2.0 Introduction

Industrial planning in India aims at two main inter-related objectives: (a) maximising the total output (especially in the priority areas) in relation to the given volume of investment and materials; (b) minimising the total cost including the foreign exchange component of the industrial programme. In the context of these objectives, industry studies are often suggested to bring out the importance and the structural role of the industry with its specific development problems in the general industrial complex of the economy. For this purpose, this chapter deals with mainly (1) historical development of the levels of operation of the forging process in general, (2) structure of the industry in private sector during 1963-66 and state-wise structure during 1963-65, (3) development of the industry since the inception of five year plans, (4) imports and exports during 1957-1969, (5) demand pattern of forgings by using industries in India during 1960-1964, (6) market imperfections, growth of unutilized licensed capacities and other development problems (see also Appendix to this Chapter II) and nature of official statistics of the industry. Thus, this chapter is intended to bring out the general background of this industry study, emphasizing the significance of a jobbing type industry in the Indian economy and the need for detailed data on product multi-dimensions for planning purposes.
2.1 Historical development of forging process

Forging hammers have undergone a constant development with the introduction of forged parts of larger size and more intricate complex shapes. After the development of gravity hammers with guided ram, mechanical power and closed die impression forging processes are introduced during 18th century. During the 19th century, progress in power hammers has been accelerated. A number of technical innovations in processes and materials for hot forging and cold forging methods have been developed and improved upon, as the efficient use of materials and quality forgings are needed during 20th century. Steel age of 20th century brings forth the foremost importance of steel among all metals for forging process purposes. Thus, the art of forging has taken many transformations through its historical development.

In general, the art of forging process may be defined as the plastic deformation of metals or alloys into some predetermined size or shape generally at elevated temperatures, by a compressive force exerted by a hammer, press or upsetting.

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The art of forging dates back to rock ages when man needed crude weapons hammered between stones. The old primitive forge, wherein metals are heated by means of a blast of air, is employed during the second lineage of stamping jewelry and coins, around 1600 B.C. Hand Sledge is the principal tool of hand hammering, supplying energy for many centuries.

2. Some of these have been discussed in the Appendix to the III Chapter.

machine. Parts or members produced in such a manner are called forgings.

2.2 Levels of operation and their nature

Depending on the requirements of size, shape, mechanical properties and many other dimensional specifications, different forging methods with different time requirements of activities in die shop, heat treatment, machining, finishing, shot-blasting and inspection, are made available. All these facilities form part of and are ancillary to the forging process. These ancillary shops are the features of a fullfledged commercial independent forge unit whose main activity is to produce forgings on customers' orders. These are generally large scale units providing employment to hundreds of persons and producing limitless forgings of varied dimensions. However, the age old procedures of hand forging on an anvil are still followed by small units, especially for repairs and maintenance works of large units to upkeep latter's equipment. Some other forge shops are captive units of the large units, whose main products consume the forgings of their captive forge shops. Next, there are many an unaccountable list of small household black smithy type forge units as ancillary shops to the local large establishments. Thus the levels of operation range from a single blacksmith's shop to the large scale units. However, there are no reliable estimates of production statistics of all these levels of operation to analyse the economies of different levels of operation with respect to
any optimum size. 4

2.2 Modal type size as an approximation to optimum size
and the structure of the industry in private sector
during 1963-1966 and over states in India

While it is not often possible to discover the optimum
size by factual investigation, the existence of a modal type
size associated with a large proportion of the total number
of firms, may be taken as a first approximation and as
empirical evidence to identify the optimum size of a firm. 5
In what follows, the modal type sizes are computed from the
structure of firms distributed over plant capacity ranges.
For this purpose, licensed capacities of the firms in
private sector during the years 6 1963 to 1966 are taken
and the structure with respect to modal type size is
examined.

Actual installed capacities of the firms are required
to be taken for this purpose of analysis. Such data are not
available from any source. Similar data for public sector
units and for any other years are not available. It is
assumed that the structure of the firms based on tonnage

4 See Chamberlein, E.H., Theory of Monopolitic Compe-
tition, 1933, Harvard, pp. 104 for the definition of optimum
size as the output corresponding to minimum of average cost
curve of a firm.

5 See Robinson, E.A.G., Structure of competitive
industry, pp. 15-17.

6 The period 1963-66 is the latter half of the Third
Five Year Plan period in India. During this period, it is
observed that this industry attained peak levels of growth
of production (see the Section 3) of this Chapter II).
licensed capacities in private sector, as depicted in Tables 1, 2 and 3 may provide an approximation to the structure of firms based on installed capacities. Similarly, the percentage of utilized to licensed capacities may serve as an approximation to the percentage of utilized to installed capacities. They are underestimates to the extent of divergence of installed to licensed capacities. These production/licensed capacities include those of some captive units. However, there is no specific knowledge of the contribution of the captive units to the total production/licensed or installed capacity.

2.2.1 Structure Over Years

While there is not much change in the structure from 1963-64 to 1964-65, there is quite a drastic change in the structure of firms and of tonnage licensed during the period ending December 1966. These are observed from the percentages in Table I and from the modal sizes in Table 2. The negative quantities in Table 1 refers to (i) either revoking of the licenses or (ii) actual reductions in the number of firms or (iii) due to increases in the plant capacities so that a shift of those firms' capacities fall in the succeeding capacity ranges over the years 1963-1966. While there is no evidence to justify the cases (i) and (ii), the case (iii) can be deduced from Table I (especially columns (6) to (9)). A summarized picture of the distribution of the firms and tonnage licensed capacities is presented in Table 2.
Table I. Structure of the firms licensed upto 1963-64, during 1964-65 (average of two years) and 1966 (calendar year) in private sector, according to their licensed capacity ranges

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.of units</td>
<td>Percentage of (2) to total number of units</td>
<td>Total tonnage</td>
<td>Percentage of units capacity licensed</td>
<td>Total tonnage</td>
</tr>
<tr>
<td>0-1000</td>
<td>21</td>
<td>55</td>
<td>9638</td>
<td>17.03</td>
<td>5</td>
</tr>
<tr>
<td>1000-2000</td>
<td>13</td>
<td>35</td>
<td>20312</td>
<td>35.90</td>
<td>-2</td>
</tr>
<tr>
<td>2000-3000</td>
<td>2</td>
<td>5</td>
<td>8400</td>
<td>14.84</td>
<td>3</td>
</tr>
<tr>
<td>5000-12000</td>
<td>2</td>
<td>5</td>
<td>18240</td>
<td>32.23</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100</td>
<td>56390</td>
<td>100.00</td>
<td>7</td>
</tr>
</tbody>
</table>
Table 2. Modal sizes and Mean sizes of plant capacity (licensed) in private sector upto 1963-64, 1964-65 and upto 1966

(all in tons per year)

