CHAPTER FIVE
Chapter Five

A CASE STUDY OF BARAUNI FERTILISER PROJECT
(INDIA)  

5.1 Project Planning

5.1.1 Salient Features

In November 1966, the Fertiliser Corporation of India (FCI) submitted the feasibility study to the Government for setting a 600 tonnes per day (TPD) Ammonia Plant and 1,000 TPD Urea Plant at Barauni with low sulphur heavy stock (LSHS) as the main feedstock.

On 2.12.1966, the Government advised the FCI to modify the feasibility study to provide for an identical plant with naphtha (instead of LSHS) as feedstock. The proposal was modified and submitted on 14.12.1966. The project cost was estimated at Rs. 351.4 million. It was approved in January 1967. A commercial credit agreement with Technimont of Italy was signed on 30.10.1967. The contract became effective from 10.3.1968 after approvals of respective authorities were obtained.

Planned completion period of the project was 36 months from the date of the signing of contract and the target date for completion of erection and starting of commissioning.

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1 This case study is extracted from: Bureau of Public Enterprises, "Barauni Fertiliser Project", Op.Cit.
activities was fixed 31.3.1971. Actual completion date of commissioning was March 1976 and commercial production commenced from 1.11.1976.

5.1.2 Location of the Project

Barauni Fertiliser Project (BFP) was located on the northern bank of the river Ganges at Barauni in Begusarai, an underdeveloped region of North Bihar. The main criteria for setting the site of the project at Barauni were:

1. **Availability of suitable land.** The plot of the land where the project was to be located is out of the flood zone. And as earthquake was perceived, pile foundations for vibratory equipment and heavy building structures was provided for by the design consultants (The Former Planning and Development Division of the then FCI) right from the beginning.

2. **Proximity of Barauni Refinery from where the main feedstock is to be supplied.** The Indian Oil Corporation Refinery at Barauni, 4 kilometers away makes the availability and transport of naphtha easy and economical.

3. **Availability of water.** Seven tube-wells were planned to be installed for adequate and easy availability of water.

4. **Proximity to Barauni Thermal Power Station (BTPS) from where power is to be supplied.** No problem was anticipated in meeting the power requirement of about
20 MW for the project. In fact the BTPS of Bihar State Electricity Board is situated at a distance of 1 kilometer away from the project area.

(5) Accessibility of the project from other consumer States and availability of transport facilities like roads and rail links (both broad and metre gauge). The road network was quite suitable and adequate for transporting materials and equipment for construction. And as for the rail transport, the project was located near both broad and metre gauge lines emanating from Barauni Railways Station/Garhara Marshalling Yard.

(6) Facilities for disposal of effluents. The BPP located near the flood protection Bundh of river Ganges makes it easy to discharge effluents. Lagoons made by borrowing of earth required for raising the site level were also used for disposal of effluents.

(7) Employment potential in the area. Employing from Barauni, an underdeveloped area of North Bihar is meeting one of the important social needs of the country.

5.1.3 Integrated Planning

The Planning and Development Division (PDD) was entrusted with the entire job of planning, designing and engineering of the project. The feasibility study envisaged locating the township as an extension of the existing refinery township (10 kilometers away from the project area) with a view to have an integrated township with common community facilities for the two projects.
5.2 Detailed Engineering

5.2.1 Civil Work

Framed structures of the buildings were designed on the basis of economy and suitability depending on the requirements and their longevity. The lessons gained from the experience of implementing two fertiliser projects at Durgapur and Cochin helped PDD in the detailed engineering. Certain repetitive designs were adopted. In late 1969, however, scarcity of structural steel was noticed which led to modification of the design of other structures where work had already been taken up. Reinforced cement concrete was used.

The civil construction works were carried out by adopting latest techniques spelt out in Indian Standards (IS) codes and Central Public Works Department (CPWD) specifications. Schedules and rates for Delhi was adopted for the purpose of estimates by plant authorities.

The work of site filling, levelling and grading was taken up as envisaged in the feasibility study. Villagers resisted and demanded high compensation for their lands. There was a strong local political opposition too against acquisition of land. As such, a full working season was lost. The State Government was kept informed but nothing tangible came out. Therefore, additional borrow pits within the project premises were digged out in 1971.
Pile foundations were adopted for all vibratory equipments besides other important structures and buildings. The work of pile foundations also faced some problems due to shortages of steel rounds, continued labour problems and Indo-Pakistan War which started in December 1971.

