4.2.3 Problems of Marekting and Distribution

Through the above discussions and investigations of marketing aspects of locally manufactured MW/LE products, it has been pointed out that the absolute shortage of the finished and semi-finished industrial products prevails in the market, resulting in the economy of the seller's market. This artificially created seller's market has long made the manufacturers tend to save the efforts to up-grade the quality of products and to reduce the price. In this connection, the manufacturers do not and will not pay much attention to marketing for their products still for some time to come.

Although the above tendency is, in general, true, the MW/LE products discussed above require some qualification. The first group products (pumps) already have high effective demand of public procurement. Therefore, unless the Government procurer specifies the quality standard, the pump manufacturers will enjoy the privileges of the seller's market. The second group products (agricultural implements) have only a limited demand as the products are not well-popularized yet among farmers. Therefore, it is not known, even when the quality products are produced at lower prices, whether the farmers purchase them or not. Yet the manufacturer should be reminded of the importance of producing marketable products even at this stage of production. As for the last group products (transport equipment) various types of new and practical designs should be introduced as the needs and the potential demand are already well-recognized by the rural farmers.

From the promotional and extension aspects, the rural markets should be mobilized for populalization of and effective demand creation of the MW/LE products through regular demonstration of these machines and implements.

In order to achieve the target of the industrial development set in the Second Five-Year Plan, the importance of marketing and distribution should be fully recognized by small scale industrialists, because the marketing is deeply and directly related to their production and sales activities and their future prospect of expanding the unit. Furthermore, proper policy measures for the marketing and distribution have to be taken in collaboration with various Government agencies concerned.

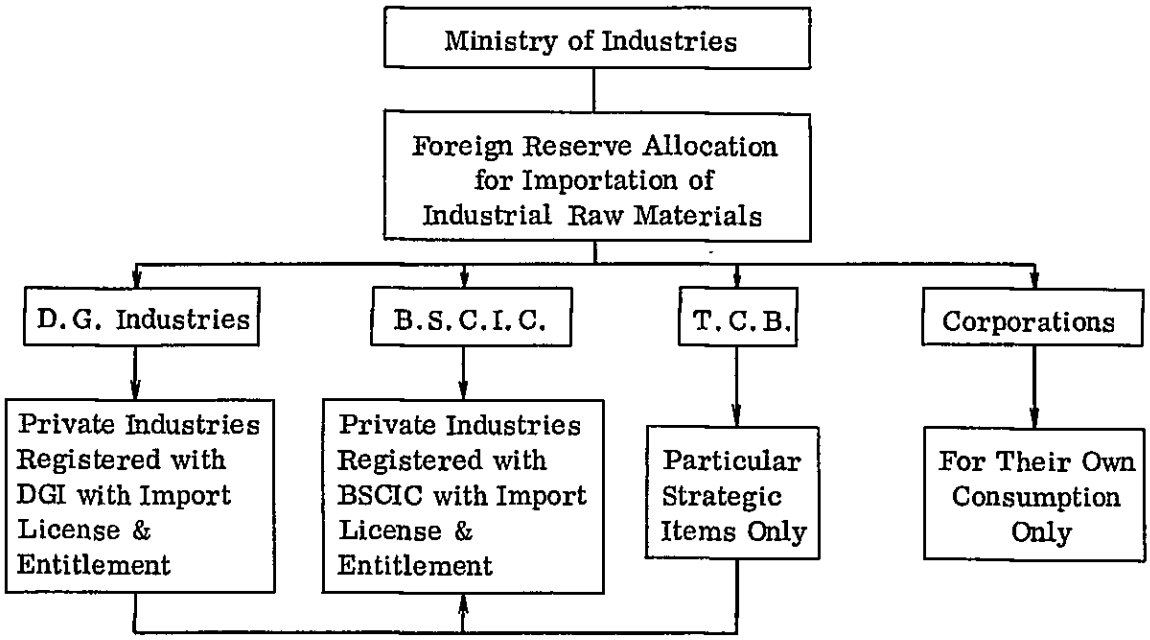
4.3 RAW MATERIALS SUPPLY

4.3.1 Import Procedures

The economy of Bangladesh relies its supply of industrial raw and ancillary materials almost entirely on the foreign supplies. This, in turn, implies that industrial production activities are greatly influenced by the supply conditions of imported materials - e.g. foreign reserve allocation on raw materials importation, and that the raw materials tend to catch exorbitantly high prices in the market as their scarcity becomes often very acute. As a matter of fact, the Team has found that prices of some of the imported raw materials are two times as expensive as those observed in the Japanese domestic market.

Importation of industrial raw materials is usually undertaken by three types of organizations. The first is the individual private industries who are registered with either D.G. Industries or BSCIC, and have the import license. The second is TCB who has special rights to import particularly important items exclusively. And the third is the various public corporations who import necessary raw materials for their own production activities. In an attempt to explain the system or raw materials importation visually, Figure 4.3.1 is drawn as below.

Figure 4.3.1 System of Importation of Industrial Raw Materials



Source : Compiled by JICA Team

The private industries registered with BSCIC are those whose factories are usually located within the BSCIC industrial estates, while the private industries registered with D.G. Industries are those who are engaged in manufacturing activities outside the BSCIC industrial estates. The each individual industry obtains the import license, in which items of raw materials and their values - import entitlement - are specifically spelled out. Therefore, once an industrial unit obtains the import license, it is entitled to import the full volume of the raw materials from abroad except the items that TCB imports. However, as there is always a shortage of foreign reserves in the country, it is often not the case that the industrial unit can import them to its full entitlement. The Government allocation of foreign reserves onto raw materials importation usually falls in short of their full demand. Though a ratio of actual import to the full entitlement differs item by item, it is usually lower than 50 percent.

As for TCB's activity, TCB imports several strategic industrial raw materials such as pig iron, steel billet, zinc ingot, aluminium ingot, cement, G.C.I. sheet and so on, which are, then, sold to domestic manufacturing units belonging to the private sector only. The private manufacturing units, thus, consume its import entitlement. The public corporations, on the other hand, import their own raw materials exclusively for their own consumption.

In all the cases above, when the raw materials are imported, the indentors are always involved. The indentors submit quotations to the importer such as private industries, TCB and public corporations and when the best indentor is selected, the importer often employs the indentor as an importing agent. In the cases of TCB and the public corporations except the private industry, public tenders are usually invited.

There is another source of foreign reserves for industrial raw materials importation; that is, the Wage Earner's Scheme. Although there are some restrictions in the items to be imported in this scheme, the foreign currency earned by the Bangladesh nationals abroad can be quite freely utilized by the private sector business concerns. Particularly, when a manufacturing industry imports raw materials by utilizing a remaining non-allocated portion of import entitlement, it can enjoy the benefit of 50% discount of import duty, which will offset more than the disadvantageous rate in the foreign exchange market of the Wage Earner's Scheme*.

4.3.2 Supply of Raw Materials

Domestic physical distribution networks of industrial raw materials usually originate from Chittagong and Chalna. This is simply because Chittagong and Chalna are the only international ports of entry which can deal with bulky cargo importation, and some raw materials manufacturing industries are located there.

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* This market is called the "non-authorized but non-illegal" exchange market. The exchange rate in this market is Tk. 18/- to Tk. 19/- per dollar, while the authorized Government exchange rate is Tk. 15/- in early 1980.

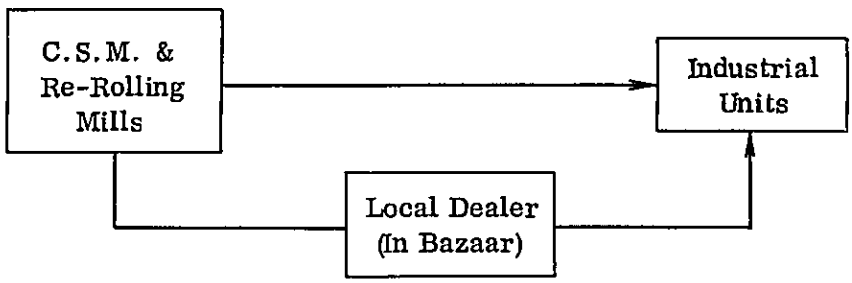
Major raw materials such as pig iron, steel billet, non-ferrous metal ingot, chemicals and so on are mainly distributed directly to locations such as Kushtia, Bogra, Comilla and Chandpur, where the manufacturing and processing factories are located, by either rail or truck, and are partly diverted into the Dacca Bazaar where many wholesale dealers concentrate. Then, some of these major raw materials are again physically distributed to various factories of different locations in the country. As for minor raw materials and ancillary materials, they usually take a channel of Chittagong (Chalna)---Dacca---rural towns, just like the latter case of major raw materials.

As the prevent study is primarily directed to MW/LE industrial development (and more narrowly agro-supporting manufacturing industry development), it is hereunder investigated how main raw and ancillary materials are supplied and distributed.

(1) Structural Steel Products

Most of the structural steel products such as M.S. flat bar, M.S. round bar, M.S. angle, M.S. sheet and M.S. wire are manufactured by Chittagong Steel Mills Limited and other public and private steel re-rolling mills mostly located in Chittagong and Dacca. These steel products are sold either directly from the mill to the industrial units or indirectly through the bazaar in old Dacca as shown in the following figure, Figure 4.3.2:

Fig. 4.3.2 Structural Steel Distribution



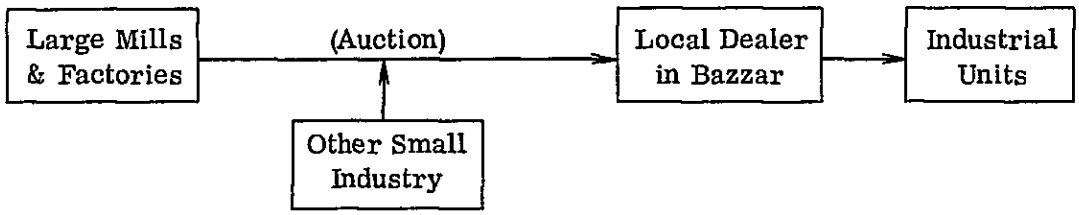
Source : JICA Team

As the Government prohibits importation of structural steel products, there is no importation of these items. Although the demand and supply conditions of steels are not known precisely, the demand is understood to always exceed the supply. This is mainly due to the fact that the steel mills can not procure enough steel billets and scrap metal for structural steel production.

(2) Scrap Metals

As the metal raw materials are always in short of supply in the country, the scrap metals are highly demanded as the secondary raw materials in a free market. The ordinary flow of scrap metal supply originates at large factories where a relatively large amount of scrap metals is regularly disposed and auctioned. Scrapped machines and equipment and scrapped cars and vehicles are another source of scrap metal supply.

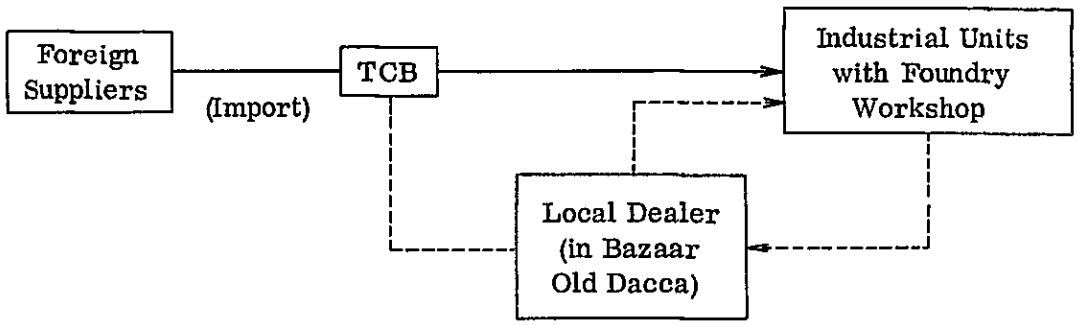
Fig. 4.3.3 Scrap Metal Distribution



(3) TCB Items

As mentioned elsewhere TCB possesses exclusive rights to import certain strategic raw materials such as pig iron, billet, zinc ingot, aluminium ingot, and G.C.I. sheet. TCB, then, distributes these particular items to the private industries only. The case of pig iron is shown in Figure 4.3.4. The ordinary straight line shows the usual distribution channel, while the dotted line shows the local market channel.

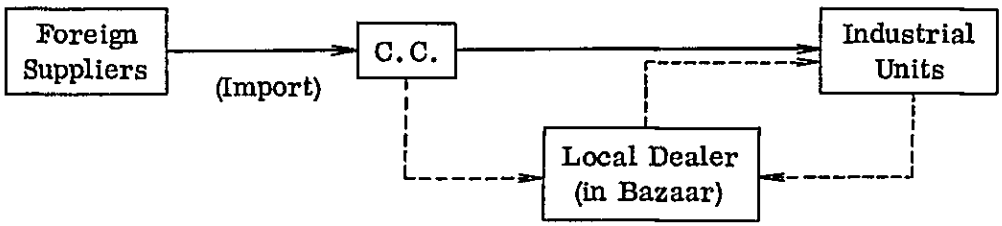
Fig. 4.3.4 TCB Items Distribution - Case of Pig Iron -



(4) Coke

Similarly as TCB items, coke is imported and distributed solely by an exclusive agency, the Coal Controller. The distributional flow is, therefore, quite similar to the case of TCB items. Figure 4.3.5 shows the coke distribution stream and the dotted line indicates ancillary market channels.

Fig. 4.3.5 Coke Distribution



(5) Wood

This is one of the most valuable and rare raw materials locally available. There are various hard wood varieties named like Gorjon, Jarn, Babla, Sandri and Shaishu. As the wood is available all over the country, the small scale industries usually procure it through local saw mills.

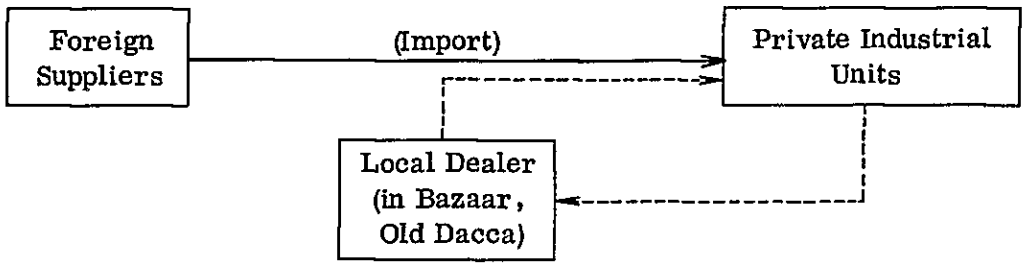
Fig. 4.3.6 Wood Distribution

(6) Other Raw Materials

Other raw and ancillary materials such as cold rolled steel sheets, spring wire, bolts and nuts, revets, iron balls, and ball bearings, high carbon steel products and so on are imported directly by private industrial units through utilization of the import license and/or the Wage Earner's Scheme. The distributional flow of the raw materials can, then, be described as in Figure 4.3.7.

The dotted line again shows the ancillary market distribution channel. This case, thus, quite the same as the case of direct importation by public corporations.

Fig. 4.3.7 Other Raw Materials Distribution



4.3.3 Problems of Raw Materials Supply

The present state of affairs in the field of raw materials distribution has been identified descriptively. The system of the distribution itself may be more effectively reorganized by the Government guidance or intervention. However it may not be wise to disturb the long established machinery of the distribution within a short period. Rather the Government should pay more attention to presently envisaged short run problems.

(1) Allocation of Foreign Reserves

The first problem is the chronic seller's market. The demand for any raw materials is so much in excess of the supply. This is inevitable in the sense that importation is only the supply source of raw materials and the foreign reserves are very limited in the Country. Then, what the public authorities are expected to do is to establish a method of most efficient and proper allocation of foreign reserves

to industrial raw materials importation. In order to do so, an intensive investigation into the present industrial activities is urgently required so as to streamline the fund allocation.

(2) Mal-practices by the Importer

The second problem also stems from the same cause as above. The scarcity of imported raw materials leads to very high market prices of raw materials. This, then, encourages mal-practices of the industrial importers. An importer/industrialist, instead of consuming raw materials fully for their own industrial production, sell a part of the raw materials to the market at fairly higher prices than the import prices, gaining relatively high and easy profits. And also, in order to make easy money of this sort, they try to obtain unnecessarily excessive import entitlement. A certain public control should be imposed on this regard.

(3) High Prices

The third problem is the exorbitantly high prices of the raw materials. On one part, this is clearly related to the shortage of raw materials and on the other hand it is closely related to high import duty on raw materials. The former is directly reflected in the commercial market price and the latter similarly pushes the price upward - usually 100% tax incidence on the part of the manufacturer. The actual price comparison reveals that the prices of the import raw materials are 50% - 100% higher than the Japanese domestic market prices. The high raw material prices, then, push up the prices of products substantially, resulting in forcing the customer to buy the products at uncessarily high prices. Thus, more delicate and careful administration on policy measures of the tariff rates is desired.

(4) Timing of Foreign Reserves Allocation

The forth problem is the quick, timely and regular allocation of fund to the import entitlement. Industrialists have their own production plans according to the annual fluctuation of product demands. Industrialists, thus, prepare to apply for import license and entitlement. However, it is usually the case that the application processing takes long and, furthermore, the Government fund allocation on raw materials importation is delayed. By this, the industrial activities and its

development are greatly hampered.

(5) Cash on Delivery

The fifth problem is related to the credit system. One of the most remarkable things in the business system in Bangladesh is that every single transaction is done by cash but not by credit. This practice does not only slow down the physical distribution of raw materials but also disturbs the timely procurement of raw materials on the part of the industrialist.

(6) Transportation

In connection with the timely physical distribution of raw materials, there is a point to be noted, that is, the carrying arrangement and transportation is, without exception, taken care of by purchasers of raw materials. In order to improve the present system, there may be scope for suppliers of raw materials to arrange the transportation, which may reduce the burden of laboursome procedure as well as the carrying cost.

One of these 6 problems, the third, the fifth and the sixth problems are also common to the finished products discussed in 4.2.