<table>
<thead>
<tr>
<th></th>
<th>Upto 1963-64</th>
<th>Upto 1964-65</th>
<th>Upto 1966</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Modal size</td>
<td>334</td>
<td>396</td>
<td>1531</td>
</tr>
<tr>
<td>(b) Mean size</td>
<td>1489</td>
<td>1640</td>
<td>2717</td>
</tr>
<tr>
<td>(c) Mean-Mode</td>
<td>1155</td>
<td>1244</td>
<td>1166</td>
</tr>
</tbody>
</table>
### Table 3. Statewise structure of licensed and utilised licensed capacities of firms in private sector

<table>
<thead>
<tr>
<th>Year</th>
<th>1963-64 (March ending)</th>
<th>1964-65 (Average of two years)</th>
<th>1964-65 (Average of two years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of units</td>
<td>Percentage of licensed units</td>
<td>Percentage of licensed units</td>
</tr>
<tr>
<td>West Bengal</td>
<td>16</td>
<td>42</td>
<td>65.84</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>5</td>
<td>13</td>
<td>4.64</td>
</tr>
<tr>
<td>Madras</td>
<td>4</td>
<td>11</td>
<td>6.18</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>5</td>
<td>13</td>
<td>10.39</td>
</tr>
<tr>
<td>Delhi</td>
<td>2</td>
<td>5</td>
<td>2.63</td>
</tr>
<tr>
<td>E. Punjab</td>
<td>3</td>
<td>8</td>
<td>3.80</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>1</td>
<td>2.67</td>
<td>1.93</td>
</tr>
<tr>
<td>Kerala</td>
<td>1</td>
<td>2.67</td>
<td>1.59</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>1</td>
<td>2.66</td>
<td>3.18</td>
</tr>
<tr>
<td>Gujarat</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**All India Total** | 38          | 100.00                      | 36.390                       | 45           | 100.00                      | 73810                        | 100.00                          | 45306                              | 100.00                             | 61.38                              |

Sources to prepare Tables 1, 2 and 3 are both official and non-official data collected from (1) the annual reports of (a) Directorate General of Technical Development (DGT), New Delhi and of (b) the Association of Indian Drop Forging and Stamping Industries, Bombay.

Identification of the figures with the sources is not possible as the tables are processed for uniformity and presentation purposes from the original more detailed data. The modal sizes presented in Table 2 are based on a more detailed distribution. (-) values refer to reduction while the +ve values refer to additions.
2.2.2 **Structure over states**

For state-wise analysis of the structure of licensed and utilized capacities, only for an average of the calendar years 1964-1967, licensed tonnage and actual production statistics are available. For 1963-64, licensed tonnage capacity statistics only are available. While there is an increase in the actual number of units and licensed tonnage in West Bengal, Maharashtra and Madras, there is no change in the number of units and in the licensed tonnage capacities of the rest of States, as observed from Table 3. Historically, the concentration of forging units in West Bengal is to meet the railways requirements. Maharashtra and Madras have developed very recently quality forgings' units to meet the requirements of automobiles, diesel engines, tractors, earth-moving machinery and other heavy engineering equipments. Maharashtra and Madras are thus leading the industry in private sector.

The actual production structure is closely similar to that of licensed tonnage capacities. There are 7 States utilizing their licensed capacities at a higher percentage compared to all India private sector firms' average percentage utilization (61.38%). The other three states, E. Punjab, Rajasthan and Gujerat are far below this level in their percentage utilization of licensed capacities in private sector.

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7 Because of recent growth of forging units especially in Maharashtra, some firms which have been licensed very recently and covered under the field investigation of this study in III Chapter are not included in the above table.
2.3 Development of the industry since the inception of Five Year Plans

Prior to the First Five Year Plan (1950-51 to 1955-56) the forging industry is completely under the shadow of their using industries as captive small scale or even as household units. Such small ancillary shops are continued to be unaccounted for, due to the difficulties of estimation. Industrial programmes, in general and of steel plants in particular, are launched during the Second Five Year Plan (1955-56 to 1960-61). But the steel forgings industry has not grown along with the steel plants. Tata Iron and Steel Plants' (TISCO) yearly production of wheels, axles and tyres for railways from 1948 to 1962 has remained stagnant around 21,000 tons. The Durgapur steel plant started producing wheels, axles and tyres from 1962-63 onwards. Coupled with the Durgapur Steel Plant's (DSP) production of the wheels, axles and tyres, the total production rose to 32,000 tons in 1962-63; 32,000 tons in 1963-64, 60,000 tons in 1964-65, with a small fall to 48,000 tons in 1965-66.

Similarly, the railway sleepers production remained stagnant around 7,000 tons per annum during 1947-1960-61, rose to 16,000 tons in 1961-62, 32,000 tons in 1962-63, 41,000 tons

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8 The steel plants launched during the Second Plan have started their production only after the end of the Second Plan because of the gestation period for erection and installation.
in 1963-64, 68,000 tons in 1964-65 and to 69,000 tons in 1965-66.9

By the end of the Third Plan, the Indian Railways' demand for sleepers is as much as 75,000 tons per year.
The original capacity of 60,000 tons per year, of sleepers plant is expanded over years by 1967, to 75,000 tons per year. Similarly, the wheel sets plant capacity of 37,000 tons per year at DSP is likely to expand to 93,000 tons per year. Thus, it is only after the development of Iron and steel plants and of railways that forge shops came into existence since the Third Plan.

2.3.1 Recent Public Sector Projects and their features

Though plans are there (since the inception of Third Five Year Plan (1960-61 to 1965-66) to develop forging capacity in public sector, especially the Foundry Forge project (FFP) at Ranchi, Mining and Allied Machinery Corporation (MAMC) at Durgapur and a forge shop at Alloy Steel Project (ASP), much of their construction, erection and installation work is still in progress. FFP may take upto 1975-76 to reach its full capacity of 50,000 tons per year according to their estimates. MAMC forgeshop could not reach its 8,000 tons per year capacity. ASP forge shop

9 Source to all these production statistics:

Hindustan Steel Ltd. (H.S.L.), Statistics for Iron and Steel Industry in India, Ranchi, 1966, p. 9. Though the wheel sets and sleepers are manufactured by the basic process of forging these have not been included in the official statistics of demand, production, etc. of steel forgings, but they have been included in those of Iron and Steel industry as perhaps their mills are part and parcel of steel plants.
started production from 1966-67 onwards attaining its yearly capacity of 4,000 tons of finished forgings in a few years. Thus, these three plants together may provide a maximum production of 6,000 tons by 1966-67, whereas their potential capacity likely to be available by 1975-76 is 62,000 tons per year to meet the demand of steel plants, heavy machine building plant (HMBP) and Heavy Machine Tools Plant (HMTP).

Two more projects, one at Hardwar and another at Vardha, are proposed to be set up, during Fourth Five Year Plan ending by 1973-74, with capacities of 15,000 tons per year and 8,300 tons per year respectively, to meet the demand of heavy electricals and engineering industries. If these two projects are also realized, there will be a potential capacity of 87,300 tons per year by 1975-76 in public sector. The nature of the equipment like heavy presses, upsetters and hammers with high capacities in the public sector projects is such that they can produce heavy forgings of above 3 ton piece weight, while the private sector has invested in such equipment which can turn out a maximum piece weight of 3 tons only.