Plant civil works were taken over by Messrs Bridge and Roof Co. (India) who commenced work in July 1969. The major works were completed in June 1972 resulting in a delay of 19 months. This was due to irregular flow of drawings from PDD who were depending upon data to be supplied by equipment suppliers — both foreign and indigenous. Indigenous suppliers delayed the service because of labour problems besides shortage of steel rounds, structural steel, unprecedented floods in 1971 and Indo-Pakistan War in December 1971.

5.2.2 Equipments

PDD was entrusted with the responsibility for detailed engineering for equipments. It had an agreement with Technimont for process and know-how.

Equipments were either imported, fabricated indigenously but from raw materials procured from foreign suppliers or fabricated indigenously from indigenous raw materials. About 60 per cent of the equipment was procured from indigenous suppliers. The Government pursued a policy of developing indigenous know-how for the manufacture of capital goods.
Therefore, many equipments imported earlier for Durgapur Fertiliser project were procured indigenously for the first time for BFP.

Such policy, however, had its drawbacks which were reflected in the delays of delivery of equipments ordered from indigenous manufacturers. As a matter of fact, there were certain areas of special equipments required for fertiliser and chemical industries for which the manufacturing facilities at that time were non-existent or inadequate to meet the demand. Some of the critical areas of such equipments were pumps, high pressure compressors, high pressure pipes and fittings, values and metallurgy.

Table 5.1 shows completion dates of equipments erection. The erection work was delayed due to disturbed labour situations and failure on the part of erection contractors. Furthermore, the agencies available in India for tackling the piping erection were few and they adopted a monopolistic attitude while tendering for contracts.

Due to labour problems at Barauni, some of the contractors closed down their site establishments during the period mentioned against each as below:

(a) SL : 13.2.72 to 16.5.72, i.e., 3 months.
(b) Dodsals: 19.3.72 to 16.5.72, i.e., 2 months.
(c) FACT : 4.9.72 to 9.10.72, i.e., 11/4 months.
(d) HEC : May 1971 to 12.4.72, i.e., 11 months.
(e) GDC : Abandoned site in June 1973.

Another problem faced was that the local labour unions
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Contractor</th>
<th>Job</th>
<th>Value Rs.(000)</th>
<th>Completion Date Planned</th>
<th>Actual</th>
<th>Time overrun (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ganooon Dunkerley &amp; Co.Ltd., New Delhi (GDC)</td>
<td>Mechanical equipments</td>
<td>1,517</td>
<td>Sept., 1971</td>
<td></td>
<td>Contractor left in June 1973. Thereafter, the job was done departmentally.</td>
</tr>
</tbody>
</table>

**Source:** Ibid., p.21.
demanded that there should be no interim retrenchment. Therefore, the contractors had to employ a very limited manpower and continue with it till the completion of the work. This had its effect as it resulted in major delays in completion of erection works.

5.3 Project Implementation

5.3.1 Problems Faced

Problems were faced during construction, fabrication, erection and commissioning stages. During the construction stage, the project authority was mainly faced with delays in land acquisition and shortage of steel. Although the State Government of Bihar State initially promised to provide land free of cost, it changed its mind and the FCI had to pay a substantial price. Also local population stiffly resisted and the State Government did not intervene. Land acquisition was completed in November 1968, i.e., almost two years after the approval of the project.

During the construction stage, there was shortage in some steel rounds and structural steel. No priority was given to the FCI. Therefore, it had to go to the black market to secure the emergent requirements of steel at higher prices.

With respect to the fabrication stage, the fact that indigenous manufacturers being still in the developing stage
delayed in fabrication and supply of the equipments. Some new imported raw materials were required for fabrication. The import of these materials also caused delays. Some items were transported in sections and assembled at Barauni. The PDD had to import some of the structural plates because of acute shortages and supplied that to the construction agencies. This also caused delays.

Another problem faced during fabrication was that few of the parties who did not possess the required capabilities and technical expertise were registered as indigenous manufactures. No importation, therefore, could be possible for the item which they could manufacture. It was only after long-drawn discussions with the authorities and the indigenous manufacturer that importation was allowed. This caused unnecessary delays.

