tons annual capacity to be built in two stages with the possibility of expansion to an ultimate capacity of 165,000 tons. The investment required for the first stage with a capacity of 45,000 tons was estimated at Rs. 18.6 crores and for a capacity of 80,000 tons, Rs. 26.7 crores. Whereas the British proposal involved building a number of comparatively small decentralized units, which nevertheless would have been large by UK standards, the Russian experts proposed to construct what would eventually become an extremely large factory at a single location. This project alone would have an ultimate capacity sufficient to supply the estimated requirements of the entire Indian economy for steel mill equipment as well as heavy machinery required for other industries.

9. A committee, under the chairmanship of Sir Jehangir Ghandy, Director of Tata Iron and Steel Industries Ltd., and consisting mainly of representatives from private sector industries, was appointed by the Government to study the two reports. This committee came to the unanimous conclusion that the British proposal was preferable and more suitable to the country's needs for the following reasons:

(i) The British proposal allowed for the dispersion of industries. Except for the heavy machine shops, which would have to be located near a foundry forge, and perhaps the medium and heavy machine tool plant, which might be located close to the same site with some advantage, the other projects could be located independently. Such a dispersion seemed particularly desirable for strategic and transport reasons. It was also felt that while a concentration of the heavy engineering industry could create difficulties in finding a sufficient number of skilled workers, a dispersion of industry would tend to generate a country-wide reservoir of skilled labor.

(ii) The scope of the British proposal was considered more favorable to the development of a heavy engineering industry because it covered a wider range of products. In addition to the future requirements for iron and steel-making equipment, the plants were also to produce the requirements for the chemical and fertilizer industries.

(iii) The British proposal allowed for an earlier start of production and earlier returns.

10. The majority of the committee was of the opinion that within the framework of the British proposal the heavy structural fabricating plant was of very high priority.

11. The committee had been told that the Government intended to invest up to Rs. 40 crores in the establishment of a public sector heavy engineering industry. Since this included about Rs. 20 crores for a foundry forge, financial considerations may have had some influence on the committee's decision. Within this financial limitation the range of products under the British proposal may have seemed particularly attractive.

12. The Government of India did not follow the committee's recommendations; it accepted the Russian proposal. A major reason for this decision was the fact that the Soviet Government had at that time offered a loan for the development of five projects which included the proposed heavy machine building plant at Ranchi and a coal mining machinery plant at Durgapur. No comparable aid was associated with the UK proposal.

13. A contract for the preparation of a Detailed Project Report was signed on December 14, 1957. The Detailed Project Report was to embrace the full projected capacity of 80,000 tons to be built in two stages with broad guidelines for an ultimate expansion to 165,000 tons. After the Detailed Project Report had been accepted by the Indian Government on November 14, 1959, a contract was signed with the Russians for the supply of plant and equipment required for the first stage of 45,000 tons capacity. However, just when the corporation was about to invite tenders for the civil construction work the Government decided to expand the project to the capacity of 80,000 tons in one stage. Consequently, the contract with the Russians for supply of machinery and equipment had to be extended. While this decision would without doubt have resulted in some economies in the civil construction work the major force behind it seems to have been the availability of another credit extended by the Soviet Government to the Government of India.

(b) Progress of Construction

14. The agreement with the Russians on the heavy machine building plant was very comprehensive.1/ It included the supply of the entire amount of 15,145 tons of required fabricated steel, of 1,117 tons of reinforcing rods, and of 50,000 square meters of armored glass from Russia. The Russians were also to supply all the detailed working drawings for the entire construction program. The implementation of the project has definitely benefited from this arrangement with the result that the project has progressed roughly according to schedule.

15. The plant site was prepared in 1960 and construction was started the following year. In accordance with Russian practice construction and erection has been scheduled on an annual basis with schedules drawn up before the beginning of each year. Thus, the schedule for 1965 was in a preparatory stage in November 1964. This makes it difficult to obtain a clear picture of the overall delays. The Detailed Project Report did not set any targets for the completion of civil works construction or the commissioning of the project. However, on the basis of a tentative schedule prepared by the Russians in April 1962, it appeared that civil works were about 3 to 12 months behind schedule at the time of the Mission's visit in January, 1965. Their completion was expected in the second quarter of 1965. The delivery schedule for the equipment indicated that equipment would be arriving up to the end of 1966. It was anticipated that the plant would be commissioned in 1966/67. The delays experienced were attributable to:

1/ This was in marked contrast to the arrangements made with the Czechs in the case of the Foundry Forge Project (see below).

(i) delayed dispatch of the detailed working drawings; some foundation drawings were received only after the corresponding equipment had already reached the plant site;

(ii) delays in the procurement of indigenous building materials; and

(iii) delays in the delivery of the equipment, especially some of the electrical equipment.

16. When members of the Mission visited the plant in January, 1965, construction and erection of the project were in an advanced stage. All auxiliary departments such as stores, maintenance shops and box-making shops were virtually completed. The major production departments were nearing completion and production had started in some of them on a limited scale. Over all, about 54% of the equipment was in position; out of a total of approximately 28,000 tons of equipment coming from the USSR, about 20,000 tons had been received. The construction and erection schedule had been drawn up so as to complete one-half of the entire project as soon as possible. In fact, the equipment that remained to be installed would largely duplicate what was already there.

17. The department for manufacturing coke-oven equipment and cranes was the most advanced. Civil works and electrical works were 91% and 86% complete, respectively. 80% of the mechanical work of erection had been done and all the machines received so far were erected. Production had started in the structural fabricating section where heavy steel structures are welded and some overhead cranes had been assembled. It was expected that this section would be employed heavily during the following year or so producing fabricated steel for the Heavy Machine Tool Project and some 6,000 tons of steel structures for the foundry forge.

18. In the forging and heat treatment department, civil works were about 90%, and mechanical and electrical works about 80% completed. Some minor jobs were being done by the department, mostly in connection with the construction and erection of the project.

19. Civil and electrical works in the reduction gear department and in the medium and small machinery department were about 85% to 90% completed; erection of machinery and mechanical works were 80% completed in the reduction gear department and 75% completed in the medium and small machinery department. Some of the equipment was not expected to be delivered until later in 1965 or in 1966. The very small output of castings from the Foundry Forge Project was being machined in these two departments. In addition, some job work was being done for other enterprises, such as, for instance, machining of wheels for locomotives and railroad wagons for the Chittaranjan Locomotive Works.

20. Only the heavy machines department was still in an early stage of construction. Civil works were 73%, electrical works 22% and erection

of equipment only 10% completed. The erection of large overhead cranes, capable of handling 150 tons, was well under way and foundations for the machinery were being prepared.

21. The Russian chief engineer was reported to have stated that production could have been started over the whole range of products if it were not for the lack of orders. Apparently there was some difficulty in getting orders from the existing iron and steel plants, mainly because these plants incorporated many different types of equipment depending on the country of origin. For this reason, it was the view of the corporation that the Heavy Machine Building Project should concentrate its efforts at first towards supplying other Soviet-aided projects, e.g., Bhilai and Bokaro steel plants. Discussions were said to have been held in Moscow regarding the extent to which the Heavy Machine Building Project could contribute to the construction of Bhilai's sixth blast furnace.

22. Once orders do come forward, difficulties will arise in procuring the required materials and components. This is especially critical in the case of the necessary castings and forgings which will not be available from the foundry forge for several years to come and will have to be imported until that time. Similarly, motors, switchgear, ball bearings, etc. of the heavier size ranges are still not available indigenously and will have to be imported. Apart from considerations of this kind, it is intended to operate at first in the field of machine assembly. Machinery would be imported in a completely knocked-down condition and then assembled and tested at the Heavy Machine Building Project.

(c) Project Costs

23. At the time of the Mission visit the total capital cost of the Heavy Machine Building Project was estimated at Rs. 43 crores, out of which the equivalent of Rs. 26.85 crores was in foreign exchange.

24. The agreement with the Russian collaborator provides for most of the foreign exchange expenditures:

		(Rs. lakhs)1/
(i)	Payment for Detailed Project Report, working drawings, design documentation, etc.	164.86
(ii)	Plant and machinery tools, fixtures, etc.	1,923.15
(iii)	Payment of foreign experts	116.81
(iv)	Training of Indian personnel	30.00
	TOTAL	2,234.82

1/ 100 lakhs = 1 crore
(1 lakh = 100,000)
(1 crore = 10,000,000)

25. These expenditures are being financed as follows:

		(Rs. lakhs)
(i)	Under 500 million ruble credit (1957)	1,593.38
(ii)	Under 1,500 million ruble credit (1960)	592.07
(iii)	Trade and payment agreement	49.37
	TOTAL	2,234.82

26. Interest at the rate of 2½% has to be paid and accrues from the date of the use of the corresponding part of the credit. Payment of the accrued interest and repayment of the credits will be made in 12 equal annual instalments starting one year after the completion of deliveries necessary for the commissioning of the project. The amounts repaid may be used for the purchase of Indian goods and/or converted into free pounds sterling.

27. The most recent estimate of project cost is much higher than the earlier estimates. The Preliminary Project Report submitted in 1957 contains the following estimates.

	(Rs. crores) 45,000-ton stage	80,000-ton stage
Construction work	5.65	7.75
Purchase of equipment, f.o.b.	11.68	16.88
Erection, tools, accessories, etc.	1.36	2.05
TOTAL	18.69	26.68

28. The Detailed Project Report of 1959 showed increases in the cost estimates of 16.9% and 5.5% for the first and second stages, respectively:

	(Rs. crores) 45,000-ton stage	80,000-ton stage
Construction	5.46	7.06
Plant and equipment	15.14	19.34
Erection	.86	1.13
Tools, fixtures and auxiliary furnishings	.40	.62
TOTAL	21.86	28.15

29. Since 1959, it has been found necessary to increase the estimates still further. A major reason was that the following items were not provided for in the Detailed Project Report:

		(Rs. lakhs)
(i)	Cost of the Detailed Project Report, technological documentation, etc.	226
(ii)	Customs duties	304
(iii)	Port trust and handling charges	90
(iv)	Indigenously procured tools, fixtures, etc.	11
(v)	Cost of foreign experts	240
(vi)	Costs of training	75
(vii)	Costs of temporary construction	75
(viii)	Office recurring and non-recurring expenditures	325
	TOTAL	1,346

In addition, increased labor costs on civil construction and increased requirements for construction materials have raised the construction costs Rs. 139 lakhs over the 1959 estimate.

30. With the above additions the estimate of total capital cost was increased to Rs. 43 crores (as of January 1965). The breakdown is as follows:

	(Rs. crores) Local	Foreign Exchange	Total
Plants and machinery	3.55	19.96	23.51
Erection of equipment	1.13	-	1.13
Civil construction	8.22	1.48	9.70
Consultant fees, foreign experts, training, etc.	-	5.41	5.41
Establishment	3.25	-	3.25
TOTAL	16.15	26.85	43.00

31. This investment appears to have been distributed annually as follows, including estimates for 1965/66:

(Rs. crores)

	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	Total
Foreign exchange	1.81	3.62	5.43	7.24	4.14	4.61	26.85
Local	1.19	2.38	3.57	4.76	2.86	1.39	16.15
Total	3.00	6.00	9.00	12.00	7.00	6.00	43.00

32. The above estimate does not provide for the following items:

(i) The cost of the land required by the Heavy Machine Building Project proper: the land was given free to the corporation by the Government of Bihar. From what the Corporation had to pay for the land of the township it can be estimated that the cost of the land would have been roughly Rs. 0.3 crores (1,000 acres at Rs. 3,000).