10 These observations are drawn from the booklets and annual reports of the companies and are similarly felt on field investigation of the plants. Source to these general production statistics or targets of the plants is the small booklets published by the concerned companies, firms and industry.

11 Report of the Planning Commission for machinery group industries for IV five year plan.

12 This is observed by the members of the Association.
2.3.2 Growth of Private Sector

In private sector, there are 28 firms licensed to produce 34,000 tons per year by 1960-61, 30 firms to produce 47,772 tons by 1961-62, 38 firms to produce 56,790 tons by 1963-64, 44 firms to produce a maximum capacity of 1,30,424 tons per year by the end of December 1966. However, the actual percentage utilization of the licensed capacity in 1963 is observed as 61.38% (See Table 3). Due to general recession in demand, followed by labour unrest etc. during 1967, almost all firms have been affected, with the result that the licensed capacity and output figures have gone down to 83,740 tons per year and 40,500 tons per year respectively. During 1968, licensed capacity reached to 1,00,800 tons per year and the actual production 44,000 tons per year of 44 licensed firms in the private sector. Utilization of licensed capacity is 48.36% in 1967, 43.6% in 1968, whereas it is 61.38% in 1965. Thus, the private sector has faced a growth in production and licensed capacity from 1960-61

of drop forgings and stamping industries and also being accepted by the public sector projects like FFP, ASP and MAMC officials. As on field investigation of both private and public sector projects, this distinction is visible.


The main sources for all these production/capacity statistics are (i) Planning Commission's Fourth Five Year Plan Report of the planning group for machinery industries, (ii) Annual reports of Directorate General of Technical Development (DGT), (iii) Annual report of Association of Steel Forgings and stamping industries. All these have to be conglomorated as all these are partial in reporting their statistics.

13 See footnote 13.
to 1964-66 reaching peak levels, followed by a sudden trough during 1966-1967 and a slight recovery in 1968 in steel forging industry. Taking both public and private sectors together, there may be a maximum of 50,000 tons per year achieved production available by 1968, while the demand estimate by 1973-74 is 2.75 lakh tons. 16

2.4 Imports and Exports of Iron and Steel Forgings

Imports form as a part of supply and exports as a part of demand. The statistics of imports and exports of iron and steel forgings and castings are published in "Monthly Statistics of Foreign Trade of India" from 1957 onwards. Those of iron and steel forgings are distinguished in the same reports from 1966 onwards. The imports and exports statistics of iron and steel forgings for the period 1957 to 1965 are estimated on the basis of the composition of the forgings and castings in the year 1965 as ratio estimates. As the re-exports are negligible (4 or 5 tons during 1959 and 1960), these have not been shown separately and deducted from the imports. All these statistics are in current prices.

An analysis of 5 to 6 months imports of iron and steel forgings during 1967, collected unofficially from the Bureau of Commercial Intelligence, Bombay, shows the demand for imports using industry-wise on an average as follows:

Railways consume 75%, motor vehicles 12%, tractors 3% and all others like metals and machinery industries require 10% of the total imports.

16 Same as 15.
Table 1: Estimates of imports and exports of iron and steel forgings

<table>
<thead>
<tr>
<th>Year ending</th>
<th>Imports</th>
<th></th>
<th>Exports</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tonnage</td>
<td>Value in Rs.</td>
<td>Tonnage</td>
<td>Value in Rs.</td>
</tr>
<tr>
<td>1947 December</td>
<td>6340</td>
<td>1,64,14,766</td>
<td>99</td>
<td>33,898</td>
</tr>
<tr>
<td>1948 December</td>
<td>3080</td>
<td>95,00,400</td>
<td>49</td>
<td>36,031</td>
</tr>
<tr>
<td>1949-60 March</td>
<td>7566</td>
<td>2,27,51,442</td>
<td>18</td>
<td>18,496</td>
</tr>
<tr>
<td>1960-61 March</td>
<td>9832</td>
<td>2,82,14,792</td>
<td>326</td>
<td>1,22,902</td>
</tr>
<tr>
<td>1961-62 March</td>
<td>12759</td>
<td>3,71,21,851</td>
<td>988</td>
<td>3,65,982</td>
</tr>
<tr>
<td>1962-63 March</td>
<td>7985</td>
<td>2,57,48,749</td>
<td>698</td>
<td>2,76,144</td>
</tr>
<tr>
<td>1963-64 March</td>
<td>9016</td>
<td>2,93,73,964</td>
<td>1169</td>
<td>4,31,068</td>
</tr>
<tr>
<td>1964-65 March</td>
<td>22657</td>
<td>4,07,81,093</td>
<td>1246</td>
<td>4,38,490</td>
</tr>
<tr>
<td>1965-66 March</td>
<td>12332</td>
<td>3,74,29,903</td>
<td>334</td>
<td>1,98,309</td>
</tr>
<tr>
<td>1966-67 March</td>
<td>11238</td>
<td>5,24,21,876</td>
<td>6</td>
<td>7,792</td>
</tr>
<tr>
<td>1967-68 March</td>
<td>13000</td>
<td>6,10,00,000</td>
<td>6</td>
<td>4,590</td>
</tr>
<tr>
<td>1968-69 March</td>
<td>N.A.</td>
<td>N.A.</td>
<td>158</td>
<td>3,52,393</td>
</tr>
</tbody>
</table>

Source: Monthly Statistics of Foreign Trade of India, Department of Commercial Intelligence and Statistics, Calcutta, Government of India.

N.A. - Not available.
2.4.1 Trends in imports and exports

Imports are increasing from 1957 up to 1961-62 March (except in 1978), with a sudden fall in 1962-63 and galloping increase upto 1964-65 March, with a sudden fall in the immediate year 1965-66. Exports are decreasing upto 1959-60 March, with a sudden increase during 1960-62, a slight fall in 1962-63, a sudden increase during 1963-65, and a sudden fall in 1965-66. The imports and exports are steady during 1966-68. Imports and exports are following similar trend from 1960-61 onwards.

2.4.2 Imports and exports as external supply and external demand to the economy

Exports are relatively negligible compared to imports or to total supply. Indigenous production or gross domestic output + imports = total supply, while the total intermediate demand + exports = total demand. As total demand = total supply, the total intermediate demand = indigenous production + imports - exports. Thus, intermediate demand is the same as supply for internal demand. Changes in stock are assumed to be zero. The statistics of indigenous production of large scale units are available from the Annual Survey of Industries reports. They are shown under the 'Products and byproducts (Table 6 of ASI reports) of '341-3 Iron and Steel castings and forgings' industry group. These total intermediate demands for different years 1960-1964 are calculated for studying the demand pattern of using industries in the next section. Each using industry's con-
umption of steel forgings as material inputs are also given in the ASI reports (Table 5 of the ASI reports). Thus, the ratios of the using industry's demand to the total intermediate demand of steel forgings provide the demand pattern of using industries.