4.4 MANAGEMENT

4.4.1 General Management Problems

It is estimated that more than 95% of small scale metal working/light engineering firms in Bangladesh are being managed by the proprietor/manager (and/or his partner). The profile of these enterprises can be expressed as follows according to the 1979/1980 survey by TECHNONENT ASIA/JICA:

- Operational history: 11 to 20 years
- Location: Dacca, Chittagong, or Comilla
- Number of Employees: 5 to 10
- Investment in Machinery: US$15,000 to 35,000 (approximately Tk. 225,000 to 525,000)
- Wages: Tk. 300 to 500 per worker
- Annual Sales: US$39,000 (Approximately Tk. 585,000)
- Average order size: 8- to 10-day work volume
- Raw materials inventory: 7-day supply
- Material cost: 31 to 50% of total production cost
- Working capital: US$3,000 per month (Approx. Tk. 45,000)
- Investment needed for modernization: US$66,000 (Approx. Tk. 990,000)

The small scale metal working/light engineering industries currently face managerial problems in the following areas:

a) The general management

b) Financing and accounting

c) Production

d) Sales and Marketing

e) Labor relations/personnel affairs

Although the existing situation of these industries is far from the science of modern business management, much cannot be expected of the enterpreneurs in view of their current capabilities and their training should be limited to most important subjects.

The existing metal working/light engineering industries are being managed either by (i) the proprietor/manager who had previously had some connection with this sub-sector, or by (ii) a hired technical or sales expert. In the case of (ii), the enterprise can very well be advantageous in fields where technology and sales are specialized but is liable to have financial management problems, while in the case of (i), under the unseparated capital/management setup, products tend to be of an inferior quality or the management to have less knowledge of marketing.

In the Tongi Industrial Estate, which the Study Team visited, two foundries falling under case (i) and case (ii) respectively were noted to exist. In the case (i) foundry, the owner-manager, who probably was skilled in manufacturing and the marketing of iron castings, was taking orders in accordance with the manufacturing capacity of the foundry. This owner-manage was later discovered as a result of interview to have little financial and accounting knowledges. The obsolete facilities of this foundry can be modernized by re-investment in order to improve the productivity and expand business opportunities, but the management would be improved at the same time. A new foundry which received a bank loan can be mentioned as one falling in the case (ii). This foundry had new facilities and had recruited a foundry foreman from outside. BUET was also to provide technical assistance with regard to specific technology (malleable cast iron production). The owner-manager of this foundry appeared to have only general marketing information and, therefore, the future operation of this enterprise would possibly encounter some problem.

In addition to people falling under either of these two cases, those who have received some technical training but are not experienced in this particular area and have no capital constitute the third group of candidates for new entry into small scale metal working/light engineering industry. These three groups are compared in Table 4.4.1. While it is believed that few falling in this third case have actually established themselves as managers in this sub-sector so far, it will become essential

Table 4.4.1 Comparison of Possible Managers of Small Scale Metal Working/Light Engineering Industry

Item	(i) Technical/Marketing Experts of the Industry	(ii) General Investors in Manufacturing	(iii) Educated but Inexperienced People with Little Fund
1. Sources of Supply	. Existing small scale metal working and light engineering industry. . Nationalized large scale companies	. Owners of manufacturing companies in other sub-sector. . Owners of merchandising companies	. Diploma Engineers . Graduates of TTC courses (. Rural blacksmiths)
2. Advantages	. Technical and marketing know-how	. Financial and general managerial know-how	. Eagerness of starting business in rural areas
3. Disadvantage	. Lack of financial and accounting know-how	. Lack of technical and marketing know-how	. Lack of technical, marketing, financial and accounting know-how
4. Desirable Capacity	. Cost consciousness	. Quality consciousness . Marketability consciousness	. Cost consciousness . Marketability consciousness
5. Needs for Management Training	. Accounting/bookkeeping . Personnel/labour management	. Production management . Raw materials and products management . Sales and marketing	. Accounting/bookkeeping . Production management . Raw materials and products management . Sales and marketing

Source : JICA Team

that they be motivated and urged to establish their enterprises in the rural area.

Although the production of farming tools and other small metal products -- a role which blacksmiths play in rural areas -- may be called a cottage type metal working/light engineering, it is believed that only few of blacksmiths, most of whom have little formal education and are short of machining, welding and machine assembly technology, will be able to foster themselves as modern industrial enterpreneurs and to expand their operations to small scale but full fledged metal working/light engineering industry that can produce metal products with complicated shapes. Most prospective blacksmiths can be developed as small scale industry operators through adequate training in machining and management.

4.4.2 Elements of Management Problems

Contributions by various elements to the managerial problems of small scale industries are rated as presented in Table 4.4.2, which shows that the solution of funding and financial management problems results in the solution of nearly 80% of the entire management problems.

Table 4.4.2 Importance of Elements of Management Problems in Small Scale Metal Working Industries

Category	Ratio (%)
Financial	79.0
Technical	8.6
Marketing	5.1
Infrastructure	2.5
Labour	4.4
Others	0.3

Source : TECHNONET ASIA/JICA

Therefore, the provision of ample funds will be vitally important to the development of this sub-sector. Other indicated elements are also related to fund generation; enterprises which possess technical and marketing capabilities and are blessed with adequate infrastructure will have little difficulties in raising funds from external sources.

(1) Financing and Accounting

TECHNONET ASIA/JICA survey has resulted in the finding of a surprising fact that approximately 80% of small scale metal working industries have never received long term loan of any kind. This was probably because industries in this sub-sector could be started with acquisition of inexpensive used machines or self-made machines and without a long term loan, while the average amount of new investment needed by each unit enterprise (Tk. 200,000 to 500,000) was smaller than the average size of long term loans for small scale industries at large.

Metal products and light machinery have recently become more complicated and require a greater number of machines for their fabrication, while the price of machines has increased due to inflation, and, therefore, it is believed that future investments will have to rely heavily on long term loans.

When interviewed, a number of small scale industries complained the difficulty of obtaining a long term loan, giving the following reasons: (i) lack of information pertaining to the activities of commercial banks in this area and the inadequate number of bank branch offices which can process loan application from small industries, and (ii) the complicated loan procedure and the rigorous appraisal of applications. Therefore, it is believed necessary that commercial banks and BSCIC will take initiative in disseminating information on long term loans and application procedure to enterpreneurs.

The greatest problem in financial management is usually the lack of working capital because (i) the importation of raw materials is limited to twice a year, (ii) raw materials inventory and products stock are maintained at a high level, and (iii) the collection of accounts receivable takes time. A commercial bank short term

loan system is currently being developed for the solution of this problem, and adequate guidance should be given to enterpreneurs to be able to utilize the system.

Business bookkeeping/accounting must be said very backward; it is not even separated from household accounts in some cases. Advice should be provided for the separation of business accounts from household accounts and, then for the introduction of production cost control and other financial controls. One possible way of developing business accounting capabilities will be standardized bookkeeping, cost and other financial control training courses to company bookkeepers and accountants offered by commercial banks, BSCIC or BMDC.

(2) Production Management

Production management includes materials and parts control (or purchase and inventory management), machinery maintenance, and quality inspection and control, and constitutes a part of production technology in wide sense of the term.

It has generally been observed that materials and parts control is being done only inadequately. Delivered materials are not inspected due to the lack of necessary facilities but are only manually classified. The level of materials inventory has been reported (TECHNONET ASIA/JICA Report) at 7-day supply, but the Survey Team had an impression that the level is actually much higher than indicated because of the low operation rate and because materials supply cannot be expected to be on a regular basis. In the example of foundries, a fair amount of rejected products are being recycled as scrap metal and constitute a portion of the materials inventory.

Imported parts such as ball bearings represent the only parts inventory; because product parts are mostly self-made and self-supplied, the consciousness of inventory control is almost non-existent. The inventory of imported machine parts, cutting tools, and griding stones is too high by Japanese standard, constituting a reason for a large amount of working capital. Inventories of these imported spare parts were sometimes observed to have been put in a good order.

The Mirpur Agricultural Workshop and Training School of CARITAS can be mentioned as an exemplary case of raw materials and parts control. However, in a majority of cases, materials and parts are being controlled mostly from antitheft

point of view, rather than from production point of view.

Bangladesh is a seller's market, and, therefore, product inventory control is being conducted only inadequately. It was observed in many cases that the product stock yard was too small for the proper storage of products and the products were kept disorderly often resulting in breakdown. Products are also being broken in transit due to improper packaging.

Machinery and equipment are not frequently maintained: generally, they are repaired when broken (TECHNONET ASIA/JICA Report). Regular maintenance is essential not only for the prolonged life of machines but also for the better quality of products.

Quality inspection and control have been discussed under 4.1. Materials inspection, intermediate inspection, and finished products inspection are not carried out almost at all. While BMDC currently offers courses in quality control method for the employees of large enterprises, a simplified version of these courses should be offered for small scale industries in the future.

(3) Sales and Marketing

The greatest sales and marketing problem of small scale metal working/light engineering industries is that they do not know (i) what they should make, and (ii) to whom they should sell. To take agricultural implements and machinery for instance, production facilities inevitably remain idle because the purchasing power of farmers is limited and the government has a few plans for the promotion and extension of such implements and machinery. Also, the dead copies of imported agricultural implements and machinery produced by small scale industries, who have only a limited product development capability, are either unsuitable to agriculture in Bangladesh or of an inadequate quality for the exploitation of potential markets. The entry of too many existing manufacturers into a small market has often resulted in excessive competition, making it difficulty for them to take a proper pricing strategy.

The exploitation of potential markets in the agricultural sector and the accomplishment of effective sales and marketing activities are beyond the capabilities of

small scale industries. Therefore, Government should make efforts for market exploitation and let the results known to marketing people of small scale industries so that they will be able to carry on sales activities easily. It should be desirable that the Government will at the same time offer simple training courses in the following subjects for the education of salesmen and marketing people of small scale industries.

- The analysis of needs for various products
- The estimation of market size and market characteristics
- The method of establishing distribution channels
- Customer management
- Pricing strategy

(4) Labor Relations and Personnal Affairs

No complicated labor problems can occur in small scale metal working/light engineering industries which employ only five to ten workers on the average. The survey of small scale enterprises by TECHNONET AISA/JICA have resulted in pointing out that problems in this area are (i) that decision making is done by one person, (ii) that wage level is low, (iii) that the employment of skilled laborers is difficult, (iv) that the turnover of laborers is too high, and (v) that labor productivity is low, and, further, that these problems are of about equal importance.

Labor turnover is high and productivity is low because wages are low and working conditions and environment are poor, and vice versa. In order to break this vicious cycle, the most important will be to change the philosophy of owner-managers who currently monopolize the labor and personnel management power. In addition, following will be ways to improve the current situation:

- That the wage structure be adjusted generally upwards, introducing performance and seniority pay systems.
- That technical training be given to laborers.
- That factory (building, machinery layout/configuration, lighting, ventilation) be improved.

- That working hours be established and work to be performed within the working hours defined.

The social status of blue-collar workers is generally low in Bangladesh, and, therefore, their wage level remains low. This trend must be changed if the labor problems of small scale industries are to be solved. Mere improvement of wage structure will be incapable of effectively preventing labor outflows to service industries, where the worker status is higher, or to the Middle East countries, where wages are higher.

4.5 FINANCIAL AND OTHER INSTITUTIONS

4.5.1 Finance

(1) Current Status

About 7.5% of the projects approved for sub-loans under the Second Small Scale Industries Project of IDA was in metal working/light engineering (MW/LE) sub-sector. A part of ADB's small scale industrial sub-loans is also directed to this industrial sub-sector (see under 2.1). Even if some preferential treatment is available to industries in this sub-sector on the reason that they are agro-related and mostly located in rural areas, no particular measures have been taken from industrial side for the reinforcing of these industries.

On the other hand, Bangladesh Krish Bank (BKB) has provided loans to farmers for the purchase of agricultural machines. Financed heretofore are imported machines, but, in view of the rising demand for the domestic production of centrifugal pumps, power tillers, and related machines, BKB is now promoting some MW/LE industries.

In summary, this BKB system is for the diversion of some of ADB and own funds for use as working capital of, or for the leasing of production machinery for, the manufacturers of agricultural implements and machinery. For the time being, this system is being applied to a limited number of centrifugal pump manufacturers and steel tube makers. In the future, fixed assets investment funds will be provided to selected enterprises. The advantage of this system to the financed enterprises is that their marketing risk is small, because BKB buys their products on preferential basis. BKB plans to lend a total of Tk. 480 million to the existing agro-industries and Tk. 590 million to new agro-industries in the next five years. Parts of these funds will be made available to agricultural implements and machinery manufacturers.

(2) Problems

Following problems are identified of small scale industrial finance:

a) Geographical Coverage and Project Identifying Function of Financing Bank

Presently, IDA funds are loaned by two banks, Sonali and Janata, and Bangladesh Government funds are handled by six commercial banks. Together, Sonali and Janata have 1,360 branches in total, while the commercial banks have 2,950 branches throughout the nation. Therefore, these financial service networks seem to have a fairly adequate coverage. In the case of BSB, number of its offices is only eleven, including the head office. In view of the inadequate geographical coverage, BSB loans might be limited to certain types of industries or to certain geographical areas.

These banks must essentially be equipped with capabilities for the processing of loan applications and the appraisal of loan projects. BSCIC plays the central role in investment promotion and investment counselling on matters other than financing. It will be desirable that branches in rural Bangladesh banks will constantly maintain close contacts with local industries and identify and foster new industrial investment project, just as the branches of Japanese local banks have done in Japan. At least major rural branches should be manned with a financial counselling expert.

b) Loan Conditions

The investment ceiling of Tk. 2.5 million including land, building, machines, and facilities, should be reviewed from time to time in consideration of price increases in the future. As far as the past record reveals, MW/LE industrial projects generally remained within this limitation.

Many of the interviewed enterprises are in need of a new short-term financing system for the provision of working capital to finance their stockpiles of raw materials, parts, and components inevitable due to the established 6-month validity of import lisence under which the stockpiles must be replenished twice a year with imports.

The IDA sub-loan condition that the amount of investment must not be over US$3,000 (Tk. 45,000) per regular employee can be unrealistic in the case of MW/LE industries, in view of the fact that even an Indian made lathe costs

Tk. 100,000. The application of this condition should, therefore, be made flexible.

It is established as desirable for IDA loan purposes that raw materials produced or processed in Bangladesh constitute at least 60% of the total. It is not always possible for MW/LE industries to satisfy this term, because they rely on imports for many raw materials to include steels, non-ferrous metals, pig iron, and cokes. Yet, the foreign exchange required to pay for these imported materials will be partly offset when MW/LE industries have accomplish substitution for imported machines parts. Therefore, the application of this term should also be made flexible.

c) Laon Application and Appraisal

Loan applications are processed by commercial banks as illustrated below.

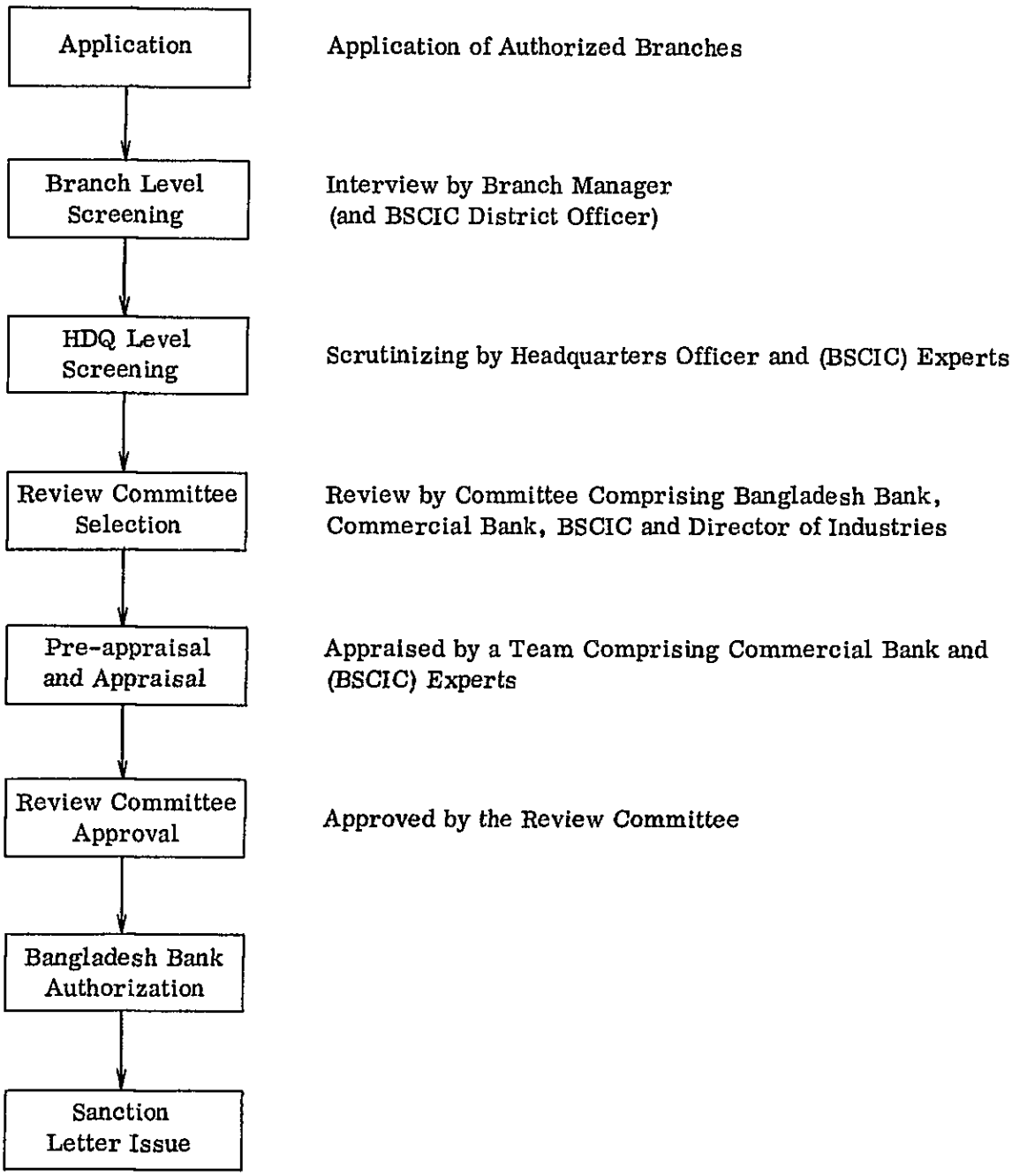
The problems of this process are:

- The application form is too complicated for the enterpreneurs investing in small scale industries.
- An excessive period of time is required for the process, from the time of application to the time of sanctioning.
- Project appraisal is very difficult with regard to the product, manufacturing technology, and market, inasmuch as MW/LE sub-sector covers a very wide area.