(ii) The cost of the township at Ranchi: total cost of the Ranchi township is estimated at Rs. 30 crores. The township will serve the three projects located at Ranchi and the requirements of the Corporation's central administration. Assuming a share of 35% for the Heavy Machine Building Project would mean that approximately Rs. 10.5 crores would have to be charged to the project.

(iii) Working capital: requirements for working capital may be assumed to be 40% of the value of annual output. At full capacity level of output (valued at estimated c.i.f. import prices) this would amount to Rs. 17.9 crores.

(iv) Interest during construction: if interest during construction is calculated at 10% from the beginning of construction in 1960/61 until investment has been completed in 1966/67 it would amount to Rs. 17.46 crores.

33. If all these factors are taken into account the estimated total capital costs (as of January 1965) would be increased to Rs. 89.16 crores, as follows:

	(Rs. crores)
Land	0.30
Township, including land for township	10.50
Civil construction	9.70
Plant and equipment	23.51
Erection of equipment	1.13
Consultant fees, etc.	5.41
Establishment	3.25
Interest during construction	17.46
Working capital	17.90
TOTAL	89.16

(d) Expected Performance

34. At the time of the Mission's visit the Corporation expected that the Heavy Machine Building Project would increase its production in stages, reaching its full capacity output of 80,000 tons by 1972/73. Annual production costs (excluding depreciation and any interest or return on capital) were estimated to be Rs. 44.45 crores at this stage, out of which the equivalent of Rs. 2 crores would be in foreign exchange. Depreciation was apparently estimated at Rs. 1.9 crores. This estimate is considerably higher than that contained in the Detailed Project Report prepared in 1959. In that report the cost of production at full capacity was estimated at Rs. 28 crores on the same basis and depreciation was estimated at Rs. 2.4 crores. A breakdown of this estimate is given in Table 1; similar information was not made available to the Mission on the more recent estimate, so it has not been possible to show precisely where the increases took place.1/

35. The sales value of the output of 80,000 tons was estimated to be Rs. 56 crores. The detailed composition of the output is unknown as also are the price assumptions used. The Detailed Project Report (1959) does contain a production program for capacity operations broken down by broad types of equipment and quantity in tons. It also contains a set of "tentative world market prices" corresponding to each general type of product. These are shown in Table 2. These data indicate the total value of output at full capacity to be Rs. 41.4 crores, or 74% of the more recent estimate of Rs. 56 crores. The difference between the estimates could be ascribed to a number of reasons.

(a) Revision of world price estimates on the basis of better or more recent information.

1/ On the basis of full costs including depreciation the increase should probably have been higher than indicated since the more recent estimate of depreciation appears to be low.

(b) The addition of a factor for transport to India assuming prices used were those in exporting countries.

(c) The addition of a factor for tariff protection in India.

Any of these factors or any combination of them might account for the increase in the estimate. For the purpose of making some tentative economic calculations, we have assumed the revised figures included an allowance of 20% for tariff protection, with the remaining difference accounted for by price increases and/or the addition of an allowance for transport costs, and have reduced the projected sales figures accordingly to obtain estimates corresponding to the c.i.f. value of imports.1/

36. At the time of the Mission visit (January 1965) physical output, sales value of output at assumed c.i.f. prices, and operating costs (excluding depreciation and any interest or return on capital) were estimated by the Corporation to develop as follows:

	1964/ 1965	1965/ 1966	1966/ 1967	1967/ 1968	1968/ 1969	1969/ 1970	1970/ 1971	1971/ 1972	1972/ 1973
Output in tons	6,700	16,000	19,500	23,000	27,400	35,000	45,000	60,000	80,000
					(Rs. crores)				
Sales value at c.i.f. prices/1	1.04	5.60	9.60	12.80	15.20	19.60	25.20	33.60	44.80
Foreign exchange	1.08	1.95	1.89	2.20	2.20	2.00	2.00	2.00	2.00
Local cost	1.03	5.33	9.01	13.05	14.57	19.30	24.25	32.40	42.45
Total cost	2.11	7.28	10.90	15.25	16.77	21.30	26.25	34.40	44.45

/1 Value of sales estimated by the Corporation less 20%.

1/ We would not minimize the difficulty of determining a reasonable estimate for the value of future output of such a plant. The figures used here are admittedly very approximate.

Table 1: BREAKDOWN OF ESTIMATED PRODUCTION COST OF HEAVY MACHINE BUILDING PROJECT ACCORDING TO THE DETAILED PROJECT REPORT (1959)

	45,000-ton Stage		80,000-ton Stage	
	In Rs. lakhs	in % of total	In Rs. lakhs	in % of total
Direct materials	1,023.51	56.2	1,927.22	63.3
Indirect materials	47.27	2.6	75.49	2.5
Energy	44.72	2.5	58.23	2.0
Cost of secondary heat treatment	37.39	2.0	75.72	2.5
Wages and salaries	133.01	7.3	203.17	6.7
Leave payment	12.10	0.7	18.50	0.6
Sick leave	2.83	0.1	4.32	0.1
Provident fund	6.30	0.4	9.63	0.3
Wear and tear of purchased goods	90.82	5.0	116.03	3.8
Depreciation	187.13	10.2	241.28	7.9
Other expenses	150.49	8.2	167.00	5.5
Business expenses	86.78	4.8	144.88	4.8
TOTAL	1,822.35	100.0	3,041.47	100.0

Table 2: OUTPUT OF HMBP BY TYPES OF PRODUCT, PRODUCTION COSTS PER TON, AND TENTATIVE MEAN WORLD MARKET PRICES PER TON ACCORDING TO THE DETAILED PROJECT REPORT (1959)

Type of product	45,000 ton stage				80,000 ton stage			
	Annual output in tons	Cost per ton in Rs.	Tentative world market price per ton	Sales value of output in Rs. lakhs	Annual output in tons	Cost per ton in Rs.	Tentative world market price per ton	Sales value of output in Rs. lakhs
By-product coke plant equipment	6,000	3,470	4,610	276.6	7,700	3,020	4,700	361.9
Blast furnace equipment	4,000	3,600	3,990	159.6	5,500	3,780	4,330	238.15
Steel-making equipment	5,000	3,200	3,460	173.0	7,000	3,090	3,510	245.7
Crusting & grinding equipment	2,100	4,540	4,820	101.22	3,150	4,210	4,810	151.52
Crane equipment	4,400	3,950	4,220	185.68	6,570	3,560	4,110	270.03
Rolling mill equipment	20,000	4,430	6,060	1,212.00	34,500	4,050	5,810	2,004.45
Spares for metallurgical equipment	1,500	5,760	9,720	145.8	1,080	5,750	9,720	104.98
Mining equipment	-	-	-	-	880	4,080	5,160	45.41
Press forging equipment	-	-	-	-	1,360	3,500	5,570	75.75
Excavators	-	-	-	-	4,950	3,680	4,150	205.42
Oilwell drillings rigs	-	-	-	-	5,500	4,260	6,560	360.8
Miscellaneous equipment	2,000	3,400	3,980	79.6	1,810	2,310	4,000	72.4
Total	45,000	-	-	2,333.5	80,000	-	-	4,136.51
Total cost of annual output in Rs. lakhs	-	1,821.74	-	-	-	3,042.47	-	-

II. Coal Mining Machinery Project

(a) History

37. In 1956 a team of Russian experts visited India and studied the feasibility of setting up facilities to manufacture coal mining machinery indigenously. The team came up with a preliminary report early in 1957. After the Russian Government had extended a 500 million ruble credit in November 1957 to finance among other things a coal mining machinery plant, the Government of India signed a contract for a Detailed Project Report for a plant with an annual capacity of 30,000 tons. The project report was received in June 1959 and after having been examined by a committee of experts accepted in November 1959. In March 1960 a contract for the supply of plant, equipment and fabricated steel was signed with the Russian collaborator.

38. When the Russians extended another 1,500 million ruble credit in 1960 the Government of India felt that in view of the anticipated target for coal output the capacity of the project should be increased by 50% to an annual output of 45,000 tons. Consequently, the project report was revised and a revised contract for the supply of plant and equipment was signed in July 1962.

39. The collaboration agreement provided for financing of the following items:

	(Rs. crores)
Project report, working drawings, design documentation, consultancy, etc.	1.33
Plant and machinery, tools, fixtures, etc.	9.75
Expenses for foreign technicians	.81
Training of Indian engineers	.26
TOTAL	12.15

Of the total, Rs. 9.9 crores were provided under the 500 million ruble credit and the balance of Rs. 2.2 crores was covered by the second 1,500 million ruble credit. The terms of these credits were identical to those in the case of the Heavy Machine Building Project.

(b) Progress of construction

40. As in the case of the Heavy Machine Building Project the Russians insisted on a package deal and provided not only the plant and machinery, consultant services, and training but also the entire amount of fabricated steel required for the construction of the plant as well as the technical designs in detail. The Russians assumed the full responsibility for implementing the project. The project has no doubt benefited from this

arrangement. The fact that it is more or less on schedule must be attributed largely to the fact that all essential materials were procured abroad.

41. The overall progress in the construction to October 31, 1964 is illustrated by the following schedule:

	Total number of machines (including furnaces and cranes)	Number of machines received up to Oct.31,1964	Number of machines installed
Block no. 1	292	274	255
Block no. 2	179	154	98
Block no. 3	215	178	173
Forge shop	39	38	37
Heat treatment & fettling shop	25	22	2
Steel foundry	36	32	26
Iron foundry	49	40	15
Scrap preparation shop & skull cracker yard	3	3	2
Wood working block	67	55	54
Pattern shop	10	10	10
Central plant laboratory	17	15	3
Temporary fabrication section in block no. 3	4	4	4
Sub-assembly shop	41	41	41
Cranes	93	92	88
	1,070	958	808

42. The project started production of a few items in 1964. At the time of the Mission's visit in January 1965, belt conveyors and multi-stage pumping sets were being manufactured. A total of 42 belt conveyors were to be produced for the Katharia coal field and the Barauni refinery. A letter of intent had been issued by the National Coal Development Corporation for the supply of coal washery equipment on a substantial scale and a special collaboration agreement for the manufacture of coal washery equipment with Poland was under consideration.

43. In view of the fact that the estimates of coal requirements had been substantially reduced from the levels originally set for the Third Plan, there was some concern about the prospects for marketing the full capacity output. The management was confident, however, and assumed that the capacity would be fully utilized by taking up the manufacture of additional products. The fact that two major customers - the National Coal Development Corporation and the Singareni Collieries - are public sector undertakings was considered a guarantee against marketing problems.

(c) Project costs

44. Capital cost of the project with a capacity of 45,000 tons were estimated in the Detailed Project Report of 1959 at Rs. 17.50 crores, composed as follows:

	(Rs. crores)
Civil construction work	5.38
Plant and equipment	10.80
Erection of equipment	1.32
TOTAL	17.50

45. At the time of the Mission's visit the estimate of project cost was Rs. 29.30 crores. The increase of Rs. 11.80 crores was attributed entirely to the following items which were not included in the original Project Report estimate:

	(Rs. crores)
Cost of Project Report, consultancy, etc.	1.35
Customs duties, handling charges, etc.	2.30
Tools, fixtures, etc., mostly indigenously procured	1.95
Cost of foreign experts	1.70
Cost of training	0.60
Temporary construction, experts hostel, etc.	1.54
Office recurring and non-recurring expenditure	2.36
Total	11.80

46. It was expected that the investment would be completed in 1967/68 on the basis of the following program of expenditure:

	1960/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68	Total
					(Rs. crores)				
Foreign exchange component	-	0.79	3.20	4.00	2.06	1.05	0.70	0.35	12.15
Local cost	0.97	1.94	2.91	3.87	3.72	1.44	0.88	1.42	17.15
TOTAL	0.97	2.73	6.11	7.87	5.78	2.49	1.58	1.77	29.30

47. The estimate of Rs. 29.30 crores still does not include the following items:

(i) The cost of the land required by the Coal Mining Machinery Project proper: the land was given free to the Corporation by the Government of West Bengal. The land cost can be estimated roughly at Rs. 0.3 crores.