Two problems were encountered during the erection stage. The first problem was that the contractor responsible for the erection of mechanical equipments had abandoned the work of erection of Flue Gas and Reformed Gas Boiler at a very early stage. The job involved about 5,000 Indian Boiler Regulation Alloy Steel Weldings. Because of acute shortage of quality welders and being a critical activity, these led to two years delay in mechanical erection. As a result, the works of piping, erection, painting and insulation were all
adversely affected. Some imported equipments posed major quality problems. Several modifications were made which enlarged the scope of work and consequently the overall project schedule was extended. Furthermore, the fact that some contractors were unable to deliver some critical items led to delays.

The second problem during erection stage was that during the course of Primary Reformer Refractory curing, telfon seats of bull valves installed for operation of reformer were found leaking. The decision to replace the valves, however, was delayed. The whole process of procurement and installation of valves took 4 months while the installation itself took only 21 days.

5.3.1.1 Commissioning Stage

During commissioning stage, three major problems were encountered. These were:

(1) Leakages were detected in some of the shop assembled expansion belows of six riser tubes and twelve downcomer tubes of Reformed Gas Boiler. For example, the diffuser of Air Compressor was found broken and had to be removed and the upper half of the first stage diffuser plate was displaced from its position and the rotor impeller was damaged. This was fixed in position.
(2) Non-availability of stable power supply. The total requirement of the plant was 20 MW. The sub-station was energised on 7.3.1973, and till 30.4.1980, 57 trips and 66 voltage dips had occurred.

(3) The power supply to the project had been unstable. During 1976 when the project had gone into production, there had been 11 power interruptions and 29 voltage dips which had adversely affected the life of catalysts and other refractories in the plant, besides causing heavy production loss.

5.3.2 Project Organisation and Monitoring

Two organisations were authorised to execute the project. These were the PDD and the Barauni Site Organisation (BSO). The authority relationship between the PDD and the BSO was assumed to be between a designer-engineer-supplier and a purchaser, and a memo as guidelines for smooth execution of the project was drawn out. The PDD was entrusted with:

(a) Designing, engineering and supplying of Ammonia, Urea, Steam Generation and Boiler Feed Water Treatment Plants.

(b) Inspecting equipment and machinery at suppliers' shops before despatch.

(c) Supplying necessary drawings and documents required for erection and operation.

(d) Finalising suppliers' credit, submitting foreign exchange returns, obtaining necessary import licence
and arranging replacement of imported items.

(e) Supervising erection, commissioning and performance guarantee tests of the plant and deputing engineers at site to coordinate these activities.

BSO was entrusted with:

(a) Supplying basic design data necessary for designing of plant, site preparation and sub-soil investigation.

(b) Obtaining consent of statutory authorities during erection.

(c) Unloading, inspection, storage and security of materials/equipments at site and taking suitable insurance coverage, lodging and follow-up of insurance claims and arranging replacement of indigenous deficient items. Executing civil works including procurement of materials. Providing construction equipments, tools and tackles and fixing agencies for erection of plant and equipment. Arranging raw materials, utilities, chemicals and lubricants, operation and maintenance of personnel.

(d) Designing effluent disposal schemes.

(e) Arranging off-site facilities which were not included in the PDD's scope including raw water pumping, process and sanitary water treatment, storage and distribution.

(f) Preparing detailed project cost estimates.

(g) Providing necessary facilities for site staff including foreign personnel.

A general manager, assisted by various departmental
heads, was charged with the management of the project. The various departments included Project Planning and Coordination, Finance, Erection, Civil, Administration, Personnel, Stores and Purchases and Materials.

As far as the techniques adopted are concerned, network technique was used in implementation planning and control. A detailed network for individual units and master control network were drawn in consultation with construction executives, supervisors and contractors.

Monthly and quarterly progress reports regarding important activities of the project were prepared for monitoring and controlling the progress of work. Critical activities were discussed at group meetings of the concerned officials and advance actions were taken to avoid delays. Also inventory control techniques were used in material planning to help forecast material requirements and their economic order quantity.

The recruitment of operational staff commenced from the initial stage to enable them prepare daily progress reports, detailed engineering and construction supervision so that they were able to know about the project. The operational and maintenance staff were also sent abroad and to Durgapur for training in various plants.
5.3.3 **Effluent Treatment**

The project authorities arranged for effluent treatment so that the environment might not be effected. Arrangements were made for the ammonial effluent, arsenic effluent, cooling water blow-out, ash and lime sludge, wash and sulphuric acid, sewage effluent and spilling/leaked oil. By way of example, a complete closed circuit system for arsenic solution, wash caustic soda and wash sulphuric acid from Boiler Feed Water Treatment Plant were first neutralised and then allowed to overflow in the storm water drainage system, and all measures have been taken not to allow any spilled/leaked oil to go into drains.