2.5 Demand pattern of steel forgings according to using industries

To know the demand pattern using industrywise, percentage share of each industry's consumption demand out of the total supply for internal demand over 1960 to 1964 and their averages are computed. While the detailed tables distinguishing the tonnage and rupee values using industrywise are prepared, a more aggregated table is presented below. (Table 5 on page 45).

From the above table, it is clear that the major consumers are (1) Motor vehicles, (2) Earth-moving equipment

17 In which some ratio or proportional method adjustments are required to be made for the non-availability of the details for steel forgings and castings separately in the reports, to distinguish the consumption of steel forgings by (1) Motor vehicles, (2) Diesel engines, (3) Earth moving machinery (4) Others of non-electrical machinery.

The source for Table 5 is the original rupee values given in Table 5 of Annual Survey of Industries (ASI) Reports and Monthly Statistics of Foreign Trade of India for the respective years.

(a) The indigenous production of steel forgings reported in ASI reports is that of large scale units only which employ 90 or more workers with the aid of power and/or 100 or more workers without the aid of power. So, to the extent that the intermediate demand does not cover the small scale and captive units, the estimate of intermediate demand is an underestimate and the percentages are overestimates. No statistics of production corresponding to small scale and captive units are available from any source.

(b) The above table 5 does not include railways consumption demand as railways major requirements of wheel sets and sleepers have not been classified under forgings but classified under Iron and Steel by ASIC and ASI reports.
Table 5. Using industrywise demand pattern of steel forgings over 1960-1964  
(All in percentages of rupees values consumed)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motor vehicles</td>
<td>43.23</td>
<td>49.85</td>
<td>40.85</td>
<td>50.16</td>
<td>47.19</td>
<td>46.26</td>
<td>40.85 to 50.16</td>
</tr>
<tr>
<td>2</td>
<td>Diesel engines</td>
<td>17.48</td>
<td>14.43</td>
<td>18.36</td>
<td>13.82</td>
<td>10.59</td>
<td>14.94</td>
<td>10.59 to 18.36</td>
</tr>
<tr>
<td>3</td>
<td>Earthmoving equipment</td>
<td>14.87</td>
<td>14.10</td>
<td>12.91</td>
<td>15.33</td>
<td>24.48</td>
<td>16.34</td>
<td>12.91 to 24.48</td>
</tr>
<tr>
<td>4</td>
<td>Power driven pumps, air and gas compressors, vacuum pumps, refrigeration plants, speed reduction units</td>
<td>0.98</td>
<td>0.52</td>
<td>3.10</td>
<td>2.17</td>
<td>2.52</td>
<td>1.86</td>
<td>0.52 to 3.10</td>
</tr>
<tr>
<td>5</td>
<td>Others of non-electrical machinery</td>
<td>10.00</td>
<td>11.27</td>
<td>8.28</td>
<td>8.35</td>
<td>9.93</td>
<td>9.54</td>
<td>8.28 to 11.27</td>
</tr>
<tr>
<td>6</td>
<td>Shipbuilding and repairs</td>
<td>9.73</td>
<td>3.72</td>
<td>7.61</td>
<td>1.90</td>
<td>1.40</td>
<td>3.28</td>
<td>1.40 to 9.73</td>
</tr>
<tr>
<td>7</td>
<td>Machine tools</td>
<td>-</td>
<td>0.96</td>
<td>3.38</td>
<td>5.14</td>
<td>0.05</td>
<td>1.91</td>
<td>0.00 to 5.14</td>
</tr>
<tr>
<td>8</td>
<td>Sugar and tea machinery</td>
<td>-</td>
<td>2.20</td>
<td>2.40</td>
<td>2.00</td>
<td>1.74</td>
<td>1.67</td>
<td>0.00 to 2.40</td>
</tr>
<tr>
<td>9</td>
<td>Textile and jute *</td>
<td>3.69</td>
<td>0.29</td>
<td>1.21</td>
<td>0.01</td>
<td>0.16</td>
<td>1.07</td>
<td>0.01 to 3.69</td>
</tr>
<tr>
<td>10</td>
<td>Conveying equipment like buckets, elevators, strip hoists, cranes etc.</td>
<td>-</td>
<td>-</td>
<td>0.90</td>
<td>0.47</td>
<td>0.76</td>
<td>0.43</td>
<td>0.00 to 0.90</td>
</tr>
<tr>
<td>11</td>
<td>Agricultural implements</td>
<td>-</td>
<td>0.66</td>
<td>0.99</td>
<td>0.39</td>
<td>0.34</td>
<td>0.48</td>
<td>0.00 to 0.99</td>
</tr>
<tr>
<td>12</td>
<td>Tractors, harvesters etc.</td>
<td>-</td>
<td>0.01</td>
<td>0.07</td>
<td>0.74</td>
<td>0.16</td>
<td>0.00</td>
<td>0.00 to 0.74</td>
</tr>
<tr>
<td>13</td>
<td>Paper M/c construction</td>
<td>-</td>
<td>-</td>
<td>0.19</td>
<td>0.10</td>
<td>0.06</td>
<td>0.00</td>
<td>0.00 to 0.19</td>
</tr>
<tr>
<td></td>
<td>M/c and oil mill machinery</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Total 100.00 100.00 100.00 100.00 100.00 100.00
(3) Diesel engines, (4) Shipbuilding and repairs and (5) All non-electrical machinery goods like tractors, machine tools, pumps, compressors, etc. These percentages are approximately true with those of tonnage consumption of steel forgings (not presented here for this reason only) using industrieswise. The percentages of the indigenous production to the total intermediate demand are 4.78% in 1960, 4.38% in 1961, 13.24% in 1962, 37.27% in 1963 and 36.84% in 1964. However, these percentages are higher estimates to the extent they do not include captive and small scale units production of the steel forgings industry. It is to be noted that these percentages are exclusive of railways demand for wheel sets and sleepers, whose proportion is likely to be more than even that of motor vehicles.