(ii) The cost of the township at Durgapur: this is estimated at Rs. 9 crores.

(iii) Working capital: requirements for working capital may be assumed to be 40% of the value of annual output. At full capacity level of output (valued at estimated c.i.f. import prices) this would amount to Rs. 9.85 crores.

(iv) Interest during construction: if interest during construction is calculated at 10% from the beginning of construction in 1960/61 until investment has been completed in 1967/68 it would amount to Rs. 16.36 crores.

48. If all these items were included the total capital costs of the project would become Rs. 64.80 crores as follows:

	(Rs. crores)
Land	0.30
Township	9.00
Civil construction	6.92
Plant and equipment	11.96
Erection of equipment	1.32
Consultant fees, training, etc.	3.65
Miscellaneous	5.44
Interest during construction	16.36
Working capital	9.85
TOTAL	64.80

(d) Expected Performance

49. At the time of the Mission's visit, it was expected that the capacity output of 45,000 tons would be reached by 1970/71. Annual production costs (excluding depreciation) at this stage were estimated to be Rs. 23.82 crores, out of which the equivalent of Rs. 2.38 crores would be in foreign exchange. Depreciation was estimated at Rs. 1.47 crores. As in the case of the Heavy Machine Building Project, this is considerably higher than the estimate made for the Detailed Project Report (1961). In that report, the cost of production at full capacity was estimated at Rs. 15.03 crores and depreciation at Rs. 1.44 crores. A breakdown of this estimate is given in Table 3; details of the composition of the increased costs are not known to the Mission.

50. The sales value of the capacity output was estimated at Rs. 30.79 crores at the time of the Mission's visit. Neither the detailed composition of the output nor the specific price assumptions are known to the Mission. The Detailed Project Report (1961) does contain a production program for capacity operations and a corresponding set of "tentative mean world market prices". The prices are shown in Table 4. On the basis of these prices, the value of capacity output is estimated at Rs. 22.76 crores, or 75% of the more recent estimate of Rs. 30.79 crores. As pointed out in the previous case, there may be various reasons for the increase.1/ We have assumed that the more recent estimate includes an allowance of 20% for tariff protection, the remainder being attributable to revised price estimates, and have reduced the projected sales figures by that amount to obtain estimates which presumably correspond to the c.i.f. value of imports.

51. At the time of the Mission's visit (January 1965), physical output, sales value of output at assumed c.i.f. prices and operating costs (excluding depreciation and any interest or return on capital)2/ were estimated by the Corporation to develop as follows:

	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71
Output (000 tons)	10.00	12.50	17.66	25.44	35.03	40.44	45.00
				(Rs. crores)			
Sales/1	2.02	3.19	9.81	13.66	19.71	22.77	24.63
Operating costs, foreign exchange component	0.40	0.40	1.00	1.40	1.90	2.31	2.38
Local	2.81	4.04	10.54	12.65	17.14	20.83	21.44
Total costs	3.21	4.44	11.54	14.05	19.04	23.14	23.82

/1 Value of sales estimated by the Corporation less 20%.

1/ In this case the Detailed Project Report states that the estimates were made on the basis of world market prices c.i.f. Indian ports.

2/ Interest on working capital is stated to be included.

Table 3: COAL MINING MACHINERY PROJECT BREAKDOWN OF PRODUCTION COSTS
DETAILED PROJECT REPORT (1961)

	Costs in Rs. lakhs	In percent of total
Direct materials	1,159	70.4
Indirect materials	85	5.2
Fuel	12	0.7
Power and water	36	2.2
Payroll and sick benefits	77	4.7
Bonuses and premiums	12	0.7
Pension fund	5	0.3
Depreciation	144	8.7
Wear and tear of purchased goods	51	3.1
Other expenses	33	2.0
Business (sales) expenses	33	2.0
TOTAL	1,647	100.0

Table 4: COAL MINING MACHINERY PROJECT - TENTATIVE MEAN WORLD MARKET PRICES C.I.F. COMPARED WITH PRODUCTION COSTS PER TON OF PRODUCT DETAILED PROJECT REPORT (1961)

	C.i.f. prices of imports	Production costs at 45,000 tons level of production (in Rs. per ton)
Coal cutters	7,970	7,200
Loaders	9,260	6,900
Conveyors	3,530	3,070
Electric mine locomotives	5,970	4,220
Haulage gears	4,100	2,330
Electric winders	4,430	2,690
Main axial fans	3,930	2,730
Booster fans	18,000	15,850
Pumps	2,640	2,090
Spare parts	6,100	3,640

III. Foundry Forge Project

(a) History

52. The Foundry Forge is the biggest and most costly of the Corporation's four projects. The history of this project goes back to the mid-fifties when the Indian Government considered and sanctioned the establishment of a central foundry forge which would take care of the country's requirements of heavy forgings and castings. The project was to produce iron and steel castings up to 50 tons in weight and forgings up to 15 tons. In 1957 it was decided to locate the project in the immediate vicinity of the Machine Building Project thereby avoiding the need to build a special captive foundry for the Heavy Machine Building Project. In 1958 when the Heavy Engineering Corporation was formed it was entrusted with the construction and operation of the Foundry Forge Project.

53. The project in its conception and implementation comprises three different stages. The tenders which went out originally and led eventually to the choice of a Czech offer called for a foundry forge capable producing some 23,000 tons of castings and forgings annually. This formed the first stage. When it was decided later to combine the Heavy Machine Building and the Foundry Forge Projects it was considered necessary to reshape the Foundry Forge Project to an annual capacity which would meet the capacity of the first stage of the Heavy Machine Building Project at 45,000 tons. This became the second stage. The Detailed Project Report prepared by the Czechs and accepted by the Government in April 1960 covered these two stages and they have in fact been treated as one ever since. In 1959, when the Government of India decided to build the Heavy Machine Building Project up to an annual capacity of 80,000 tons in one step and not, as intended earlier, in two successive steps, a further expansion of the Foundry Forge became necessary. This was the third stage of the Foundry Forge Project. This stage, however, was split up into two phases: the first phase was to meet the additional requirements of the Heavy Machine Building Project except for forgings above 30 tons piece-weight; the second phase, consisting of purchase and erection of a 6,000-ton press, would enable the Foundry Forge to supply the required heavier weight ranges of forgings.

54. The Czech consultants prepared a separate project report for the first phase of the third stage which was accepted by the Government in 1962. The Government does not appear to have found any difficulty in accepting this expansion presumably for two reasons: (i) the capacity of the Foundry Forge in the second stage exceeded the requirements of the 45,000-ton stage of the Heavy Machine Building Plant in many ways and the additional investment required to meet the needs of the 80,000-ton stage was considered relatively small; (ii) the additional equipment was going to be financed out of a Czech Government credit. The equipment for the first and second stage had been financed by a supplier's credit.

55. The proposal for the 6,000 ton forging press (third stage, second phase) was accepted less readily. The need for the press was looked into very carefully by a special Government committee which took into consideration the requirements of the entire country for heavy forgings of this size. The committee recommended the investment even though the press would be substantially underutilized for some time to come. The committee looked also into the question of where best to locate this big piece of equipment. The Chairman of Heavy Electricals argued strongly in favor of Hardwar, the site of a new heavy electrical plant. It was finally resolved to locate the press at Ranchi, one of the decisive arguments was apparently that the Planning Commission had already approved this location and allocated the money accordingly. (It should be noted that it has been subsequently decided to locate a new 4,000-ton press at Hardwar.) World tenders went out subsequently although from the beginning it was quite clear that the Czech collaborator would get the order. However, on the basis of the world-wide tenders the Indians did succeed in reducing the price originally set by the Czechs. The 6,000-ton press was also financed under the Czech Government credit.

(b) Foreign exchange financing

56. About half of the estimated total capital expenditure of Rs. 100 crores will have been spent by March 31, 1965, i.e. Rs. 50.12 crores, out of which Rs. 25.02 crores in foreign exchange.

57. Plant and machinery for the first and second stages were supplied by the Czechs under deferred payment terms. The deferred payment credit covered 80% of the f.o.b. value of the Czech equipment. 10% had to be paid on the placement of orders, another 10% on the opening of the letter of credit. Interest at the rate of 4½% has to be paid from the date of delivery of the last consignment of machinery and equipment. The credit has to be repaid in free convertible rupees in eight half-yearly instalments starting half a year after the delivery of the last consignment. The first three instalments have been repaid in September 1963, March 1964, and September 1964. The agreement covers the following items:

		Value of Agreement	Deferred Credits
		(Rs. crores)	
(i)	Plant and machinery for first stage and roll shop equipment	10.87 c.i.f.	6.90
(ii)	Spares for the first stage	0.77 c.i.f.	0.57
(iii)	Plant, machinery and spares for second stage	7.35	5.16
	Total	18.99	12.63

58. The equipment for the first phase of the third stage and the 6,000-ton press is financed under a Rs. 23.1 crores credit from the Czech Government to the Government of India. This loan is at 2-1/2% interest repayable in eight annual installments starting one year after presentation of the first invoice. The amount will be converted into free pounds sterling. A total of Rs. 5.82 crores is being financed in this way:

		(Rs. crores)
(i)	equipment for first phase of third stage	3.02
(ii)	6,000-ton press equipment	2.23
(iii)	furnaces for first phase of third stage	0.57
		5.82

(c) Progress of construction

In March 1964, the total supply position of plant and equipment to be received from abroad was as follows:

	(Tons)
Deliveries from July 1961 to March 1962	6,000
Deliveries from April 1962 to March 1963	16,472
Deliveries from April 1963 to March 1964	17,939
Total	40,411

Total tonnage shipped was 41,678 tons valued at Rs. 14.1 crores. Total tonnage required is 50,683 tons.

60. The supply position of the equipment hardly reflects the progress in construction of the Foundry Forge Project. At the time of the Mission visit in January 1965, the major portion of the equipment was stored on the site waiting for erection. Apart from normal storage facilities other buildings were being used and, in addition, ten warehouses (each with an area of approximately 1,200 square meters) had to be built, each filled with machinery which had to be unpacked, inspected and maintained once every six months.

61. Civil works construction was more or less completed for the auxiliary shops and erection in these shops was in progress:

Shop	Completion of Civil Works (%)	Erection of Equipment (%)
Pattern Machine Shop	100	95
Pattern Storage Shop	100	100
Tool Room and Die Shop	100	37.3
Garages	100	75
Locomotive Shed	100	25
Gas Producer Plant	87.1	27.83
Boiler House	85.5	27
Coal Storage	100	100
Oxygen Plant	100	67.9
Compressor House	96.7	21.32
Storage of Combustibles	99	2.81
Switching Station	100	54.4

62. Civil works construction of the major producing shops (the grey iron foundry, the steel foundry, the forge shop, rough machine shop and fettling shop) was still at a very early stage, further progress depending on the delivery of the fabricated steel structurals. The pile foundations and the pile caps for these shops were more or less ready for the erection of the structures. Production had started in the pattern shop and in a small section of the grey iron foundry where a cupola and non-ferrous melting furnace had been installed temporarily. The value of the production of the pattern shop between July 1963 and March 1964 was close to Rs. 5 lakhs; for 1964/65 the value of production was expected to be around Rs. 12 lakhs. Production of non-ferrous castings started in May 1964; it was expected that about 132 tons would be produced during 1964/65 at an approximate value of Rs. 13 lakhs. Production of grey iron castings started in July 1964 and might be 1,440 tons for 1965, valued at approximately Rs. 29 lakhs.