5.4 **Time and Cost Overruns of the Project**

The zero date for the project was 10.3.1968 from which 36 months for completion was to be reckoned. This period covered activities upto mechanical completion including trial runs. Commissioning operations were expected to take additional 4 months.

Mechanical completion, however, was achieved in July 1975, causing a delay of 52 months (from March 1971 to July 1975). The commissioning activities took 15 months, i.e., from August 1975 to October 1976, against a planned period of 4 months, thus causing an additional delay of 11 months.
Total delay was 63 months \((52 + 11)\) in starting commercial production.

5.4.1 Analysis of Time Overruns

5.4.1.1 Delay in Construction

Delay in construction occurred in both critical and non-critical activities. Concentration here is made on critical paths. The project construction activities have passed through four critical paths; those were Refinery Gas Boiler erection (RG), Compressor erection, other equipments delivery and erection and Piping work.

For the first critical path, the RG Boiler erection, the main events are shown in the activity chart of Table 5.2.

Table 5.2

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Event</th>
<th>Completion date</th>
<th>Delay (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Scheduled</td>
<td>Actual</td>
</tr>
<tr>
<td>1.</td>
<td>Completion of Support-</td>
<td>28.2.70</td>
<td>30.6.72</td>
</tr>
<tr>
<td></td>
<td>ing Structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Delivery of RG Boiler at</td>
<td>31.3.70</td>
<td>30.11.70</td>
</tr>
<tr>
<td></td>
<td>site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Erection of RG Boiler</td>
<td>28.2.71</td>
<td>31.10.74</td>
</tr>
</tbody>
</table>


As seen from the chart above, the completion of supporting structures delayed by 28 months. This was attributed to
non-availability of required structural steel sections (12 months), flood and Indo-Pakistan War (3 months) and the inability of the contractors to carry out the work expeditiously due to disturbed labour situation at the site and resistance and agitation by the local unions against recruiting labour from outside the State (13 months).

This, while the erection of RG Boiler should have been completed one year after the completion of supporting structure, it, however, took 28 months to complete, causing a further delay of 16 months. This leaves 16 months delay (44-28) which is clearly the result of the delay in the erection of the RG Boiler. This in turn was due to the disturbed labour situation and unreasonable demands of the labour unions which did not help the contractor to mobilise adequate and skilled labour at the site; the contractor also abandoned his work which resulted in dislocation of work and inevitable delays.

The second critical path was Compressor erection in which the total delay was 48 months. The major delays were as follows:

(a) 2 months delay in receipt of consignment at the site (September 70 - November 70).

(b) 27 months delay due to discrepancies and short supplies in equipments received and due to delay in preparing erection front.
(c) 6 months delay in receipt of offer from Technimont.
(d) 10 months delay in opening the letter of credit and issuing amendments.

The above delays have been cumulative in effect. By way of example, erection of front was not ready at the site, and the vendor's representative presumably had to be called only when the front was ready for erection of the equipments.

The third critical path was the equipments erection. Total delay in this path was 41 months. Out of this, a delay of 16 months occurred in receipt of imported equipments, imported raw materials and indigenous raw materials for fabrication. Thereafter, a delay of 12 months occurred at the fabricators' shops due to their own labour problems, power cuts at their work, technological know-how problems, prior booking of vendors due to delayed availability of raw materials from the owner and consequent shop loading by the vendor with other owners.

The fourth critical path was the piping work. The total delay in this path was 48 months and the main events are shown in table 5.3.

Three observations can be made on the table 5.3. The first one is that the delays in finalisation of piping layout and order placement have a contributory effect on the delays in the supply of materials and erection. The second
Table 5.3

Activity Chart of the Piping Works
(Barauni Fertiliser Project)