Consequently, the time and efforts entailed are excessive in relation to the amount of loan. It should be advisable, however, that, in view of the fact that the simple application form which was in use previously resulted in a fair number of frozen projects, the current formalities be continued for the time being in hope for future improvements in the efficiency of the appraisal.

One problem stemming form the appraisal of MW/LE projects is the requirement that the price estimation of imported machine must be obtained from three different sources. Importation of the lowest priced machine is usually approved for the conservation of foreign exchange. However, industries

Fig. 4.5.1 Present Status of Loan Processing of IDA Small Scale Industry Credit Program



Source : Compiled by JICA Team

in this sub-sector cannot always rely on the lowest priced machines but must use a limited number of expensive machines. For instance, the life of re-conditioned motor vehicle engine will be longer when the re-grinding of the crank shaft and honing of cylinder liner are accomplished with a high grade machinery. Therefore, in the appraisal of future projects, importation of certain high grade machines should be santioned when fully justified. This will contribute to the improvement of mechanical engineering technology in the entire Bangladesh and, in turn, lead to the ultimate saving of foreign exchange.

4.5.2 Other Institutional Settings

(1) Industrial Standards and Testing

The Bangladesh Standard Institution has already established some 500 industrial standards -- mostly in the areas of textile and garments, food, household electric appliances and other consumer durables, chemical consumer products, and building materials, but only few in the areas of metals, machinery, and machinery parts.

Bangladesh, now in the Imperial weights and measures, is under urgent requirement to shift to the metric system in the face of increasing importation of metric machines and metal products from East and West European countries and Japan, and because India and other neighboring nations have already adopted the metric system. Although a member of ISO, Bangladesh has to date deferred transition to metric system under the 1967 Weights and Measures Act. As plan stands now, gradual transition is to be started from 1982, but it would be most desirable if future importation of machines can be limited to those which are based on metric system.

The existing standards for metal and machinery industries pertain mostly to material testing, and few pertain to mechanical properties, profile, size and dimension, tolerance, and chemical composition. ISO and BS systems will have to be used for the time being.

As for centrifugal pumps, diesel engines, and other agricultural machines and implements, the Standardization Committee efforts of BUET and CERDI are currently directed toward the testing standard by which imported or domestic machines of an acceptable level can be identified, but remains short of establishing standards useful for the domestic production of such machines.

Material tests and chemical analyses are done by the Central Testing Laboratory in Tejgaon under contract, but BUET may be engaged for similar services.

(2) Industrialization Consulting

An Investment Advisory Centre of Bangladesh (IACB) has been established under the Ministry of Industries for the purpose of giving consultation on industrialization projects and of assisting the formulation of feasibility reports. This Centre provides said services not only to private entrepreneurs but also to public corporations and government agencies. Since recognization in 1976, it has collected basic data necessary for feasibility study purposes. It has similar functions as the Counselling and Industrial Studies Department of BSCIC and BSB, and is capable of giving useful advices on the formulation of small scale industrial projects.

(3) Investment Incentives

Tax and other incentives are available for (i) foreign investments, (ii) investments in export-oriented industries, and (iii) investments in developing areas. Although few foreign investments will likely be made in MW/LE industries, investments in such industries will be made actively in developing areas for the purpose of rural development. The incentives for such investments are:

- Reduction of import duty on imported capital machinery to 2.5% (from the ordinary 50%).
- A loan from financial institution up to 70% of the total investment with the extention of grace period up to five years.
- Nine-year (in developed areas, 5-year) tax holiday if 30% (likewise, 60%) of profit is re-invested, invested in other industry(ies), or applied to the purchase of the government bond.

- Investments are sanctioned under liberal standards.

- Electric power rate can be lowered.

- Pooled petroleum price is available in the elimination of regional price gap.

Fixed assets are depreciated by the straight line method, and at the yearly rates of (i) 2% for buildings and (ii) 5% for facilities and equipment; no accelerated depreciation is available.

(4) Skills and Capabilities Certification System

The incentive of technical or vocational training and self-development efforts remains low in the absence of a system by which one's skills or capabilities can be certified (as discussed under 2.2.2). The incentive will be improved by the establishment of such a system, and will be further amplified if pay scale can be geared to certified qualifications.

CHAPTER 5 RECOMMENDATION OF DEVELOPMENT OF SMALL SCALE METAL WORKING AND LIGHT ENGINEERING INDUSTRIES

CHAPTER 5 RECOMMENDATION OF DEVELOPMENT OF SMALL SCALE METAL WORKING AND LIGHT ENGINEERING INDUSTRIES

5.1 SUB-DIVISIONAL DEVELOPMENT PLAN

5.1.1 Basic Plan

It is recommended that a production base or a repair-cum-production base be established in each Thana as discussed under "3.4 Development Guideline". This idea is basically the same as the concept of BADC and of Comilla Cooperative Karkhana but there is some difference between the two as follows:

- Both production bases and repair-cum-production bases are to be operated by private enterprises whenever possible.
- The bases are to utilize the existing facilities to the maximum extent, or, whenever appropriate, the existing establishments are to be converted into the bases.
- Funding, technical assistance, raw materials and parts supply, and other supporting systems are to be developed outside the bases; therefore, these bases are to be engaged only in the supply of products and service (repairing) to local populace--the very purpose for which they are to be established.
- These bases are to support not only agriculture but also other industrial sub-sectors, and transportation, construction, household, and commercial sectors.

Thanas in each sub-division are identified in Table 5.1.1. Metal working/light engineering industries are found only in certain Thanas, i.e. Joydebpur, Kushtia, Bheramara, and Bogra. The production bases and repair-cum-production bases to be established in these Thanas are outlined in Table 5.1.2. In this Table, Class 1 activities represent modern foundries and machine shops which are close to the upper limit size of small scale industries, while Class 3 activities represent the most commonly seen small machine shops with five to ten workers. Class 4, somewhat larger

workshops than blacksmith's, which are to be established in low demand areas for future expansion to Class 3 activities.

Table 5.1.1 Thanas in the Four Sub-Divisions

Sub-Division	No. of Thana	Name of Thana
Chandpur	5	Chandpur, Faridganj, Matlab, Hajganj, Kuchna
Joydebpur	5	Sripur, Kapasia, Kaliganj, Joydebpur, Kaliakair
Kushtia	6	Kushtia, Khaksa, Kumarkhali, Mirpur, Bheramara, Daulatpur
Bogra	10	Adamdighi, Dhubchanchia, Kahaloo, Bogra, Gabtali, Shibganj, Sariakandi, Shepur, Dhunat, Nandigram

Table 5.1.2 Outline of Production and Repair-cum-Production Basis

Class	Major Activities	Investment (Tk)
1	. Production of varied metal products and light machinery . Repairing automobiles and light machinery . Production of machines parts	1,000,000 - 2,500,000
2	. Production of limited types of metal products and light machinery . Repairing automobiles and light machinery . Production of machine parts	500,000 - 1,000,000
3	. Production of agricultural tools and implements . Repairing automobiles and agricultural tools, implements and machinery	100,000 - 500,000
4	. Production of small agricultural tools and simple implements . Repairing agricultural tools and implements . Makeshift repairing of automobiles	below 100,000

Source : JICA Team

The sub-divisional distribution of these bases can be planned by assigning each class of activities to the type of location as follows:

Class	Location
1	Sub-Division Centre
2	(Sub-Division Centre), Large Thanas
3	Ordinary Thanas
4	Small Thanas

The bases can not necessarily be located in Thana headquarters but in selected industrial growth centers.

("Large Thanas" in the above means those which compare to sub-division centers in terms of population and population density.) The result of the assignment is presented in Table 5.1.3.

Table 5.1.3 Distribution of Production and Repair-cum-Production Basis in Each Thana

Class	Chandpur	Joydebpur	Kushtia	Bogra
1	1	1	1	1
2	1-2	2	1	2
3	2-3	2	2	5-6
4	0	0	2	1-2
Sub-Total	5	5	6	10

Source : JICA Team

The utilization of the existing organizations and facilities is planned as follows:

- Chandpur Class 1 Production Base: The facilities and production capacity of BITAC Chandpur will be used to substitute for the production base facilities/capacity.

- Joydebpur Class 1 Production Base: A part of the facilities of metal working/light engineering industry(ies) in the Tongi BSCIC Industrial Estate will be moderized and used.
- Kushtia Class 1 Production Base: The production facilities of Rennwick & Company can be utilized.
- Bogra Class 1 Production Base: A part of the facilities of the existing private enterprise(s) will be modernized and used.

The amount of investment needed in order to establish all of these bases in the four sub-divisions within the period of the Second Five-Year Plan is estimated in Table 5.1.4.

Table 5.1.4 Estimated Investment for the Development

(Unit: Tk. 1,000)

	Chandpur	Joydebpur	Kushtia	Bogra	Sub-Total
Max.	4,100	4,100	3,550	5,400	17,150
Min.*	1,350	2,600	7,050	3,200	9,200

Source : JICA Team

Note : * Better utilization of the existing equipments and facilities

It is estimated that Tk. 150 million to 270 million will be required for the implementation of the similar project in all of the sub-divisions of the Country. However, such bases need not be distributed in a standard fashion to all Thanas; such bases may not be needed for the time being in Thanas adjacent to an existing industrial area--such as those in the eastern part of Chandpur Sub-Division near Comilla and those in the southern part of Joydebpur including Tongi--depending on local demand.

With regard to the raising of the investment funds, the following are conceivable:

- To depend on private investments to a certain extent.
- To utilize chiefly the small scale industries credit program of IDA.

- To assume that said IDA program will continue throughout the period of the Second Five-Year Plan.

A 7.5% of the total sub-loans committed during the period of the Second IDA program was approved to metal working/light engineering industries. Assuming that this ratio will rise to 10% under the Third Program, a total of Tk. 45 million can be made available for the development of this sub-sector during the two years from 1980 to 1982. Further assuming an equity ratio of 20%, the total private investments will come to about Tk. 56 million. If the IDA program in these two years is to be repeated in the three years to follow (1982 - 1985), investments during the five years from 1980 to 1985 will come to a total of about Tk. 140 million, with which the above-mentioned bases will be established in 60 to 70% of total Thanas in the nation.

ADB credit is another source of fund in addition to IDA program. The feasibility of this project will be high, as far as seen from funding standpoint, if funds from these international finance organizations can be combined with private investments under proper guidance of the government.

5.1.2 An Outline of Physical Plan

Representative cases of the production and repair-cum-production bases are described in Table 5.1.5.

Table 5.1.5 Models of Production and Repair-cum-Production Bases

	Class 1 Bases	Class 2 Bases	Class 3 Bases
1. Total investment in fixed assets (Tk)	2,500,000	1,000,000	400,000
2. Investment in land and buildings (Tk)	1,000,000	400,000	150,000
3. Investment in machinery and equipments (Tk)	1,500,000	600,000	250,000

(continued)

	Class 1 Bases	Class 2 Bases	Class 3 Bases
4. Machinery and equipments list			
1) Foundry			
. Cupola (Nos)	1	-	-
. Crucible furnace (Nos)		(1)	-
2) Machine shop			
. Centre Lathe 6' (Nos)	1	(1)	-
. Centre Lathe 4' (Nos)	1-(2)	1	1
. Univerdal milling machine (Nos)	1	-	-
. Gear hobbing machine (Nos)	(1)	-	-
. Shaper 20" (Nos)	1	1	-
. Metal band saw (Nos)	1	-	-
. Hacksaw (Nos)	-	1	1
. Tool grinder 10" (Nos)	1	1	-
. Drilling machine 1" (Nos)	1	-	-
. Bench drill 1/2"-3/4" (Nos)	2	1	1
. Twin head grinder (Nos)	1	(1)	-
. Bench grinder (Nos)	2	1	1
3) Sheet metal working, welding and forging shop			
. Sheet metal shear (Nos)	1-(2)	1	1
. Sheet bender (Nos)	1	-	-
. Crank press 50t (Nos)	1	-	-
. Friction press 100t (Nos)	(1)	-	-
. Roll bender (Nos)	1	1	-
. Spring forge hammer (Nos)	1	1	1
. Electric arc welder (Nos)	1-2	1	1
. Gas welding and cutting apparatus (Nos)	1	1	(1)
. Spot welder (Nos)	1	(1)	-
4) Heat treatment			
. Electric furnace (Nos)	1	-	-
. Gas furnace (Nos)	1	-	-
5) Wood working			
. Circular saw (Nos)	1	-	-
. Planer (Nos)	1	-	-
. Mortising machine (Nos)	(1)	-	-
. Wood lathe 3' (Nos)	1	-	-
. Bench drill 1/2" (Nos)	1	-	-

(continued)

	Class 1 Bases	Class 2 Bases	Class 3 Bases
6) Auto-diesel workshop			
. Fuel injection tester (Nos)	1	1	(1)
. Garage jack (Nos)	1	-	-
. Crankshaft grinder (Nos)	(1)	-	-
. Cylinder honing machine (Nos)	(1)	-	-
. Battery charger (Nos)	1	1	1
7) Painting shop			
. Compressor and sprayer (Sets)	1	(1)	-
8) Tools			
. Electric potable hand tools (Sets)	1	1	1
. Hand tools (Sets)			

Source : JICA Team

The model bases described in Table 5.1.5 are in the prices of early 1980, and future price inflation will probably result in some reduction in land/building sizes and less number of machines and facilities.

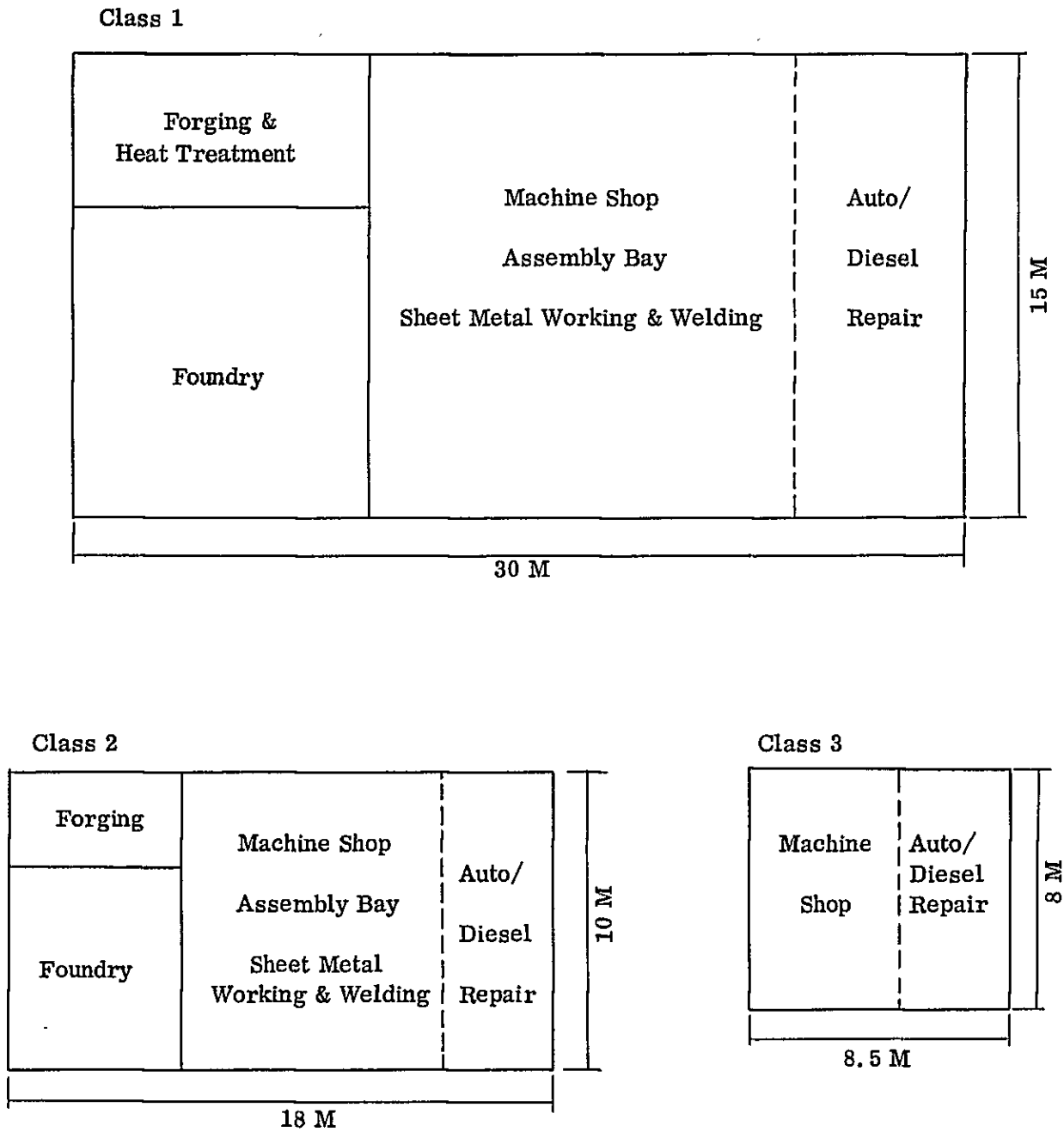
In order that the amount of investment in these production and repair-cum-production bases may be held to a minimum and that their operation can be accomplished effectively, the efforts should not be spared in the following:

- To disinvest idle machine tools owned by nationalized corporations.
- To intensify linkage between these bases and the existing private metal working/light engineering industries, particularly foundries (which are large in number), whose facilities can be effectively utilized for the base operation.
- To construct a number of factories specializing in certain function or technology in the area of Class 1 activities, which need not be confined to an integrated factory; or otherwise invest in existing specialized factories for their modernization and expansion.