2.6 Development problems of steel forgings industry in India

(1) Nature of market imperfections

When project cost estimates have been prepared, the usual practice is to make financial projections for a particular tonnage capacity of the project by the prospective entrepreneurs. No attempts have been made so far by any of the entrepreneurs to know the demand potentialities, existing capacities, actual production with respect to product dimensions of the variety of forgings and the possible range of prices for the discrete ranges of the product dimensions. The nature of the market for numerous types of forgings is that it is purely jobbing type customers oriented. Price
discriminations of all kinds, viz. charging different prices for a homogeneous commodity for different customers at the same time and place or for the same customer at different times and places, prevail much in this industry. The prices for homogeneous goods are not uniform between the firms in the industry as every thing is to be decided at each stage by negotiations and relations between the producer and the consumer. As the very nature of the industry demands the complete specifications of various product dimensions by every customer on each and every order, it is all the more necessary for the producers to have a view of the range of prices for different ranges of the product dimensions, so that their project cost estimates will be reliable. (2) Growth of unutilized licensed capacities

The growth of licensed capacity in steel forging industry has been so fast that the main problem facing the industry today is utilization of the licensed capacities. The captive capacities in production are estimated to the tune of 32,000 tonnes and capacities for which letters of

18 Robinson Joan, The Economics of Imperfect Competition, Macmillan, 1933.

19 Especially during the recent recession period, many orders have been cancelled without notice of any kind with the result that even weekly forecasts of the orders of the customers are just uncertain. This has resulted in the stock piling of certain materials, increase in unutilized capacities of certain machinery bottlenecks on other equipment and inefficiency as well as unrest of labour. These observations are based on the survey of firms in this industry.
intent of licences have been issued to the order of 2,98,000 tonnes. It has therefore become all the more imperative to take cognizance of this situation, while reviewing the present status and future programmes of the industry, especially with reference to product dimensions and to users of steel forgings.

(3) **Nature of the broad nomenclature** of the steel forgings and their users

All these nomenclatures are just indicative, as they are neither exhaustive nor truly representative of the actual requirements of the different quantitative and qualitative features of product dimensions with specifications of numerous forgings, used by the different using industries.

(1) Many models of the autos and trucks contain over 1,500 separate forgings. Steering spindle, steering cross link rod, differential spindles, anchor, crankshafts, torsion...

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**20** Source: Annual report 1966-67 of the Association of Indian Drop Forging and Stamping Industry.

Towards this end, the Association of Indian Drop Forging and Stamping Industries (hereinafter termed as Association) urged the Government - (a) to review the targets for the Fourth Plan for the steel forging industry in consultation with the producers and consumers, (b) to defer capital goods clearance in the case of licenses who had not implemented their projects by an immediate review of all licences/letters of intent, and (c) to set up a panel to guide the development of the steel forging industry. In response, (a) Government have not reviewed the target of the steel forgings for Fourth Plan, (b) the Steel forging industry has been completely delicensed without any review of the earlier licenses/letters of intent, (c) it is decided to set up a panel for steel forgings industry in 1968.

bars, ball studs, spring seats, hubs, idler arms, pitman arms, driving axles and steering arms for passenger cars, buses, and trucks are used as forgings in automotive industry for heavy duty service. Similarly, the tractors and agricultural machinery and implements parts.

(2) High strength to weight ratios and reliability are essential in structural components for aircraft which contain over 40 structural forgings (exclusive of the hundreds of the forged parts comprising the engine). Forged bulkheads, wing roots, hinges, engine mounts, brackets, beams, shafts, ball cranks, landing gear cylinders, wheels, brake carriers, discs, arresting hooks, many other fittings and structural members illustrate the important forgings for aircraft production.

(3) In jet turbine engines, iron base, nickelbase and cobalt base alloys are forged into components such as buckets, blades, couplings, discs, manifolds, rings, chambers, wheels and shafts requiring uniformly high yield and tensile strength, along with good ductility. Super alloy spacer rings, injectors and titanium reactor cases are typical of engine forgings.

(4) Heavy tanks in defense contain over 350 separate forgings. Each 250 lb and 500 lb Bomb contain 7 forgings and each of shells and mortar projectiles contain at least two forged components.

(5) Internal combustion engines and ship building repair forged cranks, connecting rods, rod caps, camshafts, rocker arms, valves, shafts, levers and flywheels.
(6) Railways locomotives and rolling stock demand wheels, axles, tyres, wheel sets, sleepers and couplings.

(7) Earth moving equipment include rollers, pumps, buckets, shoes, sidetings. Similarly hardware items.

(8) Petroleum industry requires flanges and parts of low pressure valves, parts for high pressure pumps, such as valves, piston rods, pump liners.

(9) Air compressors include air driven tools. Similarly, the materials handling equipment and sugarcans crushers.

4. Nature of published statistics of demand estimates and supply of steel forgings in India

The published demand estimates of different organisations are very aggregative. No extensive market survey is conducted on scientific lines to specify the demand pattern, taking into account the various product dimensions required by using industries. After the estimates or the targets are published for a plan, many a time castings and forgings being clubbed together, there is hardly any publication bringing out the progress that this industry makes during the tenor of the plan, which can be readily available for entrepreneurs. The combined demand estimate for castings and forgings together, does not serve purpose to either of the entrepreneurs in making their financial projections as it involves problems of both product mix and process mix.22

The more the disaggregation of the demand pattern each using

22 Problems of product mix, process mix, product multidimensionality are explained in Chapters IV and VI of this industry study.
industry wide, the more fruitful it will be for the producers in fixing up their production pattern. Indigenous production, imports and exports statistics are also very aggregative. Steel forgings industry is not shown as a separate industry group in the ASI reports. As such the inputs and outputs of this sector cannot be traced from those reports, which are the main source of information for the construction of input output tables. If the inputs corresponding to the outputs of each commodity are made available, the problem of constructing commodity-wise input output tables becomes easier.

2.7 Summary

The forging process is as old as antiquity and as new as tomorrow, developing the levels of operation from the household black smithy to the large scale manufacturing. The modal type optimum size of the industry is around 1551 tons per year by the end of December 1966. There is a drastic change in the structure of firms and tonnage licensed from 1963 to the end of 1966 in private sector. West Bengal, Maharashtra and Madras are the leading States in the industry. Development of the industry has started after the steel mills and railways have been established. The public sector projects are still in infant stage even during third five year plan period, while the private sector has grown fast especially after 1964. Imports are phenomenally high while the exports are negligible during 1957-69. Unutilized licensed capacity is growing in the industry. If it is due
to general recession, it may be a short run phenomenon.

Railways, automobiles, diesel engines, earth moving equipment and ship building dominate the demand pattern. Market imperfections, growth of unutilized capacities, nature of the broad nomenclature of the steel forgings users' wise, nature of published statistics of demand estimates and supply of steel forgings in India are the main problems for the development of the industry. All other development problems of the industry are appended to this chapter. All these development problems emphasize the need for detailed data on capacities, production, demand, prices, imports, exports and other economic variables with respect to product dimensions and to users, so that the construction of commoditywise input output tables becomes easier. The results based on the use of such a disaggregative commodity wise input output table are likely to be stable for planning purposes either for the firm, industry or for the economy.
Appendix to Chapter II

Development problems of protection and of production cost reduction in steel forgings industry