<table>
<thead>
<tr>
<th>Events</th>
<th>COMPLETION DATE</th>
<th>Delay (Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scheduled</td>
<td>Actual</td>
</tr>
<tr>
<td>Finalisation of Piping Layout</td>
<td>31.10.69</td>
<td>30.4.70</td>
</tr>
<tr>
<td>Order Placement for Piping Materials:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase I</td>
<td>...</td>
<td>31.3.69</td>
</tr>
<tr>
<td>Phase II</td>
<td>...</td>
<td>31.12.69</td>
</tr>
<tr>
<td>Phase III</td>
<td>...</td>
<td>30.9.70</td>
</tr>
<tr>
<td>Receipt of Piping Materials:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase I</td>
<td>...</td>
<td>31.3.70</td>
</tr>
<tr>
<td>Phase II</td>
<td>...</td>
<td>30.9.70</td>
</tr>
<tr>
<td>Phase III</td>
<td>...</td>
<td>31.12.70</td>
</tr>
<tr>
<td>Erection of Piping:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase I</td>
<td>...</td>
<td>31.12.70</td>
</tr>
<tr>
<td>Phase II</td>
<td>...</td>
<td>31.1.71</td>
</tr>
</tbody>
</table>

Source: Ibid., p.31.
observation is that the provision of three months for the placement of piping materials for Phase III (30.9.1970 to 31.12.1970) was not realistic. And the third observation is that the shifting of orders due to inability of certain suppliers to meet their commitments and the modification in piping layout and material requirements by the PDD consequential changes and additions to the orders have also contributed to the delay in supplying piping materials.

5.4.1.2 Delay in Commencing Commercial Production

Commissioning activities took 15 months to complete instead of 4 months as scheduled. This was mainly attributed to equipment failures and defective supplies. Major troubles experienced during commissioning and time taken for meeting them were as follows:

(a) Seal leakage in the RG Boiler - 7 months.
(b) Tube leakage in the RG Boiler - 1 month.
(c) Replacement of a large number of Ball valves - 4 months.
(d) Rectification of defect in Synthesis Gas Turbine Speed Indicator - 1 month.
(e) Floods in 1976 leading to disruption of power supply from BTPS and naphtha supply etc. - 1 month.

The project was financed through Suppliers' Credit which was guaranteed by the Indian Government. Project authority and the PDD had to rely heavily on the reviews and actions
of Technimont as they had very little say in issues such as the finalisation of specifications, designs and supplies.

The poor quality of equipments supplied resulted in various replacements and rectifications carried out during commissioning. This problem was aggravated by the fact that both the equipments supplied and their inspection were arranged by Technimont as per the main contract.

5.4.2 Analysis of Cost Overruns

The project cost was revised six times after the original approval. The costs as well as the cost/time overruns are shown in table 5.4

From the table 5.4 it is clear that as the project took more time to complete, its cost shot up, i.e., the cost overruns have largely been a function of the time overrun. Ten major factors accounted for the cost overruns; these as well as cost overruns over previous estimates are given below:

(1) Change in scope - Rs. 78.4 million.
(2) Change in exchange rate - Rs. 4.9 million.
(3) Price escalation - Rs. 39.5 million.
(4) Shift in source of supply - Rs. 19.9 million.
(5) No provision in earlier estimates - Rs. 36.4 million.
(6) Inadequate provision in earlier estimates - Rs. 175.5 million.
(7) Modification jobs - Rs. 9.2 million.
(8) Financing charges - Rs. 128.9 million.
**Table 5.4**

<table>
<thead>
<tr>
<th>Revision No.</th>
<th>Date of Approval</th>
<th>Revised Date of Commercial Production</th>
<th>Time Overrun (Months)</th>
<th>Revised Capital Outlay (Rs. million)</th>
<th>Cost Overrun (Rs. million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>30.8.1971</td>
<td>1.10.1972</td>
<td>18</td>
<td>525.7</td>
<td>174.3</td>
</tr>
<tr>
<td>2nd</td>
<td>31.3.1972</td>
<td>1.4.1973</td>
<td>24</td>
<td>544.4</td>
<td>193.0</td>
</tr>
<tr>
<td>3rd</td>
<td>26.2.1973</td>
<td>1.10.1973</td>
<td>30</td>
<td>592.7</td>
<td>241.3</td>
</tr>
<tr>
<td>4th</td>
<td>1.8.1975</td>
<td>1.1.1976</td>
<td>57</td>
<td>760.1</td>
<td>408.7</td>
</tr>
<tr>
<td>5th</td>
<td>23.7.1976</td>
<td>1.10.1976</td>
<td>66</td>
<td>863.2</td>
<td>511.8</td>
</tr>
<tr>
<td>6th</td>
<td>March,'77</td>
<td>1.11.1976</td>
<td>67</td>
<td>923.2</td>
<td>571.8</td>
</tr>
</tbody>
</table>

**Source:** Ibid., p. 33.

*Original commissioning date was March 1971 and sanctioned outlay was Rs. 351.4 million.*
(9) Departmental charges - Rs. 81.9 million.
(10) Others - Rs. (-) 2.8 million.