63. The disequilibrium between the deliveries of equipment and the progress of erection pointed to considerable delays in the civil works construction.

64. The Detailed Project Report for stages 1 and 2, as prepared by the Czechs, contained the following time schedule for civil works and commissioning of the project. These estimates were made in early 1962.

	Civil Works		Commissioning	
	Start	Completion	Start	Completion
Grey Iron Foundry	Nov. 1/62	Dec. 31/63	Jan. 1/65	Dec. 31/65
Steel Foundry	Nov. 1/62	Dec. 31/66	Jan. 1/66	Dec. 31/66
Forge Shop	May 1/62	July 31/66	Mar. 1/65	July 31/66
Rough Machine Shop	May 1/62	Aug. 31/66	Oct. 1/65	Aug. 31/66
Fettling Shop	Nov. 1/62	Jan. 31/66	Jan. 1/65	Jan. 31/66

65. By September 1964 the corresponding actual or anticpated dates were as follows:

	Civil Works		Commissioning	
	Start	Completion	Start	Completion
Grey Iron Foundry	Mar.29/63	Dec. 31/66	May 1/64	Dec. 31/66
Steel Foundry	Aug.23/63	Dec. 31/67	Sept. 1/65	Dec. 31/67
Forge Shop	Sept19/63	July 31/67	-	July 31/67
Rough Machine Shop	Apr. 8/63	Aug. 31/67	-	Aug. 31/67
Fettling Shop	Sept24/63	Jan. 31/67	-	Jan. 31/67

66. A comparison of these dates would indicate that the estimated delay in completing the component shops was expected to be generally about a year. This seems to be on the low side. At the time of the Mission's visit, it appeared that a more realistic estimate of delay would be in the order of two years or more.

(d) Resons for delays

67. The difficulties encountered in the procurement of steel, in particular fabricated steel, have been responsible for most of the delay in construction. When the project was first conceived and the agreement entered into with the Czechs, it was decided that all the fabricated steel required for the construction should be procured domestically. The total requirements were estimated at some 40,000 tons. The difficulties which subsequently arose in the procurement of the steel were twofold: the steel mills were unable to supply the necessary raw steel and the steel fabricators were unable to fabricate the requirements of the project in time. In addition, the domestic steel fabricators could not meet the qualitative standards required; they had little experience with the heavy welded structures. This necessitated redesigning the detailed working drawings and led to additional steel requirements. Some of these difficulties had been foreseen by the General Manager who requested in 1960 before the start of construction that 16,000 tons of raw steel be imported to ease the desperate situation. At the time of the Mission's visit all steel had been delivered and the major preoccupation was no longer the supply of raw steel but the limitations imposed by the steel fabricators. To ease this problem, it had been decided that 6,200 tons of steel structures for the steel foundry and the forge shop would be fabricated by the Heavy Machine Building Project. Fabrication was to start in March 1965.

68. The following table gives some idea of the extent to which steel fabrication was delayed due to delays in procurement of raw steel:

Contract	Date of Work Order	Start of Work according to Contract	Actual Start	Completion According to Contract	Anticipated Actual Completion
Grey Iron Foundry	July 7/61	July 10/61	Jan/63	April 1/64	Mar.1966
Steel Foundry	Oct. 3/61	Sept.22/61	Jul/63)	No date given	Mar.1967
Forge Shop	Oct. 3/61	Sept.22/61	Jul/63)	In contract	Jul 1966
Rough Machine Shop	Oct.3/61	Sept.22/61	Jan/64)		Jun 1966
Fettling Shop	July 7/61	July 10/61	May/63	Feb.28/64	May 1966
Gas Producer Plant	May 31/61	May 31/61	Aug/63	Mar.31/64	Sept.1965

69. Next to the problem of steel procurement, two major difficulties were noted which while causing no specific delays would have done so in the absence of the steel problem. Before the site for the Foundry Forge had been chosen, soil bearing tests had been undertaken on a sample basis. From these tests, it had beeen concluded that normal concrete foundations could be used for the steel structures and the equipment. Later, when extensive subsoil investigations were carried out, the rock formation proved to be insufficient to bear the required pressures and pile foundations had to be prepared. This was both more costly (Rs. 1.0 crore additional) and more time-consuming. The specific delay due to this change in construction would have been six months. This could have been avoided if the site of the Foundry Forge had been switched with the sites of the Heavy Machine Building Project or the Heavy Machine Tool Project. These sites showed a solid rock formation and the two other projects do not require as high bearing pressures as the Foundry Forge.

70. A significant feature of the Foundry Forge Project was that the Czechs supplied only the basic designs and documentation with the Detailed Project Report; all the detailed working drawings had to be made in India with the assistance of the Czech consultants. This meant that the Corporation had to create a Central Design and Drawing Office from scratch and had to find and train a large staff of design engineers. It was considered that the experience gained in the preparation of the designs was worthwhile, even though this may have cost time and money. At the time of the Mission's visit, the jobs for the Foundry Forge and the Heavy Machine Tool Project were virtually completed and the design office was mainly engaged in work for other public sector undertakings. In the long run the office and the staff of design engineers will be required for designing products.

(e) Project costs

7. The Foundry Forge as considered in 1957/58 was expected to cost some Rs. 20 crores. At the time of the Mission's visit the estimate was Rs. 100 crores. This increase was, of course, in part due to the expansion of the project, and the fact that certain expenditures were not included in the original project report, as well as to increases in original estimates. When the Detailed Project Report for the first stage was accepted by the Government in 1960, it was already expected that the original cost estimate would be exceeded, mainly for two reasons:

(i) The estimates in the Detailed Project Report were worked out on the basis of rates for civil engineering works prevailing in 1958.

(ii) The decision to use domestic steel required a substantial modification of the detailed working drawings in order to allow for the use of sections actually rolled in the country, thus inevitably involving the use of additional tonnage at the high internal prices.

72. Following are the cost estimates from the Detailed Project Reports up to the latest revision in August 1963:

(Rs. crores)

	First and Second Stage	First Phase of Third Stage	6,000-ton Press	Total
DPR Estimates 1960 and 1962	58.46	15.06	-	63.46
Revised Estimate for budget purposes, May, 1962	67.87	-	-	67.87
Estimate of August 1963	74.60	18.75	6.27	99.62
Total Increase	16.14	3.69	-	36.16

73. The increase of about Rs. 16 crores for the first and second stages is attributed to the following items:

(Rs. crores)

(i)	Construction costs:		
	Structural steel	3.0	
	Pile foundation	1.0	
	Railway siding	5.0	9.0
(ii)	Plant and machinery costs		4.2
(iii)	Expenditure on training, establishment, foreign experts, etc.		2.8
		Total	16.0

74. The increase from Rs. 15.06 crores to Rs. 18.75 crores for the first phase of the third state is attributed to increases or additional expenditures in:

(Rs. crores)

(i)	Construction costs		1.6
(ii)	Expenditures on training, establishment, foreign experts, etc.		2.1
		Total	3.7

75. At the time of the Mission's visit, the Corporation estimated that capital expenditures in local and foreign exchange components would be distributed annually as follows:

(in Rs. crores)

Year	1960 /61	1961 /62	1962 /63	1963 /64	1964 /65	1965 /66	1966 /67	1967 /68	1968 /69	1969 /70	1970 /71	Total
Local	0.93	2.32	5.44	6.95	9.44	11.20	8.90	8.65	3.82	3.20	1.93	62.78
Foreign Exchange	0.92	2.31	5.43	6.94	9.44	5.20	4.10	1.35	0.68	0.30	0.18	36.85
Total	1.85	4.63	10.87	13.89	19.88	16.40	13.00	10.00	4.50	3.50	2.11	99.63

76. It may be noted that the above estimates contain no provision for the following items:

(i) Cost of land
(ii) Cost of township
(iii) Working capital
(iv) Interest during construction, especially interest on deferred liability for the supply of plant and machinery

77. The land required for the project was given to the Corporation free by the Government of Bihar. From what the Corporation had to pay for the land needed for the township, it can be estimated that the costs would be roughly Rs. 0.4 crores (1,300 acres at Rs. 3000 crores).

78. Total cost of the Ranchi township is estimated at Rs. 30 crores. The township would serve the three projects located at Ranchi and the requirements of the Central Administration of the Corporation. A share of 35% for the Foundry Forge would amount to approximately Rs. 10.5 crores.

79. Working capital requirements may be assumed 40% of the value of annual output. At full capacity level of output, this would amount to Rs. 16.20 crores.

80. The project cost estimate does not include interest payments on deferred payment credits. It is assumed that interest on Government loans is similarly not included on the grounds that "the interest liability is a financing charge and should not, therefore, be made a permanent burden on the capital cost." If interest during construction is calculated at 10% from the beginning of construction in 1960/61 until investment has been completed in 1970/71, it would amount to Rs. 68.73 crores.

81. If these items were included, the estimated investment costs of the Foundry Forge would amount to Rs. 192.15 crores, as follows:

	(Rs. crores)
Land	0.4
Township, including land for township	10.5
Construction	42.47
Plant and equipment	57.15
Working capital	16.20
Interest during construction	68.73
Total	194.45

(f) Expected performance

82. At the time of the Mission's visit the Corporation expected that the Foundry Forge Project would come into production gradually, reaching capacity output including the third stage expansion by 1975/76. Output at that time would be 146,813 tons, with a projected sales value of Rs. 40.45 crores. The pattern and volume of output, the assumed selling prices and the total estimated value of sales at capacity operation are shown in the following table:

Product	Output at Capacity in tons	Assumed Sales Prices Rupees/tons	Value of Sales Rs. Crores
Grey iron castings	33,640	2,000	6.73
Steel castings	40,728	2,750	11.20
Non-ferrous castings	1,000	10,000	1.00
Forgings, including those from 6,000-ton press	49,865	3,000	14.96
Grey iron rolls	11,690	3,000	2.92
Steel rolls	6,230	3,000	2.18
Forged rolls	3,660	4,000	1.47
Total	146,813		40.46

Source: Heavy Engineering Corporation

83. The basis for the estimated sales prices is not known. The Mission was told that deliveries of the Foundry Forge within the Corporation would be priced so as to include a profit. It is not known whether the assumed prices include an allowance for protection. It is assumed that they do.

84. Annual operating costs at capacity (excluding depreciation and interest on capital)[1/] were estimated at Rs. 25.02 crores, including an equivalent of Rs. 1.20 crores in foreign exchange. Depreciation was estimated at Rs. 5 crores. The development of output, operating costs and sales, as envisaged by the Corporation, are as follows:

	1965 /66	1966 /67	1967 /68	1968 /69	1969 /70	1970 /71	1971 /72	1972 /73	1973 /74	1974 /75	1975 /76
Output in 000 tons	5.51	20.04	41.91	66.72	92.72	114.52	126.92	143.04	145.30	146.19	146.84
						(Rs. crores)					
Sales value[1/]	1.14	3.58	8.48	13.82	19.64	24.58	27.46	31.39	31.84	32.06	32.36
Operating Costs											
Foreign Exchange	0.75	0.75	0.65	0.60	0.75	1.00	1.00	1.10	1.10	1.10	1.20
Local	1.84	4.53	7.68	11.18	14.80	18.03	20.05	22.90	23.37	23.57	23.82
Total	2.59	5.28	8.33	11.78	15.55	19.03	21.05	24.00	24.47	24.67	25.02

[1/] Sales prices assumed of the Corporation less 20 percent.

1/ Interest on working capital is said to be included.