Main development problems of steel forgings industry stressing the need for detailed data on product dimensions are presented in the text of this chapter II. A few more problems in respect of (i) differential imports duties of steel forgings, (ii) imports of steel forgings that can be substituted, (iii) export promotion measures and policies of steel imports, (iv) lead time for indigenous production of forging quality steels, (v) reduction in excise duty of liquid petroleum gas, (vi) impediments due to foreign collaborations, (vii) need for developing ancillary shops of forge units, (viii) productivity calculations, (ix) provision for many break downs in this industry, and (x) skills, efficiency, incentives and other labour problems, are presented in this appendix. All these problems can be broadly classified as problems of (a) protection and (b) cost reduction of the industry. All these are generally felt by the industry officials and the members of the Association of Drop forging and Stamping industries. The Association brought out all these problems in their Annual Report for 1967-68. The other sources of information presented here are also referred to, at the appropriate places. No attempt is made here to analyse the problems in detail and to suggest alternatives, as it is a stupendous task in the absence of reliable and detailed data on all economic variables, especially with respect to product dimensions and to users of steel forgings.
(1) **Differential rates of import duties of steel forgings**

The problem of growth of unutilized licensed capacities due to present delicensing policy, still persist when the import of steel forgings continues to be licensed. The differential rates of import duties also may aggravate the problem.¹ Inasmuch as tractor parts are imported duty free, forgings are imported by the tractor manufacturers without payment of duty.²

(2) **Imports of forgings that can be substituted**

The import and export statistics from the Monthly Statistics of Foreign Trade, do not show distinctly the forg-

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¹ Forgings are being imported into the country in various forms, both as machined parts and in semi-finished or unfinished form. The manufacturers of assembled products like automobiles, tractors, etc. import forgings in substantial quantities in their completely knock down (c.k.d.) packs.

² Some of the anomalies of differential rates of import duty of steel forgings are presented below from the source Indian Customs Tariff (Fifty-sixth issue)

<table>
<thead>
<tr>
<th>Description</th>
<th>Page</th>
<th>Duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel forgings - item 63 (28)</td>
<td>174</td>
<td>10% ad valorem</td>
</tr>
<tr>
<td>Steel forgings for sugar mill machinery components</td>
<td>175</td>
<td>10% ad valorem</td>
</tr>
<tr>
<td>Steel forgings for machine tools components</td>
<td>175</td>
<td>17% ad valorem</td>
</tr>
<tr>
<td>Unmachined forgings of crawler tractors semi-finished components</td>
<td>176</td>
<td>27 1/2% ad valorem</td>
</tr>
<tr>
<td>Semifinished forgings of railway rolling stock components</td>
<td>176</td>
<td>40% ad valorem</td>
</tr>
<tr>
<td>Unfinished forgings for textile machinery components</td>
<td>176</td>
<td>27 1/2% ad valorem</td>
</tr>
<tr>
<td>Tractors' parts (forgings) Item 72(9) b finished form or c.k.d. form</td>
<td>174</td>
<td>No import duty</td>
</tr>
<tr>
<td>Motor vehicles parts (forgings) Item 73(9)</td>
<td>216</td>
<td>50% ad valorem</td>
</tr>
</tbody>
</table>

¹ (British origin)
ings from castings up to the end of March 1965 and do not show distinctly the types of forgings with respect to either their nomenclature, or their dimensions or their users for the later periods. While not much can be told in the absence of such detailed statistics especially with respect to their product dimensions, it is felt that most of these imports are in a range of below 3 ton piece weight. The same range of forgings are also being produced by indigenous industry. The steel forgings industry is introducing new products of quality steel forgings which were formerly imported and an illustrative list of those components are given below:

(a) An illustrative list of some of the components forged at a leading unit, many of which were formerly imported

I. Automotive Parts

(A) For various truck manufacturers

Crankshaft Finished
Connecting Rod
Stub Axle
Front Hub
Bevel Wheel
Bevel Pinion
Front Axle Beam
Axle Shaft

(B) Automotive Gears

Crown Wheel
Pinion

(C) Scooters

Crankshaft Half Clutch
Front Axle (½ upsetting job)
Kick Starters

3 This is observed by the Association.
(D) **Three-wheeler**

- Bearing Shafts
- Swing Arm (LH and RH)
- Steering Knuckle

(E) **Jeeps**

- Crankshafts
- King Pin Ball Yoke
- Shift Fork
- Connecting Rod

(F) **Fuel Injection Parts**

- Pivoting Part
- Nozzle Holder
- Guide Lever

II. **Tractors**

- Gear Reverse Idler
- 2nd Speed Main Shaft
- Counter Shaft
- Gear Main Drive

III. **Diesel Locomotives**

- Saddle
- Yoke
- Main connecting rod and cap
- Driver Gear
- Water Pump Gear
- Extension Shaft Gear

IV. **Diesel and Oil Engines**

- Rock Lever
- Crankshaft
- Connecting Rod
- Gear Camshaft Drive
- Camshaft
- Gear Wheel

(b) **Illustrative List of Components which a Leading Unit can forge**

<table>
<thead>
<tr>
<th>Components</th>
<th>1. Diesel and Petrol Engine Parts</th>
<th>Crankshafts, levers, flywheels, couplings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components</td>
<td>2. All automotive and Truck Parts</td>
<td>Driving axles, front axles, steering components, levers, spring seats, hubs, in addition to engine parts mentioned.</td>
</tr>
</tbody>
</table>
3. **Tractor Parts**
   Including components for track laying vehicles.

4. **Earth moving equipment**
   Rollers, Track Shoes, side links.

5. **All Hardware Items**
   Such as hooks, turn-buckles, special studs, wing nuts, eye-bolts.

6. **All Ordnance and defence items**
   Shell forgings, artillery material parts, mortar shell bodies, motor vehicle components, pintles, hooks, breach rings, depth charge components, aerial bomb fittings.

7. **All air frame forgings**
   In aluminium alloy steels, stainless steels, titanium and titanium alloys.

8. **All Railway Forgings**
   Requirements from carbon and alloy steels - hooks, clamps, screw couplings, diesel locomotive parts.

9. **Non-ferrous alloy forgings**
   In brass, bronze and aluminium bronze forging grades.

10. **Petroleum industry requirements**
    Flanges, couplings, parts for high and low pressure valves, parts for high pressure pumps such as valves, valve seats, piston rods, pump liners, drill bit parts, components for well control equipment, etc.

11. **Forgings for air compressors**
    Shafts

12. **Forgings for Hydraulic Equipment Manufacturers**
    Cylinders, pistons, valve parts, etc.

13. **Parts for the material handling equipment industry**
    Such as motive power parts, hooks, fittings, steering components, hydraulic valves and similar items.
Japan is the major competitor in the international market for forgings. Japan has the three-tier pricing system for reducing the steel cost as follows:

(a) Export price of steel controlled through consortium in the international market,

(b) Domestic price of steel for internal use only and

(c) Concessional price of steel for export of end products in which the export of forgings plays a dominant role.

The Indian steel forging industry has to face a tough competition in the international market, particularly from Japan. Thus, the exports of forgings are linked to quality steel imports.

In this connection, the Association in their Annual
A few proposals on which Government have no immediate reaction are given below: As the steel mills are of Govt. undertaking, the problem of communication between the Association and the Government arises. The source for these is the same Annual report of the Association.