The production bases of Class 1 activities should have rooms for future growth for medium scale integrated machinery assembly plants or rooms for the mass-production of specialized parts, because, as the machinery industry of Bangladesh will be developed in the future, need will rise for division of work and for the strengthening of industrial linkages.

Presented in Figure 5.1.1 are conceptual layouts of plants for these Classes of activities. The actual size of each factory will depend on land cost and building construction cost and, therefore, these conceptual layouts should be used only for reference. In consideration of the nature of work, casting and forging process should be housed in a separate building.

Figure 5.1.1 Model Factories



Source : JICA Team

5.2 DEVELOPMENT POLICY AND INSTITUTIONAL MEASURES

5.2.1 Financial Measures

No special financial loan system for small scale metal working/light engineering industries has been established as pointed out under 4.5.1--only attempt in this area being the selective loans provided by BKB to foster the manufacturers of pumps and other agricultural tools and implements. Metal working/light engineering is certainly one of the most important industrial sub-sectors in order to support agriculture, but it is not so desirable as to be fostered even at the expense of an imbalance in overall industrial development.

It is, therefore, recommended that no special financial assistance system be created for the development of small scale metal working/light engineering industries, but that about 7.5% to 10% of small scale industry loans provided through commercial banks and BSB be allocated to these industries under a flexible quota to be officially announced--flexible, because any portion of the quota unused by these industries is to be directed to other sub-sectors.

Regional loan quotas may very well be established in order to encourage investments in certain designated areas, e.g. Rajshahi District, where the number of small scale metal working/light engineering industries is smaller than other districts and is only about 6% of the national average.

Other methods of accomplishing certain objective with exclusive financing is to create a quota for the modernization of machinery and equipment of the sub-sector or to assign, and make loans in the order of, priority. Priority financing for some 70 designated sub-sectors has been effective in facilitating the modernization of generally outdated machines and equipment of small industries in Japan. A fair number of factories in Bangladesh which the Survey Team visited were operating with outdated machines and equipment, and need for such financing is substantial. A system to finance the solidification of the foundation of existing enterprises, as opposed to new investments, is believed valuable.

For those which are financially incapable of purchasing needed machines and equipment, a system may be developed for the leasing of, or financing the purchase of, certain designated machine and equipment on a long term installment basis. Such a lease system is not unconditionally recommendable, however, because leased machines may not be well maintained in use, as in the case of irrigation pumps leased by BADC. A long term installment system may be useful for the purchaser of a relatively low priced machine who cannot pay for it but the amount is too small to bother with the complicated bank loan procedure.

In the next place, it is recommended that commercial banks' capabilities in processing and appraising loan applications be much improved. As for the Third IDA sub-loans, the situation will be much improved since the loan handling by a greater number of banks to include from Janata and Sonali Banks to Agrani is expected. It will be desirable if accelerated training be given to a larger number of bank personnel engaged in the processing of loan applications so that applications can be accepted in major local cities.

Authorities for loan appraisal, which is presently centralized in Dacca, should be much delegated to local cities in order that local conditions and local needs will be taken into consideration in loan appraisal. Concrete appraisal criteria and standards should be developed, under which a major part of appraisal can be accomplished by local bank offices, leaving only the checking of important items for Dacca headquarters. One alternative way to achieve said delegation is to have a several experts from Dacca participate in local (perhaps, District level) loan appraisal committees.

It is not necessary that the established loan conditions, such as the conditions of IDA sub-loans, be strictly applied to small scale metal working/light engineering industries, because they are somewhat more capital-intensive than other small industries and because their dependence on imports for raw materials is great, e.g. most of steels, pig iron, and cokes. Rather, it should be desirable that loan conditions be applied with flexibility.

An interest rate of 11.5% per annum and a repayment period of 10 to 12 years are presently generally acceptable loan terms. However, in view of the unstable

financial foundation of small private industries, it should be desirable that financial routes be simplified in order that interest rate may be reduced even by a small margin. Also, efforts should be made to keep interest spreads to a minimum for the case of IDA sub-loans.

These recommendations are summarized in Table 5.2.1.

Table 5.2.1 Summary of Recommendations on Financial Measures

Problem Area	Recommendation
1. Loan availability	- Allocation of 7.5% to 10% of total loan amount for small scale industries to metal working/light engineering. - Allocation of specific loan quota to developing areas
2. Loan priority	- Loan priority to modernization of machinery and equipments at metal working/light engineering factories.
3. Long term installment	- Promotion of purchase of modern machinery through long term installment basis.
4. Loan appraisal and processing	- Decentralized loan appraisal and sanction activities on district level.
5. Loan conditions	- Flexible application of loan conditions to metal working/light engineering industry financing.
6. Loan terms	- Reduction of interest rate applicable to small scale industries.

Source : JICA Team

5.2.2 Tax and Other Incentives

The new Industrial Investment Schedule should offer greater, but never smaller, incentives for the industrialization of developing areas. Particularly, there is no need of shortening the period of tax holiday from the current nine years for those areas.

Buildings are depreciated over a life of 20 years and machines and equipment, 10 years, both under straight line method leaving no salvage value. However, depreciation may be accelerated to conform with the period of tax holiday, i.e. nine years for developing areas and five years for other areas.

BSCIC has advocated (i) tariff protection and import restriction and (ii) excise duty exemption for the securing and expansion of markets for the products of small scale metal working/light engineering industries. Domestic products should certainly be protected against imports, but protectionism often results in poor quality but high price of domestic products at the sacrifice of end users. Moreover, the quality of these particular products, namely agricultural implements and machinery, will directly affect agricultural productivity.

Then, the importation of high quality and low priced products should not be restricted under indiscriminate protectionism; rather import control should be accomplished with concurrent efforts to improve the quality of domestic products and to prevent, through the establishment of product standards, the marketing of any products with an inferior quality.

The exemption of the products of small scale industries from excise duty will be justified.

Table 5.2.2 Summary of Recommendations on Tax and Other Incentives

Problem Area	Recommendation
1. Company tax	- Existing tax holidays must be retained, namely up to 9 years for developing areas and up to 5 years for developed areas.
2. Depreciation	- Within the period of tax holidays accelerated depreciation of machinery and equipments should be promoted.
3. Import protection	- Tariff protection and restrictive import will be only possible after upgrading quality of domestically manufactured goods and reducing their production costs.
4. Excise tax	- Exemption of excise tax on metal working and light engineering industrial products is recommended.

Source : JICA Team

5.2.3 Raw Materials Supply

Six problems are specifically envisaged in the field of raw materials supply during the previous discussion in CHAPTER 4. They are, then:

- Shortage in allocation of foreign reserves,
- Mal-practices by the importer,
- High prices of raw materials,
- Un-timely foreign reserve allocation,
- Cash business practice and
- Inefficient transportation.

The first problem can not be solved straightforwardly as this is a kind of given condition. However, it is possible to make the present inefficient and inproper allocation of foreign reserves on industrial raw materials more optimal by the efforts of the authorities. An intensive study for the foreign reserves allocation on raw materials should be carried out. The second problem can also be solved partly

by the above efforts. In this connection, it may not be recommended to stop those mal-practices all of the sudden by law enforcement as it means a crackdown of the distribution machinery of raw materials. Indirect methods such as to assess the import entitlement and production performance should be recommended. The third problem will be answered by the efforts of the authorities concerned. The high prices of raw materials will be reduced by the governmental price control and varied tariff rates on the use of raw materials e.g. lower tariff rates on agricultural use. The fourth problem, the problem of slow and irregular allocation of fund to the industrial import entitlement, can only be solved by up-grading the efficiency of governmental administration. The fifth problem is particularly true to the small scale metal working/light engineering industries, who suffer, quite often than not, from the lack of working capital. It may be recommended that the Government establishes a credit insurance system e.g. a credit insurance corporation, for the small scale industrialists. The last problem will only be solved by establishing a transport cooperative which owns trucks and lorries for not only raw materials supply and procurement but also transportation of finished products.

In order to solve all these problems at a time, there is an idea in the Government circle that a public or cooperative organization which solely deals with industrial raw materials importation and their distribution should be established. One should note, however, that the idea will only be implementable when the coordination and adjustment with other organizations such as TCB, D.G. Industries and BSCIC are fully pursued. Besides, the large public corporation will not function in a healthy manner as many examples of other corporations show, unless extremely well-elaborated planning is made.

Table 5.2.3 Summary of Recommendations on Raw Materials Supply

Problem Area	Recommendations
1. Foreign Reserves	- Optimization and proper allocation of foreign reserves for raw materials importation.
2. Importer Malpractice	- Reassessment of import entitlement and production performance.
3. Raw Material Prices	- Price control on raw materials in domestic markets.
4. Working Capital & Business Practice	- Establishment of a credit insurance corporation for payment of raw materials import.
5. Transportation	- Establishment of a transport cooperative.
6. Stable Supply	- Establishment of a raw material import and distribution organization - a optional recommendation.

Source : JICA Team

5.2.4 Infrastructure

Transport and electric power/energy supply, being most important of infrastructure to small scale metal working/light engineering industries, pertain to all industries and the entire nation and, therefore, are outside the purview of this Study. Nevertheless, it should be pointed out that very important to this sub-sector are power and energy rates, the availability and condition of mini-industrial estates.

Small scale industries currently suffer under the higher power rate of all (see under 2.4.2), and it will be very desirable that the rate be lowered to approach that which is now applied to medium scale industries. Also desirable, in view of the inadequate investment capabilities of enterprises in this sub-sector, will be to establish a system under which transformers will be leased from PDB.

The Survey Team visited the BSCIC Industrial Estates and observed that the achievement of full occupancy was difficult for some local estates, and that factories of various sub-sectors had located themselves in a disorderly manner. Therefore,

it is recommended that mini-industrial estates of a reasonable land size be established for the locating of closely related industries so that industrial linkage can be created between themselves and also that they can be engaged in joint or cooperative activities for mutal benefit. For the time being, such mini-estates may be built in the suburbs of Dacca and Chittagong, for the relocation of small scale metal working/light engineering industries and related activities from downtown areas of these cities and for their expansion and modernization.

Table 5.2.4 Summary of Recommendation on Infrastructural Development

Problem Area	Recommendation
1. Electricity rates and prices	- Adjustment of electricity rates for small scale industries with those for medium and large scale industries. - Adjustment of fuel oil prices with those of pipeline gas.
2. Electricity supply	- Rental service of PDB transformer to small scale industries
3. Industrial estates	- Construction of mini industrial estates for small scale metal working/light engineering factories including for the purpose of relocation.

Source : JICA Team

5.2.5 Marketing and Distribution

Marketing is a very comprehensive practice related to production and sales activities. In the previous chapter, it is identified that there exists the crucial problem of the seller's market in the economy, which tends to save the efforts to up-grade the product quality and to reduce the price. In addition, for several metal working/light engineering products which do not have effective demand at the present, it became clear that various efforts to create potential demands for them are urgently needed.

In order to tackle these problems, various direct and indirect methods by government efforts will be considered. As the first direct method, it should be recommended to establish the Bangladesh Industrial Standard. The metal working/light engineering products so far discussed do have little requirement of the industrial standard. As a result, the quality of the product is not uniform and usually quite low. Secondly, the metal working/light engineering products should have an opportunity to exhibit themselves to the public as most of these products are not known among the farmers. Exhibition fairs and a circuit display should be held under the auspices of the Government. Thirdly, it is recommended to establish a patent registration system for inventors of these metal working/light engineering products. If this system is established, the creativity of the people will be motivated and the product quality will gradually be up-graded. Fourthly, improvement on industrial designing should be encouraged. It is expected that the demand for numerous industrial products of appropriate technology origin will increase in the near future. In order to satisfy this kind of needs, designing ability in the form of an industrial design centre or else should be strengthened. Fifthly, the market information services should promptly and timely be distributed among the parties concerned. There are no activities of this sort in the country except the Bangladesh Handicrafts Marketing Corporation Ltd. This corporation, however, is only meant for exportation of handicrafts products. The information channelling of domestically manufactured products to domestic consumers should be strengthened.

The above five methods are direct ones; "direct" in the sense that the Government can and should take initiatives in these efforts. There are, then, two kinds of indirect methods. One is that the Government should take necessary measures to strengthen the marketing training through the existing institutions and the other is that the Government should support and encourage the industrial and agricultural cooperatives to organize the collective sales and distribution system.

Table 5.2.5 Summary of Recommendations on Marketing and Distribution

Problem Area	Recommendation
1. Product Standardization	- Establishment of the industrial standards for metal working and light engineering products.
2. Public Relations	- Regular or circuit exhibition fairs and displays of the products.
3. Patent Registration and Design Development System	- Establishment of a patent system. - Encouragement of industrial designing; an industrial design centre.
4. Market Information	- Effective dissemination of market information both to manufacturers and to consumers.
5. Training	- Training in marketing practice at the proposed training institute.
6. Collective Marketing	- Encouragement of organizing collective sales and distribution systems.

Source : JICA Team

5.2.6 Managerial Support

The vast majority of small scale metal working/light engineering industries in Bangladesh are being operated under a quite inadequate management. Essential for them, along with appropriate technical support, will be external assistance to improve management capabilities.

Such external support can be in terms of (i) training, and (ii) consultation and/or circuit advisory services. The establishment of training-cum-advisory center for small scale industries to accomplish both (i) and (ii) above, as advocated by BSCIC and BMCD, will be useful.

Small industries are particularly incapable of bookkeeping and accounting, cost management, and financial management. It is recommended that commercial banks, BSCIC, and MBDC jointly formulate simple manuals for the training of company

employees in these areas, and that such capabilities be developed through proper training and/or circuit advisory services.

Production management methods constitute a major part of production know-how, and training in such methods might be given together with technical training. It is recommended that simple production management method manuals (such as simple testing method of steels, method of rejecting unacceptable castings and so forth) be developed for small scale industries.

Market research capabilities may not be developed in a relatively short period of time and, therefore, it is recommended that check list be developed for use in characterizing each market and that people in this sub-sector be trained in the use of the check list. In view of the frequent difficulties in collecting accounts receivable, adequate training will be necessary in skills of discriminatory judgement of sellers and in account settlement. When BSCIC will establish a system for the promotion of sub-contracting, it will be essential that adequate training be offered in sub-contracting procedure.

Many experts in this particular industrial sub-sector and investors are believed to be wrong target of promotional activities for the purpose of bringing a large number of small scale metal working/light engineering industries to rural areas, because they will naturally prefer to locate in the suburban areas close to a large market. It is believed worthwhile to try to find candidates who have little financial capabilities but ample eagerness to settle themselves in rural areas and to foster them as entrepreneurs through trainings in industrial technology and management skill.

Table 5.2.6 Summary of Recommendations on Managerial Support

Problem Area	Recommendation
1. Overall	- Establishment of the Management Training Institute.
	- Circuit on-the-spot advisory.
2. Accounting/cost management/financial management	- Preparation and extension of simple manuals for accounting/cost management/financial management at small scale enterprises.
3. Production management	- Preparation and extension of simple production management techniques including raw materials control and quality control.
4. Sales and marketing	- Preparation of simple check list on sales and markets.
	- Training of sales practice including management on accounts.
	- Training of sub-contracting methods.
5. Entrepreneurship development	- Special courses for the inexperienced with less own fund.

Source : JICA Team

5.2.7 Technical Support

Major problems of technologies of the existing metal working and light engineering industries have been discussed earlier in 4.4.1. This section attempts to design promotional measures for rectifying such problems and for further development of the industry. Major problem areas and proposed promotional measures are summarized in Table 5.2.7.

Table 5.2.7 Summary of Recommendations on Technical Supports

Problem Area	Recommendation
1. Level of Specific Technologies	- Skill training of workers. - Repair services for existing production facilities - Guidance in selecting appropriate production facilities and materials.
2. Engineering Design and Specifications	- Training in blue print reading. - Supplying technical drawings and testing specifications. - Subcontracting of spare parts based on technical drawings and testing specifications.
3. Production Technology	- Establishing demonstrative production units and in-plant training therein. - Technical guidance. - Common service facilities. - Product and production process development.
4. Quality Consciousness	- Laying down industrial standards and monitoring the quality of products. - Procurement by public agencies according to quality standards.
5. Specialization	- Guidance in selecting product mix. - Public enterprises to hand over some of their production activities to specialized small scale industries.

Source : JICA Team

(1) Upgrading Specific Technologies

Specific technologies refer to machining, casting forging, sheet metal work/ welding etc. Present status and problems of these technologies are discussed in 4.4.1.

The importance of training production workers may not need explanation. A number of training institutions exist in the Country which are imparting training courses for various trades at different levels. But graduates of these courses tend to work in large scale industries. Small scale industries in general cannot afford to send their workers to such courses.

Training courses of shorter duration, one or two weeks, which are tailored to problems and needs of selected small scale industries could be organized to supplement the existing training provisions. Target groups of small scale industries would be selected according to specific technologies they employ and the level thereof. Such courses would be conducted by itinerant instructors in a number of cities and towns. It is essential that such training courses are closely coordinated with extension services in order to identify problems and to provide follow-up guidance.

Most of production facilities of small scale industries are superannuated and poorly maintained. As a result, the operating precision and efficiency have deteriorated. In coordination with extension services, repair and maintenance services for the production machinery and facilities should be made more easily available to small scale metal working and light engineering industries at reasonable cost.

Guidance in the selection of appropriate production facilities and materials should be more actively provided.

(2) Promotion of Production according to Engineering Design and Specifications

Production activities of small scale industries are rarely undertaken according to technical drawings and testing specifications as pointed out earlier. In order to rectify such situation following measures are proposed.