IV. Heavy Machine Tool Project

(a) History

85. In 1954, the Engineering Capacity Survey Committee was appointed under the chairmanship of Professor Thacker to assess the demand for the various types of machine tools. The committee consisted of representatives of manufacturers, users, the inspecting authority, the Development Wing and the ministries concerned. In addition, the services of two foreign experts were made available. A census of the country's machine tool industry undertaken previously by the Development Wing and covering more than 800 factories was the basis for the study of the Thacker Committee.

86. In 1961, Dr. B. D. Kalelkar, Senior Industrial Adviser (Engineering), undertook a review of this earlier study and of the development of the machine tool industry. This review included not only medium and light machine tools but also heavy machine tools. It resulted in recommendations for the development of a heavy machine tools industry and suggested specifically a capacity of the order of 7,200 tons to 10,000 tons of eight different types of machine tools.

87. These recommendations formed the basis for the Government's decision to build the Heavy Machine Tool Project. Since the heavy castings required for the manufacture of heavy machine tools could be conveniently drawn from the foundry forge, it was decided to locate the plant in the vicinity of the Foundry Forge Project. In November 1960, the Heavy Engineering Corporation was entrusted with the implementation of the project.

88. Since the Czech Government had extended a Rs. 23.1 crores credit to finance among others the Heavy Machine Tool Project, a contract was signed with the Czechs for the preparation of a project report. The project was to have a capacity of 10,000 tons and be designed so that its capacity could be expanded to 20,000 tons. The types and quantitites of machine tools required were to be as recommended in Dr. Kalelkar's report. The development of the first stage was to be broken down into four phases so as to start production as early as possible. The project report was received in installments between January and April 1962. It was accepted by the Government of India in May 1963, and a contract for the supply of machinery and equipment with the Czechs was signed subsequently.

89. The collaboration agreements with the Czechs provide for the following services and supplies:

	(Rs. lakhs)
Detailed Project Report	29.00
Machinery and equipment (f.o.b.)	332.50
Technical cooperation in erection of machinery and equipment	4.25
Consultancy services during construction and erection	32.47
Technological documentation	65.76
Salaries of Czech experts	69.00
Total	532.98

90. With the exception of the machinery and equipment, all the items are financed under a deferred payment arrangement. The machinery and equipment are financed under the Rs. 23.1 crores Government credit. The credit on the outstanding amount, on which interest at 2½% has to be paid, is repayable in eight equal yearly instalments, starting one year after the presentation of the final invoice. The amounts repaid will be used for the purchase of Indian goods; unutilized balances will be converted into free pounds sterling.

(b) Progress of Construction

91. Construction work on the project started only early in 1964. The levelling and grading of the site, road construction, sewerage were complete at the time of the Mission's visit in January 1965. Also, at that time, contracts had been awarded for the main production buildings as well as various ancillary buildings, and work on the foundations of the main buildings was under way. It was expected that the construction work would be completed by the end of 1966, and that production of the first phase would start in 1967. The whole project was expected to be completed by 1968/69.

92. Even though construction is still at an early stage, a substantial portion of the equipment had already been shipped. Of the total supply of machinery and equipment from Czechoslovakia, which amounts to nearly 50% of the total requirements, machinery worth Rs. 129.94 lakhs (about 40% of Czech portion) had been shipped at the end of November 1964.

93. A delay of about six months seems to have been due to the late start of construction. It was hoped that the construction of the project would be speeded up by erecting equipment simultaneously as and when the buildings were completed. Basically, the project faces the same problems as the Foundry Forge Project, i.e., the structural steel has to be procured domestically and the detailed working drawings and designs have to be made in India. The project will benefit, however, from the development of the other two projects at Ranchi. The Heavy Machine Building Plant will provide most of the steel structure, hopefully during the course of 1965; the design office of the Foundry Forge Project will be in charge of the detailed designs.

(c) Project Costs

94. The Detailed Project Report submitted by the Czechs to the Indian Government in April 1962 included an estimate of Rs. 18.50 crores for the investment required "within the fenced area of the plant". Many items were excluded from this figure; a comprehensive estimate of the total project costs made in September 1962 set the figure at Rs. 26.05 crores. This estimate was reduced in June 1963 to Rs. 23.31 crores. The two estimates were as follows:

(Rs. crores)

	Original Estimate (1962)	Revised Estimate (1963)
Payments to collaborators for project reports, consultancy, etc.	4.15	3.87
Civil construction	4.29	4.39
Erection of plant and equipment	.78	.78
Plant and machinery	14.56	12.30
Miscellaneous	2.27	1.97
Total	26.05	23.31

95. The reduction of Rs. 2.74 crores was a result of negotiations with the Czech agencies to bring down the prices of plant and equipment as well as of the various services.

96. At the time of the Mission's visit, the Corporation expected the project to be completed by 1970/71, according to the following schedule:

	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	Total
				(Rs. crores)				
Foreign exchange	2.80	4.19	1.99	0.80	2.41	0.74	0.42	13.35
Local	3.10	4.66	1.48	0.28	0.26	0.17	--	9.95
Total	5.90	8.85	3.47	1.08	2.67	0.91	0.42	23.30

97. The above estimate, it may be noted, does not provide for the following:

(i) The cost of the land required for the Heavy Machine Tool Project: The land cost can be estimated roughly at Rs. 0.20 crores.

(ii) The cost of the township at Ranchi: Total cost of the township is estimated at Rs. 30 crores. If a share of 15% is assumed for the Heavy Machine Tool Project, this would amount to Rs. 4.50 crores.

(iii) Working capital: Requirements for working capital may be assumed at 40% the value of annual output. At full capacity level of output, this would amount to Rs. 3.91 crores.

(iv) Interest during construction: If interest during construction is calculated at 10% from the beginning of construction in 1964/65 until investment has been completed in 1970/71, it would amount to Rs. 13.20 crores.

98. If these items are added to the official investment estimate, project costs increase to Rs. 45.12 crores, as follows:

	(Rs. crores)
Land	0.20
Township	4.50
Civil construction	4.39
Plant and equipment	12.30
Erection of equipment	0.78
Consultant fees, etc.	3.87
Miscellaneous	1.97
Working capital	3.91
Interest during construction	13.20
Total	45.12

(d) Expected Performance

99. At the time of the Mission's visit in January 1965, the Corporation expected the project to reach full capacity output of 10,000 tons by 1971/72. The value of this output was estimated to be Rs. 9.77 crores on the basis of prices for comparable products imported from Czechoslovakia valued on a c.i.f. basis. The operating costs (excluding depreciation and interest or return on investment)1/ of producing this output was estimated at Rs. 6.64 crores, including an equivalent of Rs. 2.5 crores in foreign exchange. Depreciation was estimated at Rs. 1.30 crores. The Corporation projections of output, sales and operating costs were as follows:

	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72
Output (in tons)	1,788	2,435	5,278	5,811	6,896	10,139
			(in Rs. crores)			
Sales	1.13	1.82	4.32	4.75	6.18	9.77
Operating costs:						
Foreign exchange	1.00	1.00	1.00	1.50	2.00	2.50
Local	0.52	1.44	3.05	2.71	3.26	4.14
Total	1.52	2.44	4.05	4.21	5.26	6.64

1/ Including interest on working capital.

V. The Economics of the HEC Projects

100. In this section an attempt is made to work out some of the economic implications of the four HEC projects based on the data given in the preceding sections. The results must necessarily be tentative. We believe the data given us by the Corporation on the expected schedule of future output and operating costs to be on the optimistic side. Capacity output will probably be achieved latter and at higher cost. On the other hand we have no basis to judge the estimates of sales prices. In some cases we have assumed the prices given us by the Corporation included an allowance for a 20 percent tariff as this seemed consistent with the way the estimates were presented. In other cases where it was so indicated we have taken the prices to be the cost of imports c.i.f. Indian ports. Without more information than was available to us it has not been possible to check the reasonableness of the price assumptions. On the other hand we have used alternative assumptions in some calculations so that the effect of changing the price can be seen.

101. We have made three sets of calculations. The first is a calculation of the internal rate of return - a measure of the return on the investment in the project. The second is a calculation of one aspect of import saving associated with the project, namely, the number of years required before the savings in foreign exchange exceed the costs in foreign exchange. The third calculation also focusses on the foreign exchange aspect. It indicates what exchange rate adjustment would be required to enable each project to earn a given return - in this case 10%.

(a) The internal rate of return

102. The internal rate of return is a measure of the return to the enterprise on its invested capital over its life. It is based on a schedule of cash expenditures and receipts from the start of construction to the end of the life of the project. It is the interest rate which equates the present value of the two streams. In our calculations it has been assumed that:

(i) Capacity production can be reached on schedule, production can be maintained at capacity for the rest of the period and all production can be sold.

(ii) The official investment estimates of Rs. 43 crores for HMBP, Rs. 29.3 crores for CMMP, Rs. 99.63 crores for FFP, and Rs. 23.3 crores for HMTP are used, i.e. investment in land and townships is excluded. It is assumed that the figures for material inputs provide for working capital requirements.

(iii) Annual replacement needs are unformly estimated at 1 percent on the cumulative value of investment in construction and at 2 percent on the cumulative value of investment in plant and equipment; a major

replacement of 25 percent of the value of plant and equipment is assumed at a time between 10 and 12 years after the start of production.

(iv) The life of the four projects is assumed to be 20 years from the start of production at the end of which stores and buildings are valued at cost, and plant and equipment at 40 percent of the original value.

103. The interest rates at which the present value of the stream of costs is equal to the present value of the stream of revenues has been calculated for two levels of output prices for each project. One level is 20 percent higher than the other. We assume the lower to represent the level of import prices c.i.f. Indian ports though the actual level may be different. The results are as follows:

	Internal rate of return	
	Output valued at import price	Output valued at import price plus 20 percent
Heavy Machine Building	0 %	10 %
Coal Mining Machinery	1 %	12 %
Foundry Forge	1 %	7 %
Heavy Machine Tools	6 %	11 %

(b) Time required for net savings of foreign exchange

104. In the following calculations the stream of direct foreign exchange costs, both capital and operating, required to produce the product is compared with the costs of importing the same product according to the same schedule. The prices used are the assumed import prices. In order to compare the two streams it is necessary to discount them to a common time period. A discount rate of 10 percent is used for this purpose. On this basis the point in time when the present value of the stream of savings first exceeds the present value of the stream of costs is determined. The results are shown in the following table. If indirect foreign exchange costs such as the foreign exchange purchases of local supplies were included the period of time would have been longer; a lower interest rate would shorten the period.

	Time when direct net foreign exchange savings begin	Elapsed time after start of construction
Heavy Machine Building	1969	9
Coal Mining Machinery	1967	7
Foundry Forge	1970	10
Heavy Machine Tool	1972	8

(c) Implied exchange rate adjustment

105. Low returns on investments are sometimes defended by the argument that since foreign exchange is undervalued a higher value should be given to output than its direct cost in foreign exchange at the official rate. It also follows that the foreign exchange costs of production should also be increased, however, on balance such an increase will generally affect the output side more strongly. In the following calculations we have determined the exchange rate at which a 10 percent return on investment (including working capital and interest during construction but excluding townships) would be earned on the basis of annual costs and production at capacity operation. Output has been valued at assumed import prices.

	Implied Exchange Rate Rs. per $	Implied Premium
Heavy Machine Building	5.78	21.4 %
Coal Mining Machinery	5.75	20.8 %
Foundry Forge	7.05	48.1 %
Heavy Machine Tools	5.66	18.9 %

VI. CONCLUDING OBSERVATIONS

106. On the basis of the experience thus far with the projects of the Heavy Engineering Corporation and the prospects as they appear today, the following general comments may be made:

(i) The source and availability of foreign capital have played a very important part in determining the concept and design of the projects and the timing of their execution. In particular the availability of credit from the USSR appears to have been the decisive factor in the Indian Government's selection of the Russian proposal for a large integrated heavy engineering complex in preference to the more modest approach recommended by U.K. experts and endorsed by a committee of Indian industrialists. Similarly both the extent and the timing of the expansion of the original projects has been determined in large part by the availability of foreign credit. In these decisions technical and economic considerations have played a secondary role.