(1) The Government may issue the necessary import licences for importing the required forging quality steels from the cheapest source against export orders.

(2) The industry may get the benefit of 100% drawback of duty against exported forgings on a specially expeditious basis.

(3) Some proposals for steel prices:- The steel from the Durgapur Alloy steel plant be supplied to the forging industry to match the quality and price at which our major competitor in the world market, viz., Japan, gets it. In the case of forging quality carbon steels (say EN-8 or EN-9), the price can be between Rs. 500 and Rs. 600 per tonne and in the case of alloy steels of forging quality, it can be between Rs. 1000 and Rs. 1100 per tonne to enable the Indian forging industry to export forgings in the teeth competition from the Japanese forge companies, in view of high import duties on steels.

(4) Differences in forging cost and export price:- The forging industry in India would not miss any possibility of export, where it possible to meet variable costs as some illustrative export inquiries given below are received by three leading units of Indian forging industry.

Schedule of the computation of forging cost

<table>
<thead>
<tr>
<th>Item</th>
<th>Forging cost (variable) Rs.</th>
<th>Export price (F.O.B.) Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steering Arm Spindle</td>
<td>9.04</td>
<td>6.70</td>
</tr>
<tr>
<td>Front axle</td>
<td>16.00</td>
<td>400.00</td>
</tr>
<tr>
<td>Camshaft</td>
<td>99.10</td>
<td>51.00</td>
</tr>
<tr>
<td>Crankshaft</td>
<td>797.00</td>
<td>400.00</td>
</tr>
</tbody>
</table>

Note (i) Raw material has been computed after knocking out the element of customs duty and excise charges. (ii) The prices of raw material is based on the cheapest source of supply from global tenders. (iii) The cost computation does not include administrative and selling overheads or profit margins.
(1) **Cash assistance for exports promotion**

The cash assistance on the export orders of a value less than Rs. 5 lakhs shall be only 15% of the F.O.B. value, and if the export orders contracted for lie between Rs. 5 lakhs and Rs. 2 crores, the cash assistance on the total value of export orders shall be 25% for the period upto 31st March 1969 from 1st September 1967. If the target of Rs. 2 crores is contracted for before 31st March 1969, the cash assistance payable on the whole export effort for the period upto 31st March 1969 will be 30%. The outcome of this is that the Government of India agreed to give cash incentive to the steel forging industry to stimulate export of steel forgings. The incentive is put at 15% if the total exports of steel forgings from 1st September 1967 to 31st March 1969 reached an F.O.B. value of Rs. 1 crore or if contracts for exports of steel forgings are entered into, by 31st March 1969 from 1st September 1967 for a total value of Rs. 1 crore. If this target is exceeded, an additional 5% would be given, bringing the total incentive to 20% of F.O.B. value of exports.

(2) **A scheme for re-imbursement in the import policy**

A scheme for reimbursing the difference between domestic and international prices of especially mild steels of blooms, billets, slabs, bars, rods and rounds (meant for steel forgings)

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6 Source: Annual report for 1967-68 of the Association. The opinion given under this para 2 is that of the Association.
In addition to some other steels produced in India, to the fabricators/exporters of engineering goods (steel forgings) was introduced by the Government. But the problem faced by the leading forge shops in the country in case of export of forgings is that the overseas buyers require a high standard of quality in the forgings; consequently they are to rely on EN-8 and other high carbon steels to meet the standards expected. By using this type of high grade steel, the manufacturers are deprived of the price subsidy which would otherwise have been available if the products were of mild steel.

(3) Envisaged import policy for spring/alloy steels

The current import licensing policy on iron and steel items envisages that the imports of following categories of alloy steels are to be restricted:

(a) Spring steel flats/sections
(b) Alloy constructional steel
(c) Case hardening steel
(d) Alloy case hardening steel
(e) Plain carbon steel
(f) High speed steel.

Since the above categories of spring steel/alloy steel are being produced in the country they may also be covered by the reimbursement scheme. 7

7 Opinion of the Association given in the Annual report for 1967-68.
(4) Recent amendments in steel import policy

The recent amendment in the steel imports policy has attempted to ban the imports of following categories of steel:

(a) carbon steels totally, (b) die blocks upto 400 mm totally,
(c) % of the requirements of alloy steels. This policy has been further sought to be compulsorily implemented by ensuring that no licences for imports of steel will be allowed till letters of credit are established by the users for 50% of the requirements.

(5) Forging quality steels and lead time for indigenous production

Very often the rejections on poor quality steels, once made are not accepted for months resulting in a tremendous loss of production to the forging industry. All the supporting points on this issue are given below as the Annual report of the Association provides.

(1) Steel manufacturing industry today does not have the scarfing equipment necessary to produce good surface condition free from seams. It is also necessary that the steel should satisfy the fine grain structure alumina killed to ensure that there is no adverse grain growth at the time of heating the forging billets.

(2) Steel sizes upto 25 mm are required: Steel in sizes upto 25 mm of any category of carbon and alloy steels may be freely allowed to be imported for a minimum period of two years. This is necessary particularly in view of the problems of reduction, heating and nonavailability of rolls to meet the small sizes.

(3) Requisite quality steels for forgings: Certain categories of high and low carbon steels where carbon composition is very critical are difficult to maintain. They may also be allowed to be imported as variations in carbon percentage can create tremendous problems in metallurgical controls.

Continued/...
development of indigenous steel is encouraged over a period of time for the entire range of forging quality steels, imports of such nonavailable forging quality steels at least for that much period may be allowed to prevent any loss of production in steel forging industry.  

(4) No annealing facilities in steel mills: Whatever indigenously available alloy steels, particularly Mn or steels, are purchased by the industry. The problem in case of Ni Mo V based steels is not only one of production but also of the availability of alloying elements, which creates further delay. Almost all steel mills in India do not have annealing facilities and unless and until the alloy steels are received in annealed condition, the processing of these steel billets or bars becomes extremely difficult.

(5) Time lag to get the requisite quality steels: The forging industry has placed orders on Durgapur Alloy Steel plant for die blocks, but they are not able to get the requisite quality in time. Any breaking in die-block will result in complete dislocation of the forging production as the die sinking operation requires hours of skilled work and involves considerable expenses in operation. Therefore, to ban imports before actual trial productions have been tried out is to invite troubles in production and emergency licensing at a later date of not only the die blocks but also of forgings and quality steels, completely nullifying the actual gains in import substitution.