Training courses would be conducted for workers of small scale industries on reading technical drawings. Such courses would be organized on itinerant basis and for short duration. Advanced courses would also be conducted which impart training for designing simple machine elements.

Technical drawings and testing specifications for selected products would be prepared by public institutions such as universities, research institutes and BITAC for use by small scale industries.

Increasing attention has been given to the promotion of linkage between small scale industries and public enterprises in which the latter let out production of spare parts and components to the former. Such sub-contracting should be based on technical drawings and product specifications.

(3) Upgrading Production Technology

As discussed earlier much more attention should be given to the importance of production technology. Following promotional measures are proposed in order to upgrade production technology of selected products. Such products would be selected from those identified in 3.3.1.

A government agency would establish pilot plants, or demonstrative production units, for the selected products and in-plant training would be imparted therein. Trainees would be selected from existing industries which produce a product similar to one demonstrated by the units and from those intending to start a new business in the same line.

Consultation and advisory services as well as extension services would be extensively provided to small scale industries.

Access to common service facilities would be made more easy to small scale industries. Such services would include production of specific components, or partial processing thereof, dies, jigs and fixtures which is beyond the capability of small scale industries.

Product and production process development would be undertaken by public institutions and the results would be made available for small scale industries to embark on commercial production.

(4) Promoting Quality Consciousness

In order to promote quality consciousness of producers as well as that of consumers, more efforts would be exerted by BLIS to lay down industrial standards.

The quality of products in the market would be monitored so as to ensure that the products are manufactured in conformity with the standards.

Public agencies and enterprises which procure products from scale industries would examine whether such products satisfy quality standards set in advance.

(5) Promoting Specialization of Industrial Units

Upgrading technology of individual firms can be more effectively achieved by encouraging the firms to specialize in a certain line of technology. Such specialization would also be effective to increase the utilization of capital equipment.

In order to encourage the specialization, existing industries and prospective investors would be advised by extension service institutions in selecting their product mix.

Production activities of public enterprises would be reviewed with view to handing over some of their activities to specialized small scale industries or to those which have intention of specialization.

5.2.8 Miscellaneous Recommendations

One method of strengthening the foundation of small scale industries is for similar industries to combine themselves into cooperative activities and for industries with a strong linkage to integrate their efforts, thereby expanding the unit of their production (see Figure 1.2.1). Metal working/light engineering industries, some of which are minute in size and operate with outdated machines and equipment, should expand their scale of operation and modernize themselves under this method.

In practical terms, it is recommended that a manufacturers' cooperative be established and that the industries own and operate cooperative workshop(s) and accomplish raw materials purchase, product shipment, and marketing in joint operation. One example would be a cooperative of blacksmiths who have entrepreneurship; they can be developed into small scale metal working/light engineering industries through such cooperative activities.

A high priority should be given to the provision of funds to such business co-

operatives for the construction of their joint-use buildings and facilities. The industries should not be allowed to make disorderly entry into the new metal products markets to be opened through the establishment of a sub-contracting system, but they should be directed to make such entry in a cooperative manner while standardizing their product quality.

The existing products of metal working/light engineering industries are mostly a dead copy of imports or made to traditional design or function, as these industries are little eager to develop new designs and prototypes. However, a small number of them have started to make such developmental efforts. It is recommended that their efforts be much encouraged and fostered along with the efforts of public research organizations. This can be accomplished through, for instance, the financing of and the provision of technical advices on designing and prototype development.

Table 5.2.8 Summary of Recommendations on Other Items

Problem Area	Recommendation
1. Manufacturer's cooperative	- Financial measures to promote formation of manufacturer's cooperatives. - Formation of sub-contractor's cooperatives.
2. Design and prototype development	- Financing design and prototype development activities. - Technical advisory on design and prototype development.

Source : JICA Team

5.2.9 Summary of Recommendations

The foregoing discussions identify important problems faced by the small scale metal working and light engineering industries and recommendations pertinent to solution of those problems. There are four important aspects of problems to be closely looked into; the financial aspect, the raw materials supply aspect, the marketing aspect and the technological aspect.

(1) Financial Aspects

The followings are major problems and corresponding recommendations in the financial aspects:

- A problem of loan unavailability:
  Allocation of a certain percentage (say 7.5 to 10%) of total small scale loans to metal working and light engineering industries.
- A problem of out-dated machinery and equipment:
  Allocation of fund for small scale industry development to a machine and equipment modernization program.
- A problem of slow and time-consuming loan processing and appraisal:
  Decentralization of loan appraisal and sanction powers.
- A problem of lack of working capital:
  A special loan system and a credit insurance machinery for working capital borrowing.

These problems are more or less connected with the banking business and recommendations with improvement of their operation. The banking institution should realize that, although a small scale industrial project is not profitable in view of the fact that almost same amount of efforts is required for loan processing and sanctioning as for medium and large scale industries, the national social and economic benefits which the Bangladesh economy will gain as a whole will eventually compensate by far the banks for the low profitable operation in this regard.

A training program of bank employees in this specific field will be implemented as a part of the Third Small Scale Industry credit program funded by IDA. This is expected to substantially reinforce the existing capability of the banks.

(2) Raw Materials Supply Aspects

A number of problems are overlapped to result in an extremely difficult situation of raw materials supply.

- A problem of inefficient, inproper and untimely foreign reserve allocation:
  Streamling the allocation procedures with emphasis on importation of

essential industrial raw materials such as steels, pig iron, coke and small machine parts.

- A problem of excessively high prices of raw materials:
  The Government's control on import duties imposed on metal raw materials and on domestic market prices of these materials.

- A problem of working capital shortage frequently taking place when industrialists want to import raw materials:
  Establishment a special loan system and a credit insurance machinery (refer to the fourth recommendation indicated in the "Financial Aspects").

These problems will be successfully dealt with through practical policy and regulatory measures, if the Government is determined to do so. The Survey Team observed that raw materials supply situation, in particular, supply of proper types of steels and iron, has become aggravated and feared that this would hamper due development of small scale metal working and light engineering industries.

(3) Marketing Aspects

Manufacturers in Bangladesh, by and large, try to create the seller's market in order to control prices of their products and so attain highest profitability for smaller production. Under these circumstances, manufacturers tend to be in negligence of product quality improvement and reduction of production costs.

- A problem of lack of product standardization:
  Establishment of industrial standards even for small metal products and light machinery.

- A problem of unavailability of market and product information:
  The Government's initiative to hold exhibitions and displays of the products concerned and to disseminate product and market information through a centralized or local machines.

- A problem of lack of innovative and improved design of tools, implements and machinery:

Establishment of the patent and design registration system and a centre for industrial design and/or prototype development.

At this stage of marketing development, it is necessary for the Government to enlighten both the manufacturers and the consumers to follow a principle of "better quality at a reasonable price or cost".

(4) Technological Aspects

The prime sources of technological backwardness of small scale metal working and light engineering industries in Bangladesh include the following:

- A problem of low level of specific technologies:
  Advisory on proper selection, use and maintenance of machines and equipment. Training of workers in proper machine handling.
- A problem of negligence of engineering design and specifications:
  Training workers in blue print reading and in manufacturing in conformity with technical specifications.
- A problem of low production technology level:
  Establishment of a demonstrative production units where on-the-job training can be carried out. Establishment of a product and production process development centre.
- A problem of lack of quality consciousness:
  Establishment of industrial standards and quality standards of a certain products with testing methods thereon (refer to the first recommendation indicated in the "Marketing Aspects").
- A problem of unnecessary integration:
  The promotion by the Government to specialize in a certain fields of the metal working and light engineering sub-sector, for example, foundry, machining, forging, heat treatment, electroplating and so forth.

The above problems will be ideally solved by establishing an organization which conducts production demonstration, on-the-job or in-plant training, prototypes and their production technology development, and advisory and guidance on

technical problems.

Every problem stated above is equally important in itself. Judging from the viewpoints of how directly these problems are related to slow development of the metal working and light engineering industries within the existing machinery of the industrial system in Bangladesh, however, the financial and technological aspects should deserve priority attention.

The financial problems seem less pressing in view of the IDA project being gradually but steadily implemented. Once that the banks start the operation with their positive determination, these problems will be solved with relative ease.

The technological problems are crucial to product quality, productivity and costs of products. It is consequently recommended that intensive Government efforts be directed onto consolidating "production technology development activities" by either/both strengthening the existing facilities or/and establishing newly an organization solely devoted to these purposes.

The remaining problems of the marketing and raw materials supply aspects are by no means less important, though they are less directly related to development of the industrial sub-sector. Without solving these problems, any success in achievement of the final objectives will be difficult. It is, therefore, recommendable that the public authorities concerned should look into these problems in detail and take decisive and practical measures to improve the situation.

In should be emphasized that development of small scale industries will not be easily carried out through mere solving each problem listed heretofore. A major part of these problems are, to varied degrees, interrelated and effective policy measures could only be implemented through an integrated approach of the problem solving.

A separate small and cottage industry wing preferably be established as proposed by BSCIC, in which a basic policy of small and cottage industry development is to be formulated, and effective and integrated policy measures are to be drawn up.

The entire implementation process of these policy measures should include the following procedures:

- Cross-checking of linkage and inter-relationship of each policy measures,
- Setting up selection criteria,
- Giving priority to measures which need early implementation, and
- Assigning organizations or institutions pertinent to the problem solving.

Thus embodiment of the recommendations afore-mentioned in 5.2 could be better managed under one jurisdiction. Every effort should be coordinated and directed toward integrated solution of problems by the agency.

Although priority has been given to solving technological problems, which need urgent attention at this moment, it must be remembered that this constitute only a part of the developing activities.

CHAPTER 6 MEASURES FOR PRODUCTION TECHNOLOGY DEVELOPMENT

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6.1 A NEW ORGANIZATION FOR PRODUCTION TECHNOLOGY DEVELOPMENT

6.1.1 Elements of Production Technology Development and Transfer

The most urgently demanded for the development of small scale metal working/ light engineering industries is the improvement, development, and transfer of production technology, as it was pointed out under 5.2 above. Prime elements of the accomplishment of this are:

- Demonstration of production
- Technical training
- Technical consultation and advisory services
- Technology extension
- Special parts and components supply to the industries
- Product development and modification, products standardization, and production technology development.

If, for the purpose of this Study, production technology is interpreted to include entire modern know-how for the production of high quality products with a low cost, the transfer of such technology to small scale industries will entail not only the demonstration of and training in such established technology, but also consultation and extension for the introduction of new technology as it develops. If parts needed for the production of such high quality products cannot be self-produced and -supplied, they must be procured from outside sources. After certain technology has been completely transferred, other new products and their production technologies must now be developed. Thus, the transfer of production technology is to be repeated, thereby continuously improving the technical standard of small scale metal working/ light engineering industries and, ultimately, the entire mechanical industries of Bangladesh. The production of agricultural machines and equipment of high quality, as the result, will greatly contribute to the improvement of agricultural productivity.

The level of production/process know-how of small scale metal working/light engineering industries of Bangladesh is low, the quality of their products is inferior, and it is required that entrepreneurs even with less experience in this sub-sector be invited to enter into this industrial sub-sector. For these reasons, to be launched first would be a program for production demonstration and technical on-the-job training. The above-mentioned prime elements will probably be materialized in the order presented in Table 6.1.1.

Table 6.1.1 Sequential Realization of the Prime Elements of Production Technology Transfer

Phase I	Phase II	Phase III
. Demonstration of the advanced production technology	. Technical consultancy and advisory services	. Supply of specific parts and components*
. On-the-job training	. Technical extension services	. Products and production technology R&D**

Source : JICA Team

* : Maybe implemented in the Phase II.

** : Including standardization of products and machinery.

6.1.2 Related Organizations

A number of organizations exist in Bangladesh for the improvement, development, and transfer of metal working/light engineering technology, but they do not necessarily satisfy all of these elements.

These organizations which now exist include BITAC, BCSIR, TTCS, BADC Workshops, and agricultural research institutes -- BARI, BRRI, and CEDRI.

(1) BITAC

BITAC was established for the purpose of facilitating the improvement of industrial productivity through the provision of (i) advanced technical training,

(ii) the training of mid-level or lower technical manpower, (iii) advisory services to factory personnel, and (iv) the introduction and extension of technical know-how. The Survey Team visited BITAC in Dacca and Chittagong and observed that BITAC was engaged in few activities for small scale industries, but mostly in the following activities:

- Production of tools, dies, and parts for nationalized or large private corporations: Dacca and Chittagong.
- Development of simple prototype machines: Chittagong
- Technical training of skilled workers of chiefly large or medium sized enterprises: Dacca.

Machines installed at BITAC are mostly large and sophisticated--the utmost of which are jib boring machines and jib grinding machines--which are hardly suitable for the training of small scale industrial workers. Some small scale industries will be engaged in the production of precision parts when a sub-contracting system has been developed, but they will still represent rare exceptions among small industries.

In addition to those in Dacca and Chittagong, BITAC is now having a factory under construction in Chandpur. It also has a plan for the establishment of a technical training center in Bogra. BITAC Chandpur was initially established as a BSCIC's agricultural tools and implements production project and was subsequently transferred to BITAC and expanded to have the similar functions as those in Dacca and Chittagong (more on this under 6.1.4).

(2) BCSIR

The purpose of BCSIR establishment included (i) scientific and technological research to support industrial development, (ii) allocation of science and technology research funds to universities, (iii) commercial application of the results of basic research, (iv) collection and dissemination of scientic and technological information, and (v) the maintenance of liaison with relevant foreign organizations. Research laboratories are located in Dacca, Chittagong, and Rajshahi and they cover the following areas of activity:

- Exploitation and processing of domestic primary resources
- Utilization of industrial by-products
- Effective utilization of domestic food resources
- Development of medical utilization of herbs
- Effective utilization of domestic energy resources
- Development of appropriate technology and adaptation of imported technology.

For agro-related industries, BCSIR is engaged in research in the areas of food processing, the conversion of agro-products to energy, and the processing of herbs for medical use, but not so much in the improvement of existing processes and equipment -- that is, BCSIR has not quite reached the level of hardware studies and prototype development.

(3) TTCs

The role of the Technical Training Centres is to teach and instruct techniques which are applicable not to any particular products but to multiple purposes. The existing TTCS' carricula chiefly aim at the training in basic metal working and the manufacturing and repairing of machinery, and TTCS have not quite started training in technology for the production of machines of high quality and parts and components of high precision at a reasonable cost.

TTCs have been and is effective in the improvement of the bottom level of industries in Bangladesh, and some other organization should be looked for the purpose of providing technical training directly useful in production.

(4) Agricultural Research Organizations

BARI, BRRI, and CERDI play different roles in agricultural research and development but they are engaged chiefly in development, improvement, and extension of agricultural tools, implements, and equipment, namely:

- Cultivation, seeding, harvesting, and other farming machines and equipment.

- Post-harvesting technology

- Equipment for utilization of agro-waste (e.g. biogas)

Of them, BARI is the only organization which is engaged in the actual production of machines and equipment. When BARI's Engineering Division will be moved from the current location in Dacca City to its headquarters in Joydebpur, BARI, too will discontinue production activities and concentrate on research and development.

(5) BADC Workshop

BADC has been and is building workshops for the production and repairing of small agricultural implements and machines and irrigation equipment in rural areas. These activities aim at the improvement of regional self-supply of such equipment, the provision of information and training on such equipment to the rural inhabitants, and to demonstrate how to manage and operate these workshops to private entrepreneurs.

The location of these workshops is determined in consideration of the estimated size of market, and BADC (and/or other organizations) buys the workshop products whose quality meets certain standard and distributes them to farmers. In order that these products will have an assured level of quality, the establishment of product specifications and products standardization have been advocated. Plans have been made for extension of, and the provision of necessary training in the use of these workshop products to help farmers effectively utilize the equipment distributed to them. Now under consideration for the purpose of fostering entrepreneurs who will establish and operate such workshops in rural areas is to provide village artisans and skilled workers with tools and machines and have them produce and repair small agricultural equipment.

Construction of about 250 workshops, one for each Thana, by the final stage of the Second Five Year Plan has been considered. Of these workshops, it is possible that those which will be located in districts/sub-divisions will utilize the facilities of existing BADC workshop and/or private industries. A similar project has been implemented by IRDP under the cooperation of IDA, and the Survey Team

visited one of the workshops in the vicinity of Comilla.

The BADC project involves two problems:

a) The problem of management responsibility: if BADC will take initiative for the building of workshops, it is questionable as to how the management responsibility can be transferred to a private party and who will actually finance the transfer of ownership to private sector.

b) The problem of back-up support: question as to how the production technology of each workshop can be elevated and how products can be standardized, and who will develop new products.

In order to answer these questions, it should be advisable that these workshops be regarded just as small scale metal working/light engineering industrial units.

6.1.3 Related Organizations under Planning

(1) Institute of Appropriate Technology (IAT)

The 1977 Conference of the British Commonwealth of Nations proposed the establishment of a center for the study of appropriate technology in each member nation. BUET was the central organization in Bangladesh in the formulation of framework for such a center, and a project proforma was submitted to the Government in 1978 and was revised and resubmitted in 1979. The purpose of establishment of this center is to achieve:

- Identification of appropriate technology for Bangladesh.
- Research and development of appropriate portotype and models.
- Consolidation of similar domestic activities into organized netowork.
- Education and training, at appropriate levels, of people from relevant fields.
- Provision of advices and consultation in relevant fields.
- Role as center for the dissemination of domestic and international information.

- Joint research with and the maintenance of liaison with similar foreign organizations.
- Promotion of conferences, seminars, and workshops.

Under the current plan, IAT is to be created within the compound of BUET, but it has been proposed that IAT be made independent at some other location and have a number of regional coordination centers.

IAT research will cover wide areas of agriculture, irrigation, energy housing, health, education, traffic, industry, water sources, and so forth, and research subjects will be selected from the standpoints of improvement of domestic and imported technology, new technology development, and extension and adaptation of technology.