The total of the above cost overruns works out at Rs. 571.8 million. Out of this, four factors alone contributed to an overrun of Rs. 464.7 million, i.e., 81 per cent of the total cost overrun of the project. These factors are inadequate provisions in earlier estimates (Rs. 175.5 million), financing charges (Rs. 128.9 million), departmental charges (Rs. 81.9 million) and change in scope (Rs. 78.4 million).

The inadequate provision included commissioning expenditure of Rs. 58 million. This means the sanctions and the first revised estimates were not realistic. The August 1971 revised estimate envisaged a lower amount (Rs. 15.7 million) for commissioning activities. The inadequate provision also included charges of foreign experts and Indian Income Tax thereon.

With respect to financing charges, interest on Government loans upto October 1976 amounted to Rs. 78.8 million, and interest on deferred credit offered by equipment suppliers amounted to Rs. 40.6 million.

Departmental charges debted to the project in the last two years were Rs. 37.3 million. Had the project started its commercial operation by 1.1.1976, as envisaged in June 1975
revised estimate, the departmental charges would have been reduced by Rs. 20 million.

The cost overrun due to change in scope amounted to Rs. 78.4 million of which Rs. 62.4 million were in the first revised estimate of August 1971 while Rs. 16 million were in the last revision of March 1977. The big increase (Rs. 62.4 million) in the first revision of August 1971 was due to:

(a) An essential increase in the number of boilers in the Steam Generation Plant from 3 to 4.

(b) Corresponding increase in the capacity of Water Treatment Plant and Boiler Feed Water Treatment Plant.

(c) Increased provision of land and its development for residential units as the earlier estimates proved inadequate.

The total cost of the project would have been less by Rs. 90 million had commercial operation started on 1.1.1976. On the other hand, as seen in Table 5.4, the total cost overrun from January 1967 sanctioned estimate and August 1971 first revision accounted to Rs. 571.8 million and Rs. 397.5 million (571.8 - 174.3) respectively. After a breakup of these figures due to factors controllable by the project officials and/or its consultants, it is found that cost overruns due to time overruns beyond January 1976 and other factors were as shown in Table 5.5.
Table 5.5

Break-up of Cost Overruns
(Barauni Fertiliser Project)

<table>
<thead>
<tr>
<th>Factors</th>
<th>Over the Sanctioned Estimate</th>
<th>From August 1971</th>
<th>First Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Controllable factors</td>
<td>414.8</td>
<td>236.0</td>
<td></td>
</tr>
<tr>
<td>b) Time overruns beyond Jan. 1976</td>
<td>90.0</td>
<td>90.0</td>
<td></td>
</tr>
<tr>
<td>c) Other factors</td>
<td>67.0</td>
<td>71.5</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>571.8</strong></td>
<td><strong>397.5</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Ibid., p.37.

The controllable factors in the table 5.5 included cost overruns due to change in scope, inadequate provision made in earlier estimates, escalation in prices, items not originally provided for and increase in commissioning expenditure due to inadequate provision in the earlier detailed project report.

5.5 Lessons From Barauni Fertiliser Project

Management of Barauni Project was involved in preparing the feasibility study of the project. This helps in achieving coordination from early stages. On the other hand, building the project township as an extension to the existing refinery township saves money through integrated planning and provision of joint facilities and services to both the projects.
Added to this, the active involvement of the Planning and Development Division in implementing Durgapur and Cochin fertiliser projects helped them to carry out detailed engineering for Barauni project and to abandon relying on foreign expertise.

But the haste in modifying the project study which was done in only 12 days resulted in problems later on during implementation as leakages were detected, cost shot up and the project overran its implementation schedule. These problems were mainly due to the inadequate provision made in earlier estimates, escalation in prices, change in scope, items not originally provided for and increase in commissioning expenditure due to inadequacy in the earlier detailed project report.

Majority of the causes of time and cost overruns were controllable. Many of the controllable factors were attributed to pre-implementation stage. Had Barauni project been soundly evaluated and keenly modified, a big chunk of its cost would have been saved and it would have operated earlier to supply the fertiliser and generate profits.