(ii) The particular arrangements under which collaboration has been carried out has had an important effect on the implementation of the projects. Projects for which the foreign collaborator supplied the detailed designs and close engineering supervision together with the equipment and the essential construction materials have been implemented much more rapidly than projects which had to rely on indigenous engineering services and construction materials.

(iii) On the basis of the Corporation's estimates of future output sales and costs the returns earned on the projects will be quite modest. A very important factor in these calculations is the level of product prices assumed. In all cases except where indicated otherwise we have assumed the prices used by the Corporation included a 20 percent allowance for protection. At this level the returns range from 7 to 12 percent. If prices are assumed 20 percent lower returns are virtually eliminated except in the case of the Heavy Machine Tool Project which would show a return of 6 percent. Although our information on prices and products is not sufficient to say with assurance what the level of import prices should be for the products to be produced it is clear that the returns are very sensitive to variations around the level assumed by the Corporation and this level produces only modest returns.

(iv) Although the returns projected are on the low side, the projections of production, costs, and sales do not appear to take into account sufficiently the problems of production. There are problems raised by the great differences in the rate of progress of closely interrelated projects. In particular the production of the Heavy

Machine Building Project is bound to be affected by the delays in setting up the Foundry Forge which is intended to supply its requirements of heavy forgings. There also are bound to be problems involved in achieving the proposed levels of output at the levels of quality required. Although these difficulties will no doubt be overcome in time they will result in reducing the returns for the projects.

(v) In addition to the problems of production, there also may be problems with sales. Little attention has been given by the Corporation to marketing problems. The management seems to rely a good deal on the fact that many of the potential customers are in the public sector and could be compelled, if necessary, to buy from the Corporation. However, the problems of meeting specific requirements of particular projects where imported equipment is already in place may pose some obstacles at least in the near future.

APPENDIX IV

NOTES ON RECENT DEVELOPMENTS IN THE FERTILIZER INDUSTRY

Frank H. Lamson-Scribner

APPENDIX IV

NOTES ON RECENT DEVELOPMENTS IN THE FERTILIZER INDUSTRY

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NOTES ON RECENT DEVELOPMENTS IN THE FERTILIZER INDUSTRY

1. The need for and contribution of fertilizer to the economic development of India is discussed in the Agricultural Report. From an industrial standpoint, the problem is to manufacture it in adequate quantity to meet the demands of the agricultural sector. On the agricultural aspect, in summary, the target of demand for the Third Plan was 1 million tons of nitrogen annually for 1965-66. The production capacity target was established at 1 million tons of nitrogen with an actual production target of 800,000 tons. There will be a substantial short fall in all of these targets.

2. Our discussion will be primarily limited to the manufacture of nitrogen fertilizer. There are at present no known economically exploitable resources of potash in India; all potash must be imported. Phosphorus is also not available domestically and phosphate rock or phosphate in other forms must be imported as well. The simple conversion of phosphate rock to superphosphate fertilizer is not difficult nor highly capital intensive; in general, superphosphate plant capacity approximately balances present demands and additional plants can be built rapidly and economically as the market grows. Phosphate may also be combined with nitrogen as a complex fertilizer and this is done normally in the same plant where the nitrogen is manufactured; our discussion of nitrogen fertilizer plants will therefore be pertinent in some cases to phosphate production which will be carried out at the same plant and combined with nitrogen as complex fertilizer.

3. Production, imports and distribution of nitrogen fertilizer in recent years may be summarized as follows:

	Nitrogen Fertilizer		
	Produced in India	Imported	Distributed
	(Thousands of Tons as Nitrogen)		
1959-60	84	142	229
1960-61	112	172	212
1961-62	154	143	292
1962-63	194	229	360
1963-64	219	236	426
1964-65	238	223	591
1965-66 (estimated)	325	350	675

4. As may be seen, consumption in 1965-66 may approximate about 68% of the Plan target of 1 million tons; while production will probably be only about 40% of the target of 800,000 tons. As will be discussed below, plant capacity will probably amount to about 60% of the target of 1 million tons.

Local production has only satisfied about half of the total demand within India and in recent years substantial quantities of fertilizer have been imported to make up the balance. It should also be stated that there were substantial shortages of fertilizer until the year 1963-64 and that consumption might have been higher had more fertilizer been available. At the present time, it is probable that the demand for fertilizer is appreciably higher than the amount actually distributed. The use of fertilizer is limited by the inadequacy of the distribution system and the financing available. These aspects are covered in the Agricultural Report.

5. The establishment of the first sizeable fertilizer plant in India came in 1951 when the Government-owned Sindri Fertilizer Plant went into production. There was also some modest production from a very small plant in Mysore, a modest sized plant in Kerala and as a by-product of coke oven operations.

6. During the second Five-Year Plan, one plant in the private sector was completed which produced ammonium chloride for fertilizer use as a by-product. In the public sector, the Nangal fertilizer factory was completed in early 1961 and work was started on the Rourkela and Neyveli fertilizer projects. The last two mentioned projects have actually been completed in the third Five-Year Plan, Rourkela currently is in limited production and Neyveli is expected to go into production during 1965.

The Fertilizer Program - Third Five Year Plan

7. For the third Five-Year Plan an ambitious program was laid out to increase production from the 100,000 tons of nitrogen level current in 1960-61 to the 1 million ton level proposed for 1965-66. As a basis for this expansion, studies had been made in the latter half of the 1950's and recommendations had been drawn up to provide at least one major nitrogen fertilizer plant in each of the major States of India.1/ The decision to locate one or more fertilizer plants in each State was made on political grounds rather than economic since some of the States had no desirable locations from a raw materials resources aspect nor could adequate markets be expected to be developed in a reasonable time to take the plant productions planned. (For example, a plant with a capacity of 80,000 tons of nitrogen was proposed for Rajasthan which had no economic local source of carbonaceous raw material and where fertilizer used in 1961-62 amounted to only 5,000 tons of nitrogen. Another large plant was planned for Madhya Pradesh where fertilizer usage amounted to 6,500 tons of nitrogen in the same year.)

1/ Studies made by the Fertilizer Technical Committee set up in 1959 for the purpose of determining the best location for a fertilizer plant in each state.

8. The status of the fertilizer industry at the start of the Third Plan and the proposals included in the Plan are as follows:

Plant	State	Ownership	Nitrogen Capacity Tons Annually	Status in 1965
Existing Plants - 1961				
Sindri	Bihar	Government	117	Operating
Alwaye	Kerala	Government	20	Operating
Nangal	Punjab	Government	80	Operating
By-products, etc.	Various	Private & Gov.	25	Operating
	Capacity at Start of Plan		242	
Plants Specifically Included in Third Plan				
Public Sector				
Rourkela	Orissa	Government	120	Operating 25-35%
Neyveli	Madras	Government	70	Going into production
Trombay	Maharashtra	"	90	Going into production
Namrup	Assam	Government	33	Complete end 1966
Gorakhpur	Utter	Government	80	Complete 1967
Undefined			80	
Private Sector				
Ennore	Madras	Private	8	In operation
Vishakhapatnam	Andhra	Private	80	Complete 1967
Kothagudem	Andhra	Private	80	Complete possibly 1968
Itarsi	Madhya	Private	50	Superceded by Korba
Hanumangarh	Rajasthan	Private	80	Still under investigation.
Durgapur	Bengal	Mixed	58	Awaiting finance
Expansions & Coke Ovens		Primarily Govt.	60	Complete mid-1966
Total Specific Plants in Plan			889	
Total Capacity - end of Third Plan			1,131	
Other Plants Under Consideration for Third Plan				
Baroda	Gujarat	Mixed	96	Complete 1967
Mangalore	Mysore	Private	70	
Tuticorin	Madras	?	?	
Koyna	Maharashtra	?	?	

9. Nitrogen fertilizer capacity at the start of the third Five-Year Plan was approximately 242,000 tons annually. This capacity was supplemented up to March 1965 by the completion of the Rourkela Plant with a capacity of 120,000 tons of nitrogen (actual operations are at much lower levels as will be explained later), the Ennore Plant in the private

sector with a capacity of slightly over 8,000 tons, and minor expansions and increased coke oven by-products of something over 10,000 tons of nitrogen annually. Total capacity therefore was slightly over 370,000 tons of nitrogen as at the end of the fourth year of the Third Plan.

10. Two plants are currently going into production in India. The first of these is the Neyveli Plant which is a carry-over from the second Five-Year Plan. This plant is expected to start production during 1965 and has been vastly delayed from its original completion date estimated in 1962, as will be discussed later.

11. The second plant which will be starting up in the immediate future is the Trombay Plant which was planned during the second Five-Year Plan, and for which specific engineering was started and bids were tendered in 1959. In addition to these two big plants, additional capacity will be added through the expansion of the Alwaye Plant and increased by-products production which will add about 60,000 tons in total. Total capacity at the end of the third Five-Year Plan should therefore be about 590,000 tons of nitrogen annually but production will probably not be more than 325,000 tons primarily because production at Rourkela is limited and about 200,000 tons of the capacity will only be starting up or have operated less than one year.

12. As far as increase in production of fertilizer goes, the third Five-Year Plan has fallen far short of its objectives.

13. The first question which might be asked is whether the objective was too high; was the goal unrealistic and impossible to reach under any reasonable set of circumstances? The answer to this is no; the goal could have been reached had the task been approached properly. Observing that the Plan proposed to quadruple capacity in five years, it might be concluded that it was too ambitious. But the base to be quadrupled was relatively small, and such a conclusion is not justified. At the start of the Plan, construction was well under way on two large plants and had been started at a third. If project execution had been efficient, more than half of the goal would have been met at the Plan's halfway mark. In addition, projects which will bring total capacity to about 900,000 tons of nitrogen are currently[1/] under construction and all of these should be completed by the end of 1967. This, plus one or two other plants planned for years but not yet under real construction would have fulfilled the goal. All of the plants under construction could have been completed at least two years earlier; that is, within the Third Plan period, if they had been started without the long delays in Government before decisions were made and if project execution had been reasonably well managed and delays due to adverse governmental actions (steel allocations, slow issuance of import licenses, etc.) had been avoided.

1/ At the time of the Mission's visit, Spring 1965.

14. The relative achievement of the Plan objectives for the fertilizer industry is perhaps the poorest for any industrial sector. An important factor in this failure would appear to be the extent and nature of the Government's involvement in the industry. In this respect, the industry differs from many others. Government involvement in this case has two aspects. First, Government corporations, the Fertilizer Corporation and others, have been entrusted with the major share of the responsibility to provide new plants. As will be discussed later, the implementation of Government projects has been very slow. Second, the industry which includes both Government plants and private firms, operates under a system of price and distribution controls. These controls have prevented expected profits to private entrepreneurs from being sufficiently high to attract finance quickly for the potential private plants.

15. From a statistical aspect, the failure of the fertilizer industry stands out more than that of the other industries in which public sector companies have a substantial part. For example, the growth of many small units in the private sector electrical equipment field, masks to some extent the failure of the Government's Heavy Electricals project to produce as planned. In the fertilizer industry, projects are few in number but very large. Slowdown of a few projects strongly affects the performance of the industry as a whole. The lagging performance of the public sector projects is discussed below. In the private sector, only a few entrepreneurs were given industrial licenses to develop plants, thus limiting competition to put up the projects. These entrepreneurs have had difficulty in developing finance for projects which have limited profit potential due to price controls.