The purpose of IAT establishment and its research subject will be in conformity with the needs of Bangladesh, but research will cover excessively wide areas in much duplication with other government research institutions and will require a substantial amount of budget, even if BUET facilities will be used in the initial stage. Therefore, IAT should start to function as an information agency pertaining to appropriate technology, conducting necessary coordinations, and should, in the future, be engaged in research in areas not covered by other organizations or in areas where the national priority is given.

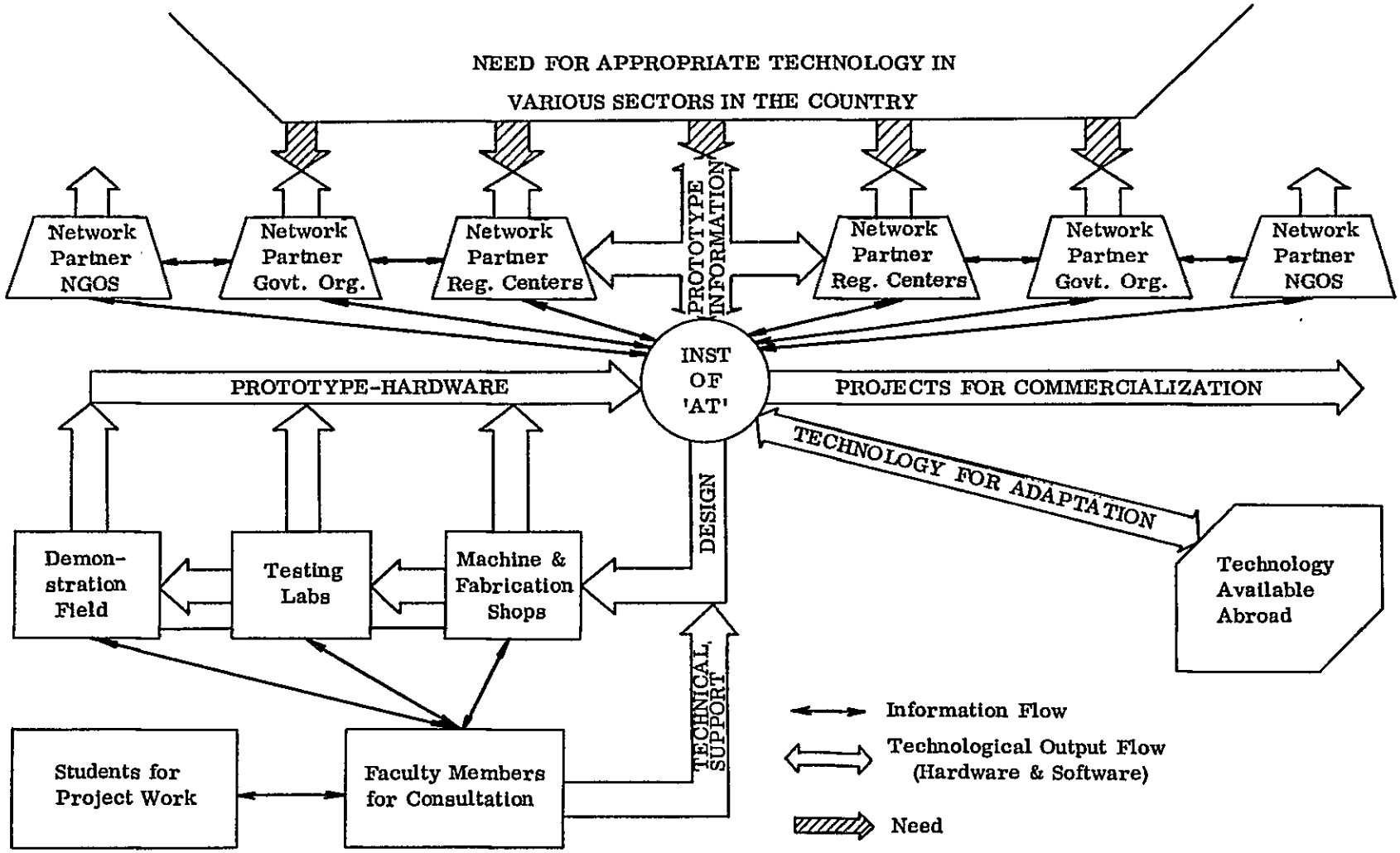
(2) Prototype and Product Development Centre (PPDC)

BSCIC has been engaged in the development of prototypes and designs for cottage industry, but not for modern small scale industries in absence of the manpower and facilities needed therefor.

PPDC has been therefore planned to fill this gap by performing the following function:

- Collection of information pertaining to existing products, design, and production/process technology
- Design and product/prototype development for the purpose of product quality improvement

Figure 6.1.1 Activities of the Institute of Appropriate Technology



Source : BUET

- Research into existing and new appropriate technology for small scale industries
- Extension of technology, design, and products.

Following are possible examples of products to be handled by PPDC:

- Light engineering products
- Processed agro-products
- Processed/preserved food
- Building materials
- Textiles and garments

The physical structure of the center which, under the plan, will be located in Dacca, will consist of (i) administration/demonstration building with a floor space of 3,300 square feet, and (ii) a workshop with a floor space of 4,000 square feet. The implementation of this project will involve the following problems:

a) The number of products/prototypes subject to study is too large to be dealt with by one relatively small establishment.

b) The center, whose major activities will be research and development, will not perform any role in technical training.

c) Some research and development fields overlap with those of other research institutes.

Therefore, the project will be more effective if implemented with an initial program centering around selected important research and development fields only.

6.1.4 BITAC Chandpur

BSCIC (then BSIC) started on Agricultural Implements Pilot Project (AIPP) in Chandpur in 1961/1962 for the purpose of producing improved new agricultural tools and implements at a low cost and of supplying them to farmers. However, this project was transferred from BSCIC, which lacked the needed manpower, funds, and technology and therefore could not finish the project, to BITAC in 1978.

BITAC made a plan of investing Tk. 14,610,000 in addition to the already invested Tk. 1,388,000 in order to accomplish different tasks, namely:

- Production of precision parts, tools, dies, jigs, fixtures, and molds, and development of metal working methods.
- Formulation and execution of advanced technical training programs.
- Production of agricultural tools and implements.
- Technical consultation and advisory services.
- Extension of production technology
- Advising on the technical training of existing metal processing industries.
- Supply of parts of and repair of marine engines for inland waterway transport.

The physical structure of BITAC Chandpur consists of machine shop, foundry shop, wood pattern shop, heat treatment shop, surface treatment shop, marine engine repair shop, agricultural implements manufacturing shop, and a building for administration and research and development. Most of these shops will be completed in 1980.

While BSCIC's intension of initiating this project is unknown, production of agricultural implements in Chandpur must have been considered unfeasible from the beginning because (i) nearby markets were small, (ii) production of agricultural implements had already started in a nearby area, namely Comilla, and (iii) supporting metal working industry was non-existent. In other words, selection of Chandpur over other more suitable locations was a failure and, therefore, the project had to be finally transferred to BITAC.

BITAC Chandpur in its new status is not without problems; there is no large factory other than nearby jute mills to which it may supply parts, the repair of low lift pumps needed for the irrigation project is accomplished by workshops located on the project site, and, therefore, the major activities of BITAC Chandpur will have to be the supply of parts and repair of marine and automobile engines. Then, the large machines and equipment in which investment has already been made will probably remain much idle. When this kind of investment is to be made, market needs

must be well defined and estimated in advance.

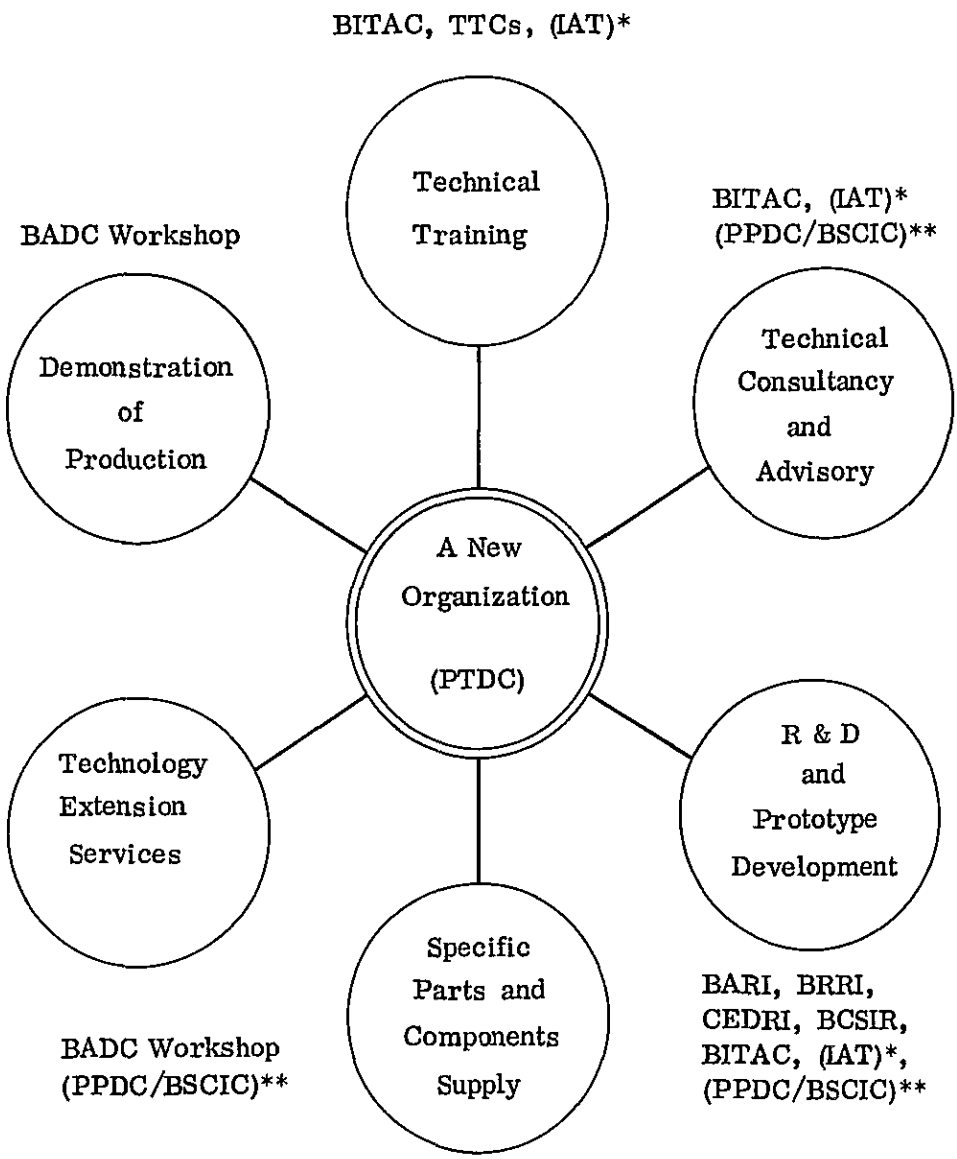
6.1.5 Need of a New Organization

None of organizations which exist or which are under planning will be able to satisfy all of the elements (see under 6.1.1) needed for the improvement of the production level of small scale metal working/light engineering industries in Bangladesh (see Figure 6.1.2 below). It will be necessary that a new organization be established with capabilities to demonstrate production activities to entrepreneurs and to offer technical training on the production of high quality products.

This organization should be unique in that it will offer technical back-up support not only to private industries but also to BADC workshops and provide training on technology which is directly coupled with production -- the training which TTC would not be fully capable of providing. The most effective method of training will be on-the-job training in the process of producing standardized metal products/light machinery which are currently in greatest demand (detail contents of the training to be discussed separately).

This new organization may be tentatively called a "Production Technology Development Centre for Small Scale Industries (PTDC/SSI)". Whether given an autonomous status or made a part of some existing organization, PTDC/SSI is to concentrate on the provision of assistances for the development of small scale metal working/light engineering industries.

Fig. 6.1.2 Elements of Production Technology Development and Transfer



(Source) JICA Team

* IAT : Institute of Appropriate Technology.

** PPDC/BSCIC : Prototype and Product Development Centre proposed by BSCIC.

6.2 PRODUCTION TECHNOLOGY DEVELOPMENT CENTER

6.2.1 Objectives and Scope of Activities

Priority must be given to the improvement and development of production technology, if small scale metal working/light engineering industries are to be developed in Bangladesh. Such technology development is beyond the capability of any of existing organizations, and a new organization which may be called a "Production Technology Development Center (PTDC)" must be established. In view of the study findings in the above, the purpose of establishment of this Center should include:

a) To improve the design and quality of products of small scale metal working/light engineering industries including agricultural tools, machines, and implements, which are vital to the development of Bangladesh.

b) To supply a large number of skilled workers to these industries for their technological improvements.

c) To facilitate the entry of private entrepreneurs into this industrial sub-sector.

d) To modernize this sub-sector by introducing the concepts of production management and quality control as well as of standardization, into the operation of these industries.

To achieve these purposes, PTDC will be engaged in (i) production demonstration, (ii) technical training, (iii) technical consultation and extension, (iv) research and development, and (v) the supply of special parts.

(1) Production Demonstration

Certain selected products will be manufactured at the Center in order to provide reference information for the improvement of facilities and production processes of the existing small scale metal working/light engineering industries and to help entrepreneurs considering entry into this industrial sub-sector understand the required production facilities and processes.

The manufactured products will be marketed through commercial distribution channels, a special channel to be opened for this particular purpose, and/or some of nationwide public channels (such as BADC route). Sales revenue will be used to pay a part of operational expenses of PTDC.

(2) Technical Training

PTDC will first train government officers (not limited to BADC employees but including local officers such as those of BSCIC District Offices who are engaged in extension and guidance services and the instructors of TTC and VTI) and, in the future, offer retraining of skilled workers of small scale industries.

Training by lectures will be limited to a minimum, and the training will be accomplished predominantly by placing trainees on the job for the acquisition of various production techniques and production management science. Therefore, candidate trainees will have to be screened carefully by a high standard and will probably be limited to those who have had certain amount of industrial experiences.

(3) Technical Consultation and Extension

The Center will advise existing industries on the solution of their problems and on the method of modernization. For new industries, advices will be given on technical management matters. As an extension service, circuit advisors from PTDC will give on-the-spot technical advices.

The subjects of these consultation and extension services will include:

- Product identification
- Market evaluation
- Product pricing policy
- Raw materials supply
- Factory site/location
- Machines and equipment selection
- Factory layout
- Raw materials and parts inventory
- Production process
- Production management and quality control

- Machines and equipment maintenance
- Production cost control
- Product packaging and shipment
- Servicing and repairing system

(4) Research and Development

Another important activity of PTDC will be prototype development and process technology development. However, as it was observed under 6.1, this activity will most probably start only when PTDC has become capable of providing the services of (1) through (3) above on regular basis. Because actual needs for agricultural tools, machines, and implements may not be easily identified and defined by non-agricultural people, and because the testing of their prototypes represents and development of these products should be left up to such agricultural research organizations as BARI, BRRI, and CERDI. The role of PTDC in this area will be to obtain the developed prototypes and to develop technology for their industrial production. With regard to the development of prototypes of other (to non-agricultural use) metal products, care should be used so as that the efforts will not duplicate efforts of other similar public research and development institutions such as BCSIR and BUET. Here again, PTDC should probably concentrate on the establishment of production technology for prototypes developed by other institutions.

Production standardization is another important role which PTDC can play in this area. The prescription of required material specifications and product measurement and tolerance will enable the guaranteeing of a uniform quality of the product and will result in increased buyer confidence in the products of small scale industries and possible consequential expansions of their markets.

(5) Special Parts Supply

When at least one each production base and repair-cum-production base have been established in each Thana, as envisaged under 5.1, it is unbelievable that all of these bases will be fully equipped with adequate and modern facilities and technology to produce and self-supply special parts and components. Then, PTDC may facilitate the assemblying activities of such bases by supplying the parts and

components on temporary basis. Over a long run, however, some specialized base in the same or adjacent sub-division will eventually start supplying such special parts and components, thereby strengthening industrial linkage.

6.2.2 Organization and Personnel

PTDC organization should be developed gradually in pace with the expansion of its activities. It should be desirable that PTDC start with production demonstration and on-the-job training (Phase 1) and, after this initial stage, start offering technical consultation and extension services (Phase 2); when the Center has acquired capability to carry out these activities on regular basis, it should finally begin efforts on research and development (Phase 3).