(6) Terms of business relations between steel mills and forging firms: The terms of business specified and insisted by steel mills like opening letters of credit, prices and settlement of claims are not in consonance with normally accepted principles of commercial business practices. Forging quality specifications are not allowed to be in the letters of credit opened by the buyer on the steel mills and is to be described as 'Iron and steel materials' and no responsibility is accepted either for the quality or the quantity of the materials shipped. Deliveries are totally uncertain and make it impossible to do any production planning and inventory control based on anticipated supplies. Not even a guarantee that defective steel will be replaced within a reasonable time limit of 45 days is forthcoming. Which commercial banks would be prepared to open such letters of credit under impossible terms of business with no guarantee for claim settlements. In the U.S.A., U.K. and Germany, which are the main importers of our steel forgings, it is an accepted practice that if the defective steel is the cause of a defective forging, not only do the steel mills replace the steel but also bear the total cost of forgings produced. The steel mills in India also must fall in line with accepted international practices both as to quality and deliveries as well as settlement of claims.
(4) **Reduction in excise duty of liquid petroleum gas**

The input cost of fuel before the excise duty on liquid petroleum gas (LPG) was Rs. 331 per M.T. and after the inclusion of duty on LPG it increased to Rs. 639 per M.T. - an increase of nearly 20% in most of the forge companies. A comparative incidence of duty on furnace oil ISI 593-1959 and grade LV and liquid petroleum gas (LPG) is shown below:

<table>
<thead>
<tr>
<th>Description</th>
<th>Furnace Oil</th>
<th>L.P. gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caloric value BTU's per lb.</td>
<td>18,600</td>
<td>21,000</td>
</tr>
<tr>
<td>Excise duty/ton (Rs.)</td>
<td>49.55</td>
<td>196.00</td>
</tr>
<tr>
<td>Heat content/ton (Million)</td>
<td>4.09</td>
<td>4.62</td>
</tr>
<tr>
<td>Excise duty expressed in Rs. per million BTU's available</td>
<td>1.21</td>
<td>4.24</td>
</tr>
</tbody>
</table>

It is apparent from above that the excise duty incidence on LPG in terms of million BTU is 370% higher than on furnace oil.

(5) **Imports of plant and equipment as a result of foreign collaborations**

Rs. 240 million out of Rs. 750 million worth of fixed investment has been financed by foreign exchange resources as indicated in the Fourth Five Year Plan report of Planning Group for Machinery Industries. It is felt that most of the civil construction, erection and installation of the plants and machinery can be done by proper location of Indian personnel, land and the indigenous supply of the steel

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11 op.cit.
structures etc.  

(6) Need for developing ancillary shops of forge units

Occasionally, finished forging components such as finished crankshafts, finished dies and others are yet being imported and one of the reasons for this seems to be that the licensed forge-shops, both commercial as well as captive, are not adequately equipped with the finishing, machining, heat treatment and die shop facilities as their ancillary shops. Absence and/or shortage of these ancillary facilities often become main bottlenecks. For a new entrepreneur, it is necessary to install those ancillary shops alone or go for an integrated project with well balanced capacities for all these shops including the crankshaft machining facility.  

(7) Productivity calculations

Conventional procedure of estimating available hours on three shifts basis aggregating 20 hours a day and 300 days a year may be misleading for financial and productivity calculations in this industry. Based on the experience over a century, even an advanced country like the U.S.A. does not consider more than 1300 hours per year as productive hours in this industry.  

12 These observations are collected from (i) "A Study on project evaluation" by S.D. Joshi, Sr. Dy. General Manager, Foundry Forge Project, Ranchi and (ii) Export policy, foreign exchange saving and import substitution, by T.R. Gupta, Chairman, Heavy Engineering Corporation, Ranchi.

13 Opinion of the Association.

more only during winter season, night shifts of summer
and only if wages are tied to quantity and quality specifi-
cations of the jobs compared to regular scales. 15

(8) Too many break-downs and provision for them

While equipment in this industry by its very nature is
self-destructive due to frequent breakdowns 16 of hammers,
presses, dies, furnaces, etc., provision to be made for
repairs and maintenance in the calculations of production
hours, replacements and additions to stocks in financial
projections is often lost sight of.

This is observed on the field investigation. See
Chapter III also to confirm the results.

To analyse the reasons concretely for under-utiliza-
tion of the capacities installed, percentages of the loss
of production hours or of the loss of tonnage have been
found as below, in a die forging firm in Maharashtra and in
an open forging firm in West Bengal on field investigation:

Table 5. Reasonwise unutilized capacities in two firms
(all in percentages).

<table>
<thead>
<tr>
<th>Reason</th>
<th>A firm in Maharashtra</th>
<th>A firm in West Bengal</th>
</tr>
</thead>
<tbody>
<tr>
<td>On hours lost basis</td>
<td>On tonnage lost basis</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------</td>
<td></td>
</tr>
<tr>
<td>1. Breakdown and repairs of hammers, presses, furnaces, dies and trimmers</td>
<td>62.36</td>
<td>24.69</td>
</tr>
<tr>
<td>2. Power shortage</td>
<td>23.32</td>
<td>26.36</td>
</tr>
<tr>
<td>3. Material shortage</td>
<td>9.39</td>
<td>21.70</td>
</tr>
<tr>
<td>4. Lack of demand and planning</td>
<td>26.35</td>
<td>20.03</td>
</tr>
<tr>
<td>5. Operator shortage</td>
<td>3.37</td>
<td>-</td>
</tr>
<tr>
<td>6. All other reasons</td>
<td>0.70</td>
<td>2.02</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

The foremost of all the reasons implies the maximum dependence
and uncertainty of this industry's equipment on their repairs
and maintenance, a regular feature all through the year and as
important as production itself.
(9) **Skills, efficiency, incentives and other labour problems**

Skills acquired in this industry are meagre in India as the organized sector is of recent origin and the learning period, especially for die sinkers is around 6 to 8 years. Substandard skills are not to be given as much weightage as the standard skills in determining the rated capacity, which mislead the financial projections. As the skills are improved, the capacity of the unit increases even with the same capital equipment. This may be one of the main bottlenecks in achieving the rated production capacities during the early years of production. The efficiency in the acquisition of skills can not be quantified especially in Die-shop, as the die sinking is an activity which can not be rated only on the basis of number of hours taken on the jobs. All the jobs are dissimilar in their working process because of draft angles, tolerances, specification of depth, smoothness, differences in the internal curvatures and the angles of the vertexes, for all of which actual skill, carefulness, constant attention of the die sinker is required rather than just time considerations. As this activity takes days and months together to prepare a die, a number of die sinkers are required to be placed on the continuing job in different shifts. This suggests group incentive scheme rather than individual incentive scheme, though there are still problems

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17 Opinion of the Industry officials.
18 Ibid. See also Chapter III of this study.
of judging the intricacies and difficult parts of the jobs
done by the different operators over-time. There is an
argument that time standards could not be arrived at, even
with many years experience in America in the die sinking
activities because of the dissimilarities in the nature of
the jobs. So, instead of introducing incentive schemes,
some suggest that higher remuneration be paid to die sinkers
compared to other labour. The working environment is so
bad that the labour is too anxious to escape the heat, grim
and dirt of the forge shops. Unless some better incentives
compared to other engineering industries are given, it may
be really difficult to attract the skilled labour.