16. The reasons for not fulfilling Plan objectives may best be illustrated by going through the various projects which were specifically included in the Third Plan and outlining a few of the occurrences which have taken place. The first plant, Rourkela, was completed during the Third Plan but the actually constructed capacity cannot be utilized. Actual operations run at 25-35% of capacity due to the shortage of gas from the Rourkela steel plant. Although this situation has been known for at least two years, as at the time the mission left India nothing had been done, but studies were being carried out. This is an excellent example of the lack of appreciation of the cost of time in Indian bureaucracy. There is a cost to the economy of approximately US$1.5 million per month in foreign exchange to purchase fertilizer which might otherwise be produced. The total foreign investment cost, about $2.1 million, for the facilities needed could be saved in about one and a half months at this rate.

17. The Neyveli Plant was included in the second Five-Year Plan as well. This plant utilizes lignite as its basic raw material and was to be completed in 1962. In fact one of the Mission members visited the plant in 1962 and much of the machinery had been delivered one year previously, i.e., 1961. Government made the decision in the case of this plant initially that structural steel could not be imported; the

total cost of such structural steel would have been in the order of magnitude of US$500,000. Due to this decision, the company had to design reinforced concrete structures which took much time, first to design and then to construct. This probably delayed the project at least one year and the cost of this in lost output of fertilizer was about $14 million in foreign exchange. In addition to this, the decision was made to construct the plant with the company's own forces rather than to utilize contractors to a large extent and to manage the construction with the company's own engineers who had not had any reasonable amount of experience in managing comparable construction projects rather than employ skilled construction managers. Delays were also experienced due to governmental procedures in obtaining import licenses, customs clearances and the like. The Mission did not try to isolate the reasons cause by cause of the long construction period of about five years, but the total effect may be best illustrated by stating that the construction of a similar plant might take two years or two and a half years at the most in the majority of other countries using good construction managers and contractors. The total cost of the delays therefore for this project would be a loss of US$30 million - $45 million in foreign exchange for fertilizer which might otherwise have been produced about half the cost of the plant in total, and more than its total foreign exchange cost.

18. Construction of the Trombay plant has also taken an inordinate amount of time. This is substantially due to the fact that the project has been changed a number of times during the implementation. The cost of these changes in time, and consequently money, has been dear. It is doubtful whether it is generally realized by those involved that for each day decisions on this plant were pending the Indian economy lost US$50,000 in fertilizer production.

19. The Namrup fertilizer plant in Assam was increased in size since the original studies of the Third Plan to about 45,000 tons of nitrogen annually. This plant will be based on natural gas available in Assam. The present market in Assam including that for the tea plantations which are fertilized intensively and for which no large increases can be expected, is about half the total capacity of the plant. Since transportation between Assam and the rest of India is difficult and expensive, the economic benefit of half of the plant's fertilizer production will be reduced due to heavy transport charges from the plant to the rest of India where the production may be utilized until local markets are developed, probably over a considerable time. Plant construction has been hampered by difficult access and by a cutback in construction activities after the Chinese invasion of late 1962. (The plant is located not too far from some of the invaded territory.)

20. The Gorakpur Project was delayed initially in the project development phase and in obtaining the necessary financing. The construction schedule laid out is quite conservative and completion is not scheduled until 1967. As with all projects in India, the time necessary to implement a project is quite long due to procedures to obtain import licenses, custom clearances, etc.

21. In the private sector the only plant completed during the third Five-Year Plan was the very modest sized Ennore unit which has a capacity of slightly over 8,000 tons of nitrogen annually. The product of this plant is actually ammonium phosphate and the plant has a comparable capacity in phosphate. After the facilities were completed quite some time was spent in getting the plant into full production due to technical difficulties. These problems have now been solved and the project is operating at capacity and consideration has been given to doubling its size. Even if the size were doubled, however, the plant would still be very small in relation to India's requirements and to the normal size of plants which may be expected to compete on an economical basis.

22. The private sector has been quite heavily criticized for not implementing the projects assigned to it in the fertilizer industry promptly. Of the large plants licensed to the private sector by Government at the start of the Third Plan, only one is currently under construction, that is at Vishakhapatnam. This project which is expected to be completed in 1967 was very slow in getting started. The fertilizer industry is an industry which the Indian Government has opened up to both public and private industrial companies; Government participation is high. In addition, since fertilizer is a commodity which has many users and few producers and whose product is considered of vital importance to the users, it is subject to being influenced by political considerations. The Indian Government has controlled the prices of nitrogen fertilizer, both on the selling side to the consumers and on the purchase side from local companies within India for many years and it may be expected to continue to control these prices or to influence the prices set by the Government companies in fertilizer in the future. To assure reasonable business success, the promoters of the project, two foreign companies and one Indian firm, felt it necessary to obtain assurances on Government policies concerning fertilizer, especially as regards to price and marketing considerations, in addition to working out all the normal difficulties of setting up a new business in India. The net result of all of this was that it took several years before the promoters felt assured enough to proceed with physical construction of the project. Since the project has a capacity of about 80,000 tons of nitrogen per year in addition to an equivalent production of phosphate (the plant is designed to produce ammonium phosphate fertilizer), the cost of project delay was more than US$15 million annually in foreign exchange for equivalent nitrogen fertilizer alone. This was the cost of the prolonged negotiations between Government and the promoters. The Government of course is concerned that the promoters should not realize an unnecessarily high profit from the economy. But what has not been so readily recognized is that unless such a project will result in profits comparable to those which may be obtained elsewhere in the Indian economy for Indian entrepreneurs or in the world for international entrepreneurs, that the projects will not be undertaken. In this case, as in others, the question might be asked whether India would have been better off by providing a more lucrative opportunity for investment, in which case the project would have been implemented much earlier, or whether it would have been better off to bargain hard giving minimal inducements and not have the plant for several years. The delay in the case of this plant of perhaps three years during negotiations cost the economy in excess of US$45 million in equivalent import of nitrogen fertilizer alone, which is almost three-quarters of the total estimated cost of the plant, only part of which is in foreign exchange.

23. The next plant which may be implemented in the private sector but for which construction has not yet started is at Kothagudem. The Bank is very familiar with the project since the project has been a candidate for financing since mid-1961. It is an interesting but agonizing case. The Indian entrepreneurs approached the Bank in mid-1961 for financing and then, in late 1961 brought in a US firm as technical collaborators with substantial financial participation; the US firm appraised the project briefly in late 1961 and during the first half of 1962 the project was developed in reasonable detail which led to a Bank appraisal mission in the fall of 1962. The project as appraised would have had a capacity of 60,000 tons of nitrogen as urea and would have been based on coal from nearby collieries. The Bank appraisal was favorable and if the promoters had been able to obtain the necessary governmental permissions and assurances in early 1963, the plant might be going into operation today. Outside influences however, the Chinese invasion of late 1962, resulted in Government increasing corporate income taxes to very high levels starting in 1963. This might not have affected many projects where prices are not controlled but in this fertilizer project with controlled prices the returns were reduced to the borderline area as far as attracting foreign technical collaborators and participants in financing. The enthusiasm of the promoters was dulled and the project dragged on with little happening during 1963 as the promoters were busy with other more attractive proposals elsewhere in India and in the world. In early 1964, the promoters again put the project forward and the appraisal was reviewed by a second Bank mission. At the same time, Indian tax levels were moderated and it appeared again as though the project would go ahead. More complications were caused in the spring of 1964 when Government reduced the prices paid for urea, the product which this plant was to manufacture. Again, this reduced the expected profits on the enterprise to the point where the case was borderline; the promoters still plodded ahead with the project with dulled enthusiasm, primarily due to some feeling of commitment. Finally in early 1965, all felt that the project was well underway and the loan between the entrepreneurs and the World Bank was even negotiated and the new company to undertake the project was formed. At this time, Government increased duties on all imports by an additional 10% excepting fertilizer and a few other vital items, but including machinery and equipment for fertilizer plants. This last straw, in conjunction with past happenings on the prices of fertilizer and the difficulties of negotiations with Government, caused the promoters to give up the project as originally conceived. The promoters currently are developing possible alternatives based on using naptha as a feed stock rather than coal; this reduces plant investment substantially but of course substitutes naptha, a product from imported crude oil for coal, a product of locally produced collieries. The outcome of the project is uncertain but difficulties and time necessary to obtain adequate assurances from Government on critical aspects of the project have resulted in delays during which time outside considerations have resulted in actions by the Indian Government which have made the project unattractive to the private investor. The delay in the case of this project has been at least three years and the plant could have been paid for completely with the foreign exchange cost of the fertilizer imported during this period.

24. The story of the other fertilizer projects of the private sector in India is unhappy. The promoters of the proposed plant at Itarsi in Madhya Pradesh (State) were unsuccessful in developing a project; the basic problems were lack of market in the area and the lack of raw materials at costs low enough to make the project attractive, although, in addition, the promoters evidently were not highly motivated. The total market for fertilizer was small in Madhya Pradesh which is quite undeveloped and the plant would have been located in a position from which it would have been difficult to ship economically by railroad to other substantial markets for fertilizer in other Indian states. When the private promoters were unsuccessful in developing the project, the project was turned over to the Fertilizer Corporation of India, a public undertaking. The Fertilizer Corporation, after study, changed the proposed location of the Plant to Korba, close to a coal mining area. The Fertilizer Corporation developed the project and had even initiated construction of some infrastructure type facilities at the plant site. Work on this was halted in 1964 when the Government of India agreed to a study of the fertilizer industry in India and the possible construction of five large nitrogen fertilizer plants by a consortium headed by the Bechtel Corporation. It is uncertain whether the plant will be built; this will depend not only on the outcome of the negotiations between the Government of India and the consortium headed by Bechtel, but also on other possible fertilizer plant proposals at other locations within India currently under consideration. It may be said, however, that the original plant location was not desirable and that the fact that the plant was not constructed by the private sector as initially planned by a Government Committee will end up being a benefit to the economy of India.

25. Another plant originally expected to be constructed by the private sector was at Hanumamgarh in Rajasthan. Again, location for this plant was not desirable even though it had been recommended in the site selection studies undertaken by the Government of India in the latter part of the 1950's. The private entrepreneurs were not successful in developing a satisfactory project. After study, however, an alternate site location has been suggested at Kotah. This latter site is more advantageous than the original site but the question as to whether a fertilizer plant should be built at all in Rajasthan has still not been answered satisfactorily. Fertilizer usage in the State is still very low, about 6,000 tons of nitrogen in 1963/64, less than one-twelfth of the proposed plant capacity. The proposed raw material for the plant would be naptha which would have to be shipped by rail from refineries on the coast of India which makes the cost of the raw material quite high and the costs of production unfavorable as compared with the production of fertilizer plants located closer to refineries, especially the new very large plants based on the latest technology. Here again it has been somewhat of a blessing that the original plant was not built since it would not have been economical. Even at the revised location, there would be serious question as to whether the project should be implemented which accounts for the substantial delays.

26. The last plant included in the Plan specifically was at Durgapur. This plant was to be a joint undertaking by the State of Bengal and private interests. Although the cornerstone for the plant has been laid, it is understood that a full go-ahead will not be given for the plant until the

results of other studies on the fertilizer industry in India in general are known and other possible promotional schemes which are now under considera- by the Government of India have been evaluated. Here there will be a likely cost of delay since the Durgapur location is probably quite a reasonable one and since project development has been delayed while studies are made of many other things in India. In economic development, there may certainly be costs due to the mistakes made by commission. But there are also costs of the mistakes of omission. For economic development, man must act. For good economic development reasonable studies should be undertaken on the basis of which intelligent decisions may be made. But interminable study and no decision is effectively a decision for no action and no development.