The ultimate organization of PTDC will include the following five departments (See Figure 6.2.1):

(1) Administration Department

(2) Training Department

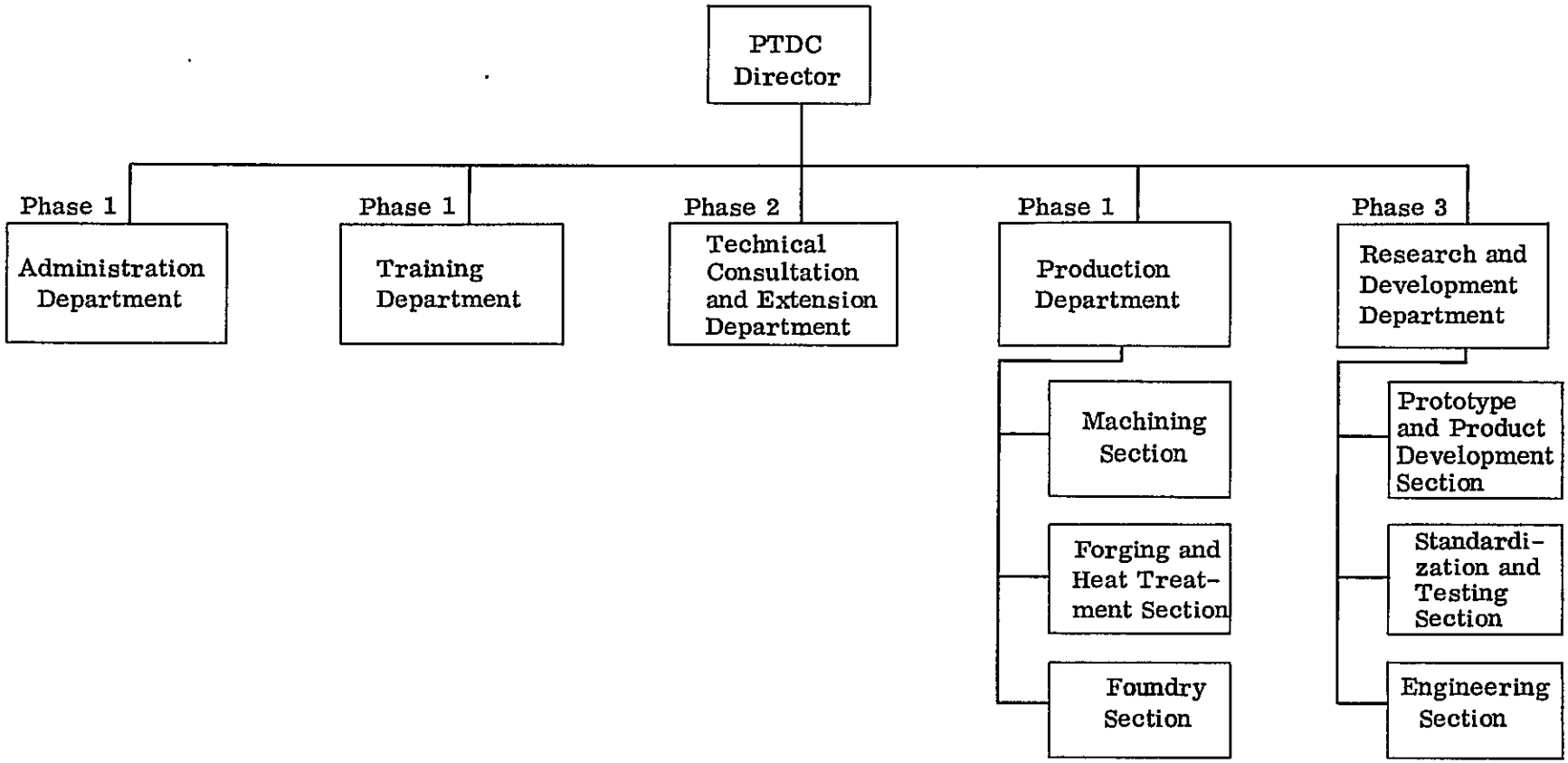
(3) Technical Consultation & Extension Department

(4) Production Department
- Machining Section
- Forging & Heat Treatment Section
- Foundry Section

(5) Research & Development Department

The Production Department will require a strength of over 90, and, therefore, the ultimate size of the total PTDC staff will be about 160. Approximate number of personnel required for each department is shown by profession in Table 6.2.1.

Figure 6.2.1 Organization Chart of the Proposed PTDC



Source : JICA Team

Table 6.2.1 Proposed Employment at PTDC

Department	No. of Employment	Profession and Specialty	
1. Administration	32	. Director	1
		. Associate Director (Chief Engineer)	1
		. Estimator	2
		. Designer	2
		. Labour & Administrative Officer	1
		. Senior Accountant	1
		. Cashier	1
		. Store Officer	1
		. Draftman	2
		. Stenographer & Typist	4
		. Senior Clerk	2
		. Telephone Operator	1
		. Driver	3
		. Storekeeper	1
		. Junior Clerk	2
		. Peon, Sweeper, Guard	7
2. Training	6	. Senior Training Officer	1
		. Machine Shop Instructor	3
		. Forging & Heat Treatment Instructor	1
		. Foundry Instructor	1
3. Technical Consultation and Extension	6	. Senior Engineer	3
		. Engineer	3
4. Production	98	. Senior Engineer	3
		. Engineer	3
		. Foreman	6
		. Machine Operator, Welder, Carpenter, Foundry Worker, Wood Pattern Worker, etc.	77
		. Peon, Sweeper, Guard	9
5. Research and Development	15	. Senior Engineer	4
		. Engineer	6
		. Research Assistant	5
Total	157		

Source : JICA Team

6.2.3 Management and Operation

PTDC will be established as an instrumentality of the Ministry of Industries, and its status will be one of the following three:

a) A function of BSCIC

b) A function of BITAC

c) An autonomous organization on an equal level to BMDC and BITAC.

It is quite possible that it will be made an autonomous organization, because BSCIC is short of engineers, technicians, and skilled workers -- not to mention industrial manager -- needed to operate PTDC and, in addition, has a failure record with regard to the operation of BITAC Chandpur, while BITAC, which will be capable of operating PTDC, is unexperienced in small scale industries and, therefore, is unsuitable, with its current operational set up, for the accomplishment of demonstration, technical training and consultation, and research and development for such industries.

BSCIC is advocating the establishment of a Prototype and Product Development Centre (PPDC), as discussed under 6.1. PTDC is compared against the proposed PPDC (whose problems were discussed under 6.1) in Table 6.2.2.

Prerequisites which must be satisfied in order that the management and operation of PTDC will be successful are discussed hereunder.

(1) Periodical Review of Product Items

PTDC is to engaged in productive activities as a means of demonstration and training for the ultimate objective of successful technology transfer. The development of new products and their production technology, and exploitation of their markets is an important role which PTDC is to play. When the transfer of certain technology has been completed and the market fully developed, PTDC is to start the same efforts on a next product. Therefore, it should continue to monitor the progress of technology transfer and market development with regard to each product for periodical evaluation to determine the appropriate timing for the discontinuation of production of each item and for starting efforts on a new item. Sources of information for the selection of such new products are:

Table 6.2.2 Comparison of PTDC and PPDC

Item	Production Technology Development Centre Proposed by JICA Survey Team	Prototype and Product Development Centre Proposed by BSCIC
1. Objectives of Establishment	. Production demonstration . Technical training . Technical advisory, consultancy and extension services . Research and development of prototypes and products . Specific parts and components supply	. Collection and dissemination of existing product design, production technology . Research and development of new prototypes and products . Research on appropriate technology . Technical extension services
2. Fields to be Covered	. Metal working and light engineering including: * Pedal threshers * Paddy weeders * Grain dryers * Push carts * Wheel barrows * Irrigation pumps * Saw sickles * Pipe fittings * Others	. Light engineering . Agro-animal-forest and their waste based industries . Food preservation and storage . Consumer goods, wood, oil, leather, clay, hand made paper, bricks, tiles, spinning, weaving and tailoring . Repair and maintenance workshop . Household industries (cottage industries)
3. Organizational Status	. Either under BSCIC or BITAC . Autonomous status under Ministry of Industry (in future)	. Under BSCIC
4. Location	. Joydebpur	. Dacca

(Continued)

Item	Production Technology Development Centre Proposed by JICA Survey Team	Prototype and Product Development Centre Proposed by BSCIC
5. Physical Plan	. Land: Approx. 3.7 Acre . Building: * Administration 5,814 sq.ft. * Machine shop 16,667 sq.ft. * Forging & heat treatment 3,333 sq.ft. * Foundry 3,333 sq.ft. * Godown 2,222 sq.ft. * Hostels & others 7,000 sq.ft.	. Land: Approx. 0.33 Acre . Building: * Administration (incl. demonstration) 3,300 sq.ft. * Workshop 4,000 sq.ft.
6. Total Investment	. Tk. 42,700,000	. Tk. 10,880,000
7. Total Employment	. Approx. 160 (Final Target)	. 47
8. Organizational Structure	. Administration Dept. . Training Dept. . Consultancy & Extension Dept. . Production Dept. * Machining Section * Forging & Heat Treatment Section * Foundry Section . Research & Development Dept.	(Not available)

Source : Compiled by JICA Team

- Relevant foreign organizations
- Domestic agricultural research organizations (BARI, BRRI, CEDRI)
- Other relevant domestic organizations (BCSIR, BUET, IAT)
- Results of own research and development

(2) Demarcation of Research and Development Fields

Major functions of PTDC will include not only prototype and product development but also the development of technology for the production of the developed product, as discussed under 6.2.1. Therefore, with regard to agricultural tools, machines, and implements and other products whose development is being attempted by a large number of research organizations, PTDC should concentrate not on the development of such products themselves but on the development of technology for their production.

Research and development fields unique to PTDC are numerous and include transportation equipment, light processing machinery for agro-products, cutlery, and (non-agricultural) tools.

(3) Stable Supply of Materials

Raw materials, or ordinary and special steels, pig iron, cokes, and machinery spare parts in particular, must be supplied on a stable basis, if production and training activities of PTDC are to be successful. In view that most of these raw materials will have to be imported, adequate foreign currency allocation and import licence should be made available to PTDC. In other words, PTDC should be treated just as BITAC is being currently treated.

(4) Training Incentive

While no particular incentive needs to be offered for the training of government personnel and TTC instructors, adequate incentive should be offered trainees from small private enterprises in order that the training will be attractive to both their employers and the trainees themselves. Following incentive measures are proposed:

- Government subsidy under which training will be offered for free or a very low tuition.

- PTDC payment for the cost of living of trainees from private enterprises during the period of training.
- The issuance of skill certificates to those who have completed the training course.
- Preferential commercial bank loan opportunities for the employers of the trainee.
- Qualification of such employers for applying the sub-contract business.

(5) Higher Wages

Wages stipulates by the Public Pay Scale for the competent engineers and skilled workers required for PTDC are lower than private wages available to them and, therefore, should be improved to approach the private wages in order that PTDC will be able to recruit such necessary manpower.

(6) Linkage with Financial Institutions

Applicants for the loan of small scale industrial development funds of IDA and ADB should be directed by the commercial bank outlet to visit PTDC to observe the demonstration and to receive advices on facilities and equipment and production processes and those who visit BSCIC for consultation be advised of the PTDC activities in order that a proper linkage will be established between financial and information services for small scale metal working/light engineering industries.

PTDC will be established for multiple purposes, and the development of its functions should be phased under a program such as presented in Table 6.2.3.

Under this phased program, the functions of PTDC will be completed in Phase III, after which PTDC is expected to have stable foundation for desired operation. The initial production activities of PTDC will be limited to the existing products whose quality urgently needs to be improved or which have a relatively large potential market. Typical of such products are shown in Table 6.2.4.

Table 6.2.3 Operational Plan of PTDC

Plan Items	Phase I	Phase II	Phase III
1. Demonstration of Production	. Test run of machinery and equipments . Trial production of selected products . Testing and inspection of raw materials and final products	. Full scale production . First review of product lines . Establishment of simple quality control system . Establishment of machinery maintenance system	. Second review of product lines
2. Technical Training	. Training of PTDC staff of the Production Dept. . Training of government officers and TTC instructors	. Training of skilled workers from small scale industries	
3. Technical Consultation, Advisory and Extension		. Technical consultation and advisory at PTDC . Circuit on-the-spot advisory	. Extension services on new products and production technology
4. Research and Development		. Collection of information on new products	. Prototype and new products development . Fabrication technology development . Standardization study . Dissemination of information on new products and their production technology
5. Specific Parts and Components Supply	(. Construction of production bases* and repair-cum-production bases*)	. Manufacture and supply of specific parts and components	. General transfer of PTDC's part supply capacity to selected production bases*

Source : JICA Team Note : * Refer to 5.1

Table 6.2.4 Proposed Production Items for Demonstration at PTDC

Technology / Production Items	Foundry	Forging	Heat Treatment	Machining	Sheet Metal Working	Welding	Wood Working	Assembly
Pedal Threshers	O		O	O	O	O	O	O
Paddy Weeders	O				O	O	O	O
Grain Dryers	O			O	O	O		O
Push Carts					O	O		O
Wheel Barrow					O	O		O
Saw Sickles		O	O					
Irrigation Pumps	O		O	O				O
Malleable Iron Pipe Fittings	O			O				

Source : JICA Team

6.2.4 Location, Building, Machinery and Equipment and Investment

(1) Location

Under the belief that the location of PTDC should satisfy the following conditions, it is recommended that it be located in the vicinity of Joydebpur:

- That it must be within the four Sub-Divisions under study.
- That it is close to BSCIC and agriculture and other research institutions.
- That it is close to some existing small scale metal working/light engineering industries.
- That transport, communication, electric power, and other infrastructure is available.
- That the recruiting of engineers and skilled workers will be easy.
- That it is a central location for the convenience of gathering trainees from all over the Country.

(2) Land and Building

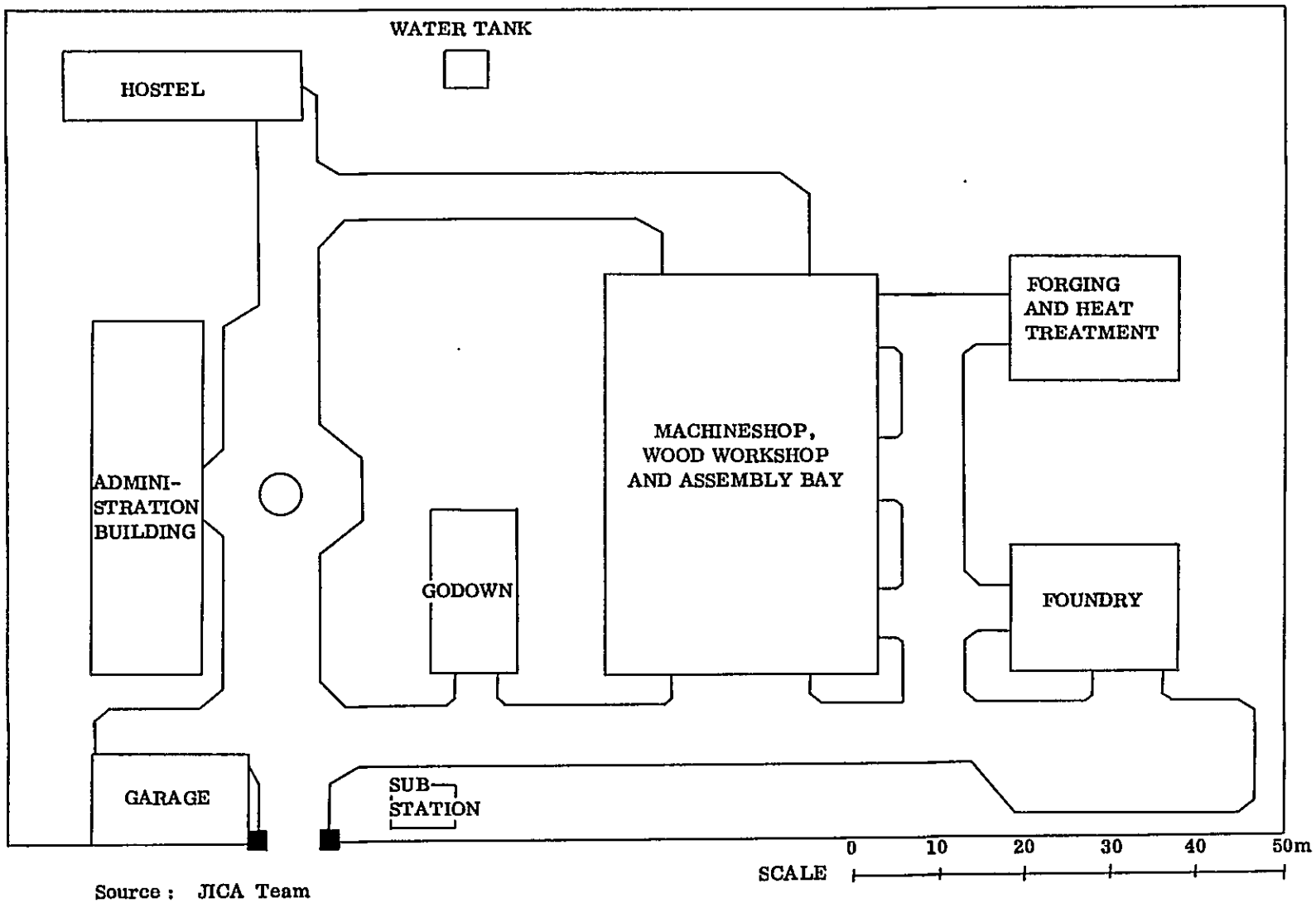
Table 6.2.5 presents land size (including some room for future expansion) and the type and size of buildings tentatively proposed for PTDC, subject to detailed study and designing before its establishment.

A possible general plot (land and building) plan for PTDC is presented in Figure 6.2.2.

(3) Machines and Equipment

The machines and equipment of PTDC must not only be capable of producing the metal products and small machines such as those shown in Table 6.2.4 for production demonstration purposes in the initial stage, but also must be adaptable to the production of new such products in the future. In this view, shown in Table 6.2.6 are major machines and equipment tentatively proposed for PTDC, subject to detailed study later.

Figure 6.2.2 General Plot Plan



Source : JICA Team

(4) Investment

The amount of total investment funds needed for the establishment of PTDC is hardly predictable at this stage when PTDC is still only in concept and its details are yet to be worked out. Therefore, the very provisional estimate tentatively proposed in Table 6.2.7, will have to be much changed depending on the details of PTDC as determined and will inevitably be affected substantially by future price inflation in Bangladesh.