27. At the time the third Five-Year Plan was formulated other plants were considered for possible inclusion in the Plan even though specific projects had not been drawn up, or licenses granted. One of these, now to be located at Baroda is under construction and is expected to be completed in 1967. This is a joint undertaking by the State of Gujarat and the public.

28. Another plant was proposed to be erected in Mysore State at the Port of Mangalore. This site location would have required that the Port of Mangalore and the transport facilities from the port to the inland portions of India be improved. The project has not been executed due to the fact that the transportation infrastructure necessary has not been provided. If the project had been implemented, it would have been a mistake since the project could not have contributed to the economy without this infrastructure. A private group is considering an alternative site for this plant at Goa and is trying to enlist a foreign company as a joint sponsor. Project plans are now being drawn up for a very large plant utilizing the latest technology which results in low cost ammonia manufacture. The exact outcome of this proposal will only be developed with time; to date, the principal Indian individual responsible for promoting the project has been working on the project for about three years.

29. The plant proposed for Tuticorin has not materialized but an alternate plant in the State of Madras is expected to be built adjacent to the new petroleum refinery which is to be built at the City of Madras. This last site, adjacent to the refinery at Madras, should prove to be excellent, substantially superior to any possible construction at the site originally considered.

30. A project for a plant at Koyna has not yet taken shape nor is it likely to be based on present expectations.

Position of the Fertilizer Industry at the Present Time

31. The status of the fertilizer industry at the present time is as follows:

Plants in Operation:

Plant	State	Ownership	Nitrogen Capacity (thousand tons annually)
Sindri	Bihar	Government	117
Alwaye	Kerala	Government	30
Nangal	Punjab	Government	80
Rourkela	Orissa	Government	120
Ennore	Madras	Private	6
Varanasi	Utter	Private	10
By-Products etc.	Various	Private and Government	21
Total of Plants in Operation			3

Plants now starting up or under construction:

Trombay	Maharashtra	Government	90
Neyveli	Madras	Government	77
Alwaye Expansion	Kerala	Government	40
Namrup	Assam	Government	45
Vishakhapatnam	Andhra	Private	80
Gorakhpur	Utter	Government	80
Baroda	Gujarat	Mixed	96
Total Plants starting up and under construction			508
Grand Total - Plants definitely committed			894

32. Total fertilizer capacity in India at the present time is 386,000 tons of nitrogen annually. As has been explained previously actual operations are not at this level. It would be expected that plant production of perhaps 90% of capacity could be maintained once certain difficulties are overcome. The construction of plants with a total capacity of approximately 508,000 tons of nitrogen annually is firmly committed which will bring total capacity in India to a level of about 894,000 tons of nitrogen. From an agricultural aspect, goals for the end of the Fourth Plan are of the order of magnitude of 2 million tons of nitrogen annually. There is, therefore, substantial need of increased production by the country.

33. The Government of India and certain private entrepreneurs are currently investigating or initiating action to develop substantial additional fertilizer capacity. A number of sites have been discussed and the state of implementation varies considerably from site to site. The plant

with perhaps the most favorable conditions for speedy implementation is at Madras, in connection with the new petroleum refinery which is to be erected there. This plant, which is expected to be a joint undertaking by the Government of India and foreign petroleum interests, will probably be large, about 200,000 tons of nitrogen capacity, and based on the new technological advances which result in low costs of operation. The Madras location should be excellent, since raw materials will be readily available, the general area to be served by the plant is one of high fertilizer usage, and transport facilities both in the way of roads and railways and also water transport on both canals and the sea are available.

34. The Government or its corporate undertakings, also are investigating projects at Durgapur, another reasonably favorable location where a plant with a capacity of 125,000 tons of nitrogen is planned, at Korba, where work has been started in a preliminary way on a plant with an expected capacity of 100,000 tons of nitrogen based on coal, at Barauni, where it is possible a plant may be built, and perhaps at Cochin, where consideration is being given to constructing a large plant with a capacity approaching 200,000 tons of nitrogen based on the latest technological processes.

35. Private interests meanwhile are considering projects at Kothagudem where a plant with a capacity of 90,000 tons of nitrogen based on naptha may be erected, at Goa, where a plant with a capacity of 160,000 tons of nitrogen based on the latest technology is being considered, and at Kotah, where a plant with a tentative capacity of 100,000 tons of nitrogen is being reviewed. The last of these plants, at Kotah, is not in a particularly desirable location and the probability of implementation is probably not large.

36. The basic locations mentioned in the previous paragraphs might be considered open to fertilizer plant development. The total capacity of plants considered is slightly over one million tons of nitrogen which, if all were implemented, would bring total capacity in India to almost 2 million tons of nitrogen. The Government or its corporations are currently considering a number of other alternatives for fertilizer development; foreign companies have evidenced interest in fertilizer development in India and conversations are being held with a number of these in the hope of developing projects which will be rapidly implemented.

37. The largest proposal of this sort was made by the Bechtel Corporation of the United States which led a consortium of interested companies in studying the Indian fertilizer situation and making a proposal for the erection of five large nitrogen fertilizer plants with a capacity approaching 1 million tons of nitrogen, 200,000 tons of nitrogen capacity for each of the plants. Field studies were made in India in the latter part of 1964 and a report was presented to the Indian Government in January 1965. Since that time the Indian Government has been discussing this possible promotion with the interested companies. It would appear that not even one plant, let alone five, will actually come about due to this approach. From press reports, the stated reasons for the lack of agreement between the foreign consortium and the Government of India

revolves around the question of control of the enterprises and the relative percentage of State versus private ownership. There are, without doubt, other reasons for failing to reach an agreement, but the important thing is not so much the reasons but the very fact that an agreement cannot be reached.

38. Fertilizer is a vital commodity to India which will provide a substantial benefit. Although most of this benefit will be realized in the agricultural sector, some of the benefits in the way of profits should be realized at the manufacturing point. The injection of capital and technical knowledge which would be provided by foreign promoters would be most valuable. But whether such foreign promoters actually come to India depends on the degree of risk as evaluated by the foreign promoters and on how the benefit "pie" is sliced.

39. As far as risk goes, foreign companies have had great difficulty in obtaining adequate commitment from the Government on certain aspects of fertilizer policy to give them enough confidence to participate financially in fertilizer project development. Had the projects been expected to be highly profitable, the companies might have taken the risks, but in fertilizer with Government price controls and expectations of reasonably low profits, potential gains did not outweigh the possible losses. With regard to splitting the benefits of a project, there appears to be a great fear in India that the slice of the pie allowed to the foreign promoters will be too large, and apparently little fear that the proposed projects may fail to materialize if satisfactory sources of foreign capital and technical skills are not made available.

40. In this situation, with fear that foreigners may realize undue profit, the Government of India spends much time in negotiation trying to reduce the cost of the project to India by reducing the financial benefits which will eventually be paid to the foreign promoters. It would appear that in a number of cases, the Government of India has been so successful in these negotiations that the foreign promoters have found the projects unattractive and decided to invest elsewhere. India must realize that it must compete for foreign private capital and that before foreign companies will invest in India, they must expect to make attractive returns over a period of time. These returns must generally be as, or more attractive than those available in the countries of origin of the foreign companies since investment in one's own country is normally simpler and much less risky. In addition, the investment climate in India must compare favorably with that of other countries in the developing world where similar projects are possible.

41. The Indian Government is currently considering other propositions of other foreign companies for possible collaboration on fertilizer manufacturing facilities. These negotiations might be expected to bear fruit to the extent that the plants are financed through government credits or IBRD type loans. But if India expects to attract private capital or capital which would be in addition to that offered on a Government to Government or multilateral basis, then it must be prepared to offer terms which will be attractive to the private financial community of the developed countries. Since the benefits of fertilizer production are substantial it would certainly seem that the Government of India can afford to offer the incentives necessary.

The Question of Time

42. If one of the large plants as is now expected to be built (with a capacity of about 200,000 tons of nitrogen annually) is delayed for one year, it costs India about $40 million in foreign exchange to purchase the equivalent fertilizer; this is close to one-half of the total investment in the fertilizer plant. Indian officials negotiating fertilizer plant proposals with foreign firms should realize that the time spent in negotiations has a cost of about $3 million per month or about $100,000 per day in terms of the foreign exchange to purchase the equivalent fertilizer production.

43. There is little time to establish fertilizer projects to reach capacity operations by the end of the Fourth Plan. Engineering, procurement, and construction of such plants in India can probably best be done in about three years; actual times for existing plants have been much longer but with good procedures an improvement to three years would be possible. After this, it is normal for a plant to take one or perhaps two years before it is operating steadily at capacity. Considering this, it is imperative to start immediately on plants if they are to be operating at capacity by the end of the Fourth Plan.

Conclusions and Recommendations

44. If India is to increase its fertilizer productive capacity to the levels projected for the end of the Fourth Plan, a large and expert effort is needed immediately. If competent project planners, engineers, and construction managers are used, the plants may be built; if competent management and technicians are found to operate the plants, they will produce efficiently. Any half effort is probably doomed to failure.

45. The Fertilizer Corporation, a Government undertaking, under instructions from Government, has set up a "Planning and Development Division" which is stated to be theoretically capable of planning and building two fertilizer production units annually. Although Indians take great pride in doing things independently of foreign help as would be the case if the services of the "Planning and Development Division" were utilized, it is the Mission's opinion that trusting a large amount of the next Plan's fertilizer program to such a group with limited experience represents too great a risk. The efforts of the group should be devoted first to the most rapid implementation possible of projects now underway. After this, it would probably be desirable to have the group work with experienced foreign engineering firms who would be basically responsible for project implementation until adequate experience is built up. Contracting with foreign engineering firms would cost more than if Indian talent alone were utilized. However, there would be every expectation that these expenditures would be recovered several times over as a result of more prompt and efficient project execution.

46. The Fertilizer Corporation currently has two operating units, Sindri and Nangal, and one unit coming into operation, Trombay. It also is building plants at Namrup and Gorakhpur and is also responsible for two more plants, Korba and Durgapur, when and if these projects are undertaken. The company was investigated in late 1964 by the Committee on Public Undertakings of the Indian parliment, and from the committee's published report, the Corporation has substantial work to do putting its present operations and firm projects in order. 1/ It is therefore recommended that no additional load in the way of new projects be assigned to the Fertilizer Corporation alone. If one of those now assigned is dropped, it might be replaced, but until present operations are running well and plants now under construction are brought into efficient production, the Mission believes the Corporation has full task. An exception to this might be if the Corporation undertook a new project jointly with an experienced foreign partner; in such a case the foreign partner should probably be delegated the responsibility for the project.

47. It is recommended that the fertilizer production facilities to be erected in the coming Plan be undertaken jointly by the Government of India or private Indian interests and foreign companies experienced in fertilizer production. Construction of such facilities in most countries is most efficient when managed by competent engineering construction managers; this should also be the case in India. To motivate economic efficiency, the foreign collaborators should be required to make a reasonable investment in the enterprise; to encourage this, the Government of India should stand ready to make commitments so that the company or companies will have prospects for profits of reasonable magnitude. The foreign company should have basic responsibility for technical and business management, but would, of course, consider the Indian environment and the views of those Indian nationals in management. If India wants fertilizer in reasonable time, it must be prepared to compromise its views with those of potential foreign participators so that a solution agreeable to both sides may be arrived at promptly. Time is of the essence. Days in discussion and negotiations have high value. It is safe to say that if India tries to maximize its own return from specific projects by minimizing the return of foreign parties, the fertilizer production facilities needed will not be built in time.

1/ Fertilizer Corporation of India Ltd., New Delhi. Committee on Public Undertakings Third Lok Sabha, Sixth Report, April 1965.