Table 6.2.5 Outline of Land and Building Size

Item	Size (m^2)	Size (sq.ft.)
1. Land	15,000 (150m x 100m)	166,670
2. Building		
. Total	3,480	38,670
. Administration	520	5,780
. Machine shop	1,540	17,110
. Foundry	300	3,330
. Forging and heat treatment	300	3,330
. Godown	200	2,220
. Hostel	440	4,900
. Garage	180	2,000

Source : JICA Team

Table 6.2.6 Important Machinery and Equipments of PTDC

Category	Type	Specification
1. Foundry	. Cupola	1 t
	. Conveyor	1 unit
	. Molding box	1 set
2. Machine Shop	. Band saw	12" x 8" max. cutting profile
	. Vertical drilling machine	1" dia.
	. Centre lathe	6' bed length
	. Centre lathe	4' bed length
	. Horizontal milling machine	#2 1/2
	. Vertical milling machine	#2 1/2
	. Gear hobbing machine	20" dia.
	. Slotting machine*	15" slot
	. Universal grinder	24" dia.
	. Keyway milling machine*	12" cutting length
	. Tool grinder	
	. Tapping machine*	1/2" dia.
	. Vertical surface grinder*	24" dia.
	. Belt surface grinder*	6" width
	. Edge grinder*	
	. Twin head grinder	12", 14", 16" dia.
	. Bench drill	1/2" dia.
3. Sheet Metal Working and Welding Shop	. Vibrating shear	1-1/2" thickness
	. Square shearing machine	6' width, 1-1/2" thickness
	. Sheet bending press	6' width, 1" thickness
	. Three roll bender	6' width
	. Double crank press*	100t, 8" stroke
	. Crank press	50t, 6" stroke
	. Power press*	20t, 6" stroke
	. Electric arc welder	20 KVA
	. Spot welder	25 KVA
	. Gas flame cutter and welder	1 set
4. Forging and Heat Treatment Shop	. Friction press	150 t
	. Spring forge hammer	80 Kg
	. High frequency hardening* apparatus	10 KVA
	. Electric heating furnace	30 KVA
	. Gas- or oil-fired furnace	(for case hardening)

(Continued)

Category	Type	Specification
5. Wood Working Shop	. Circular saw	6" dia.
	. Hand planer*	
	. Automatic planer*	
	. Square hole dirll*	3/4 square
	. Tilting elevator	16" square table
	. Mortising machine	
	. Wood lathe	2-1/2' bed length
	. Bench drill	1/2" dia.
6. Other Machinery and Tools	. Air compressor	7.5 HP
	. Fork lift*	1 t
	. Hardness testers	
	. Hand tools and jigs	
7. Office Furniture		
8. Transformer		11 KV, 3 phase, 200 KVA
9. Deep Tube Well and Water Tank	. DTW	100 m
	. Water pump	3" dia.
	. Water tank	30 t

Source : JICA Team

Note : Those machines marked with asterisks (*) will not necessarily be needed at the initial stage of PTDC operation.

Table 6.2.7 Provisional Estimation of Investment Costs of PTDC

	Investment Cost
1. Land acquisition and site preparation	1,700,000
2. Building	9,700,000
3. Machinery	12,200,000
4. Other facilities including transformer, deep tube well, water tank, fence and gate	5,700,000
5. Contingency (15%)	4,400,000
Grand Total	33,700,000

Source : JICA Team

The bases of estimating land acquisition and site preparation costs are as follows:

- Land acquisition : Tk 52,700/Acre
- Site preparation : Tk 4.0/ft^3
- Building : Tk 250/ft^2

The unit building cost, i.e. Tk250/ft^2 has been suggested by the government of Bangladesh.

Costs of the machinery and other facilities are simple summation of estimated prices of the individual machine and facility.

It is possible to develop PTDC in three Phases according to the proposed operational plan described in Table 6.2.3. The investment plan can be altered accordingly as follows:

Table 6.2.8 Phased Investment of PTDC

(Unit: Tk)

Item	Phase I	Phase II	Phase III
1. Land acquisition and site preparation	1,700,000	—	—
2. Building	6,600,000	3,100,000*	
3. Machinery	7,300,000	3,000,000	1,900,000
4. Other facilities	5,700,000	—	—
5. Contingency	3,200,000	1,000,000	200,000
Total	24,500,000	7,100,000	2,100,000

(Source) JICA Team

* : Investment for construction of foundry, godown, hostel and garage.

(5) Operation Costs and Expected Revenue

Operation cost of PTDC are, if established as a public organization, composed of the following four items;

- Manpower including overhead,
- Raw materials,
- Utility, and
- Depreciation and maintenance.

It is not clear if depreciation of machinery and building constitutes a cost item for a Governmental project.

The manpower cost can be computed by combining Figure 6.2.1 with Table 6.2.1. As for the phased operation, however, an assumption that manpower of the both Administration Department and Production Department is increased stepwise according to the phases has been adopted. The tentative estimation of the manpower cost requirement is shown in Table 6.2.9.

Table 6.2.9 Annual Manpower Cost Estimation

(Unit : Tk 1,000 p.a.)

Department	Phase 1	Phase 2	Phase 3
Administration	329.2	367.7	384.9
Training	87.2	87.2	87.2
Technical Consultation	—	170.6	170.6
Production	583.3	727.3	796.9
R & D	—	—	434.4
Total	999.7	1,352.8	1,874.0

Source : JICA Team

The raw material costs depend upon products to be manufactured at PTDC for the demonstration purpose. The production demonstration is assumed to be conducted on the following items;

- Pedal Thresher
- Weeder
- Grain Dryer
- Sickle
- Pushcart
- Wheelbarrow
- Centrifugal Pump

Raw material costs has been estimated using the unit raw material costs indicated in the ANNEX and assuming number of production of each product item, namely Tk3,200,000 per annum for Phase 1, Tk5,000,000 p.a. for Phase 2 and Tk6,700,000 p.a. for Phase 3 operation.

As for utility and fuel costs, there is no reliable data and information available in order to estimate them with reasonable accuracy. Consequently the total

cost has been assumed at Tk 300,000 per annum, Tk 350,000 p.a. and Tk 400,000 p.a. for Phase 1,2 and 3, respectively, on lump sum basis.

Depreciation and maintenance costs are calculated based on the following assumptions;

- Buildings are depreciated on straight line for 20 years with no salvage values,
- Machinery is depreciated on straight line for 10 years with no salvage values, and
- Maintenance costs are composed of building maintenance cost (0.5% of the total building cost) and machinery maintenance cost (4% of the total machinery cost).

Table 6.2.10 Annual Depreciation and Maintenance Expenditure

(Unit : Tk 1,000 p.a.)

	Phase 1	Phase 2	Phase 3
Depreciation	1,630	2,085	2,275
Building	330	485	485
Machinery	1,300	1,600	1,790
Maintenance	520	640	716
Total	2,150	2,725	2,991

Source : JICA Team

The estimated total operation expenditure of PTDC are shown in Table 6.2.11.

Table 6.2.11 Estimation of the Annual Operation Expenditure of PTDC

(Unit : Tk 1,000 p.a.)

	Phase 1	Phase 2	Phase 3
Manpower	1,000	1,353	1,874
Raw Materials	3,200	5,000	6,700
Utility and Fuel	300	350	400
Depreciation and Maintenance	2,150	2,725	2,991
Total	6,650	9,428	11,965

Source : JICA Team

The revenue estimation is essentially based on summation of sales revenue of each demonstration product item which is to be placed on the market through commercial or specially organized channels. The income from training, consultation and so forth is estimated small and therfore neglected.

The estimated revenue resulted from the demonstration operation of PTDC is Tk3,720,000 per annum for Phase 1, Tk6,920,000 p.a. for Phase 2 and Tk8,500,000 p.a. for Phase 3. The revenue will be easily increased, if one wishes to do so, achieving high capacity utilization of the installed machinery. It is not the ultimate purpose of establishing PTDC, however, to commence large scale production of the before-mentioned product items utilizing advanced technology, thus penetrating into markets of small scale industries, but to demonstrate improved production technologies which ensure high quality of products.

Table 6.2.12 shows balance of estimated revenue and operation expenditure of PTDC.

Table 6.2.12 Balance of Estimated Annual Revenue and Expenditure

(Unit : Tk 1,000)

	Phase 1	Phase 2	Phase 3
Revenue	3,720	6,920	8,500
Expenditure	6,650	9,428	11,965
Balance	-2,930	-2,508	-3,465

Source : JICA Team

The balance is negative and the deficit of operation is recommended to be covered by the Government's expenditure.

It should be emphasized that all the foregoing estimation are tentative and subject to further alteration in view of many uncertain factors involved including cost escalation due to inflation.

6.2.5 Guideline of Training

It is proposed that the trainees at PTDC be selected out of the following two groups at the early stage of operation:

- Government extension workers and technical advisors, and
- Skilled workers from private small scale industries.

The applicants for training should be strictly screened based on their past experience and technical capability. In other words, those who will be selected as trainees are expected to have sufficient experience and practical knowledge about production or repairing of small scale metal working and light engineering products.

Two training courses are envisaged at present, namely a general course and a special course, details of which are presented in Table 6.2.13.

Table 6.2.13 Proposed Training Courses at PTDC

Item	General Course	Special Course
1. Enrollment	30	5 - 10
2. Qualification of Enrollment	- Government officers working for such agencies as BSCIC and BADC. - Those who have more than 2 years practical experience in metal working and light engineering industries.	- On request basis
3. Duration	4 - 6 weeks	more than 3 months
4. Typical	- Lectures Quality Control Production Control Inventory Control Blue Print Reading Elements of Technology - Shop Training Measurement Tool and Jigs Machine Operation Maintenance Fabrication Assembly Inspection	- Shop Training on Specific Subjects

Source : JICA Team

It is desirable that the shop training exceeds 80% of the total training time and incorporates actual manufacturing practice in which transfer of manufacturing know how is expected to take place.

ANNEX

I - 1 PEDAL THRESHER

1. Product Specifications

- Engineering arrangement: See Figure
- Dead weight: Not specified
- Rated capacity: Paddy > 120 kg/man.hr.
  Wheat > 75 kg/man.hr.
- Power requirement: Non
- Others: Little vibrations and noise

2. Materials

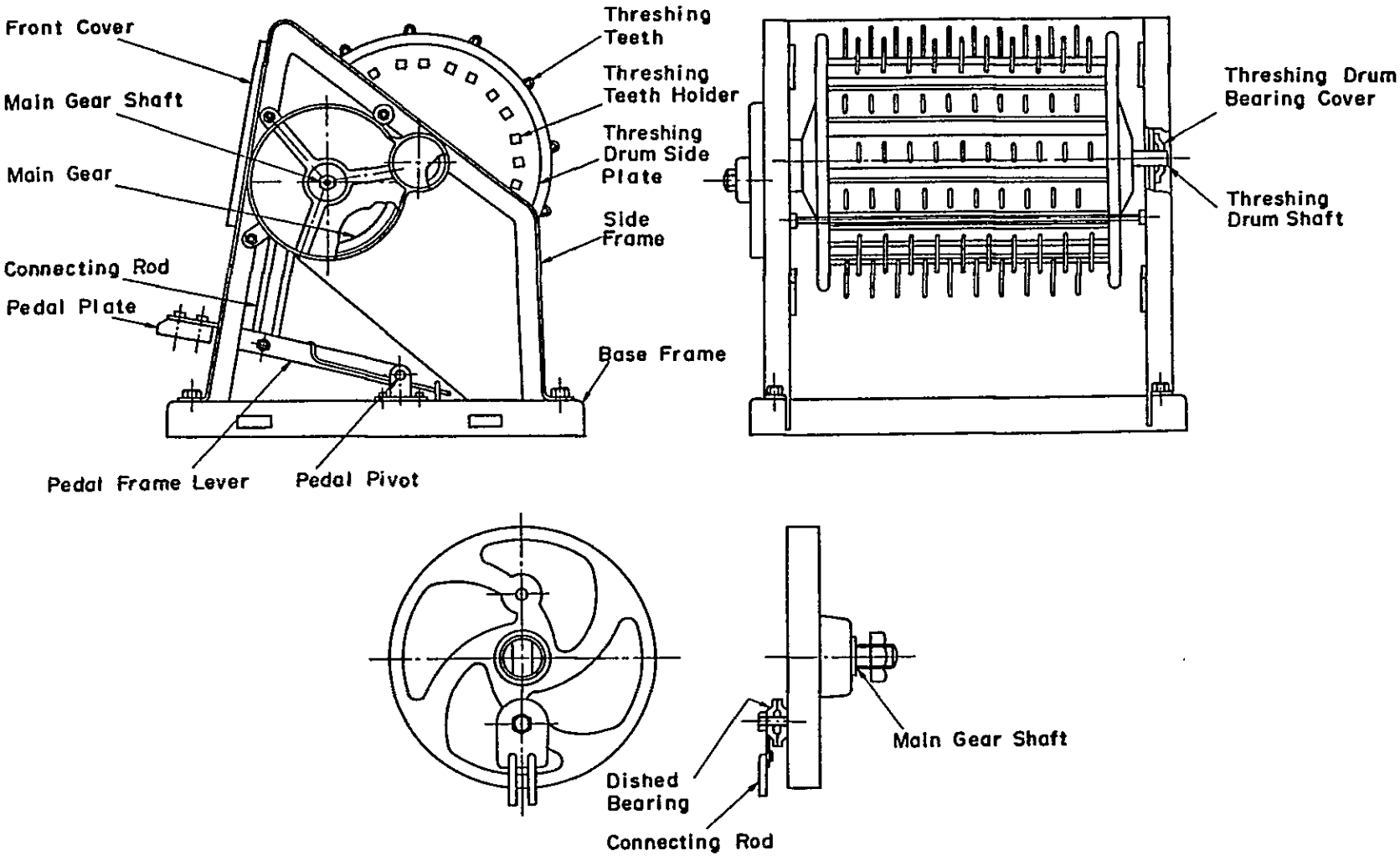
	Type	Specifications (mm)	Quantity & weight per product
1)	Wood	Frame: hard wood (pine), 40 x 40 Teeth holder: ordinary wood, 65 x 19	
2)	Steel angle	40 x 40 x 3, SS41	
3)	Steel bar	9 dia. 12 dia. and 17 dia, SS41B	
4)	Steel sheet	1 SPN 1-2 or SPC 1-2	
5)	Iron casting	Main and driving gears: FC15	
6)	Hard steel wire	Threshing teeth: 2.6 dia. SWRH4	
7)	Ball bearing	Inner dia. 17	3 pieces

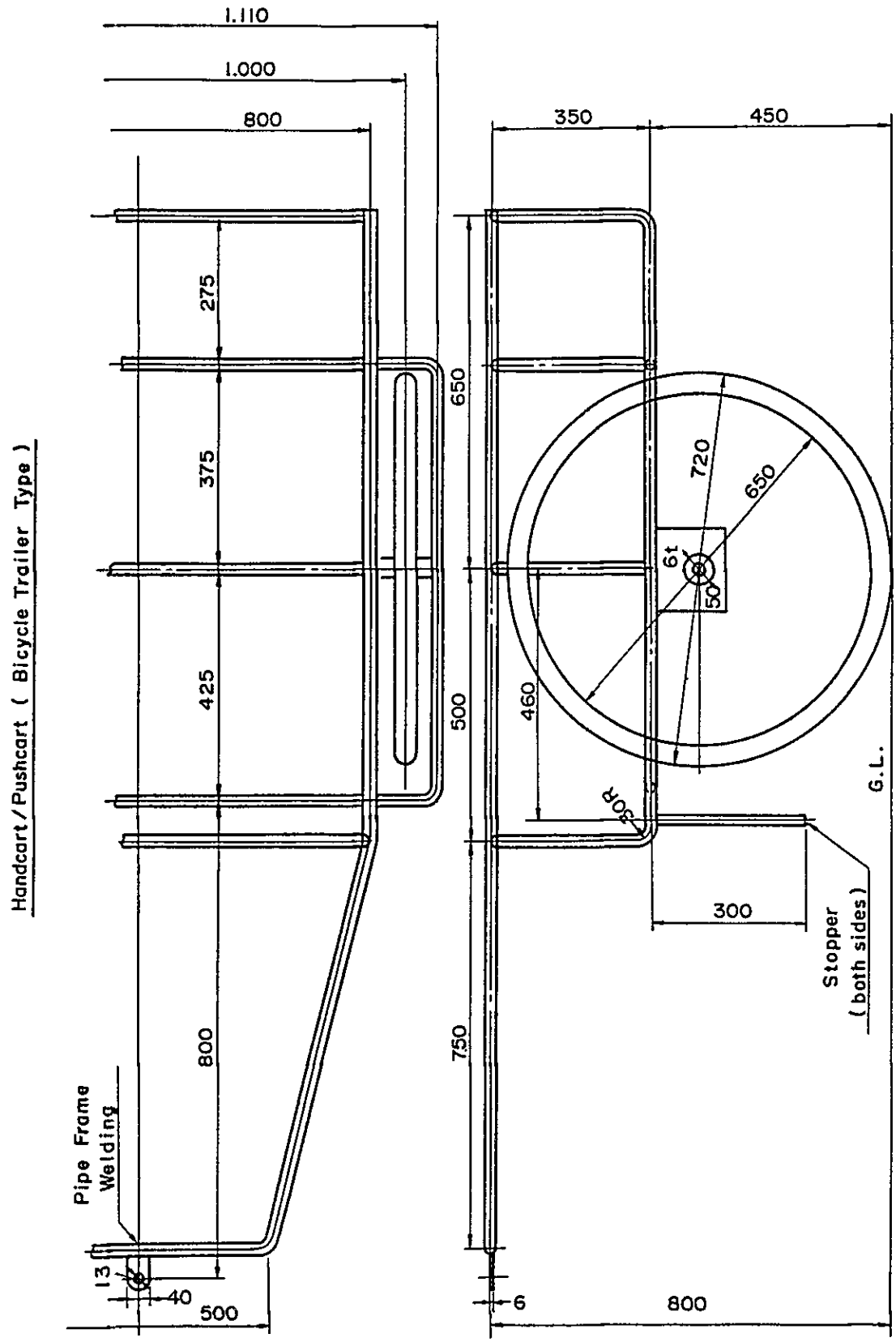
3. Production Facilities Required

- Square shear	SH	- Spot welder	SW
- Vibrating shear	VS	- 3 Rolls bender	HR
- Power press/Crank press	P/CP	- Wire cutter	WAC
- Double crank press	DCP	- Band saw	BS
- Arc welder	AW	- Lathe 4'/6'	L4/L6

- Cylindrical grinder	UG	- Wood circular saw	CS
- Vertical drilling machine	D	- Hand wood planner	HP
- Bench Drill	BD	- Mortising machine	MT
- Horizontal milling machine	HM	- Bench wood drill	BD
- Gear hobbing machine	GH	- Compressor/Spray gun	SG
- Working table	WT	- Gas fired furnace	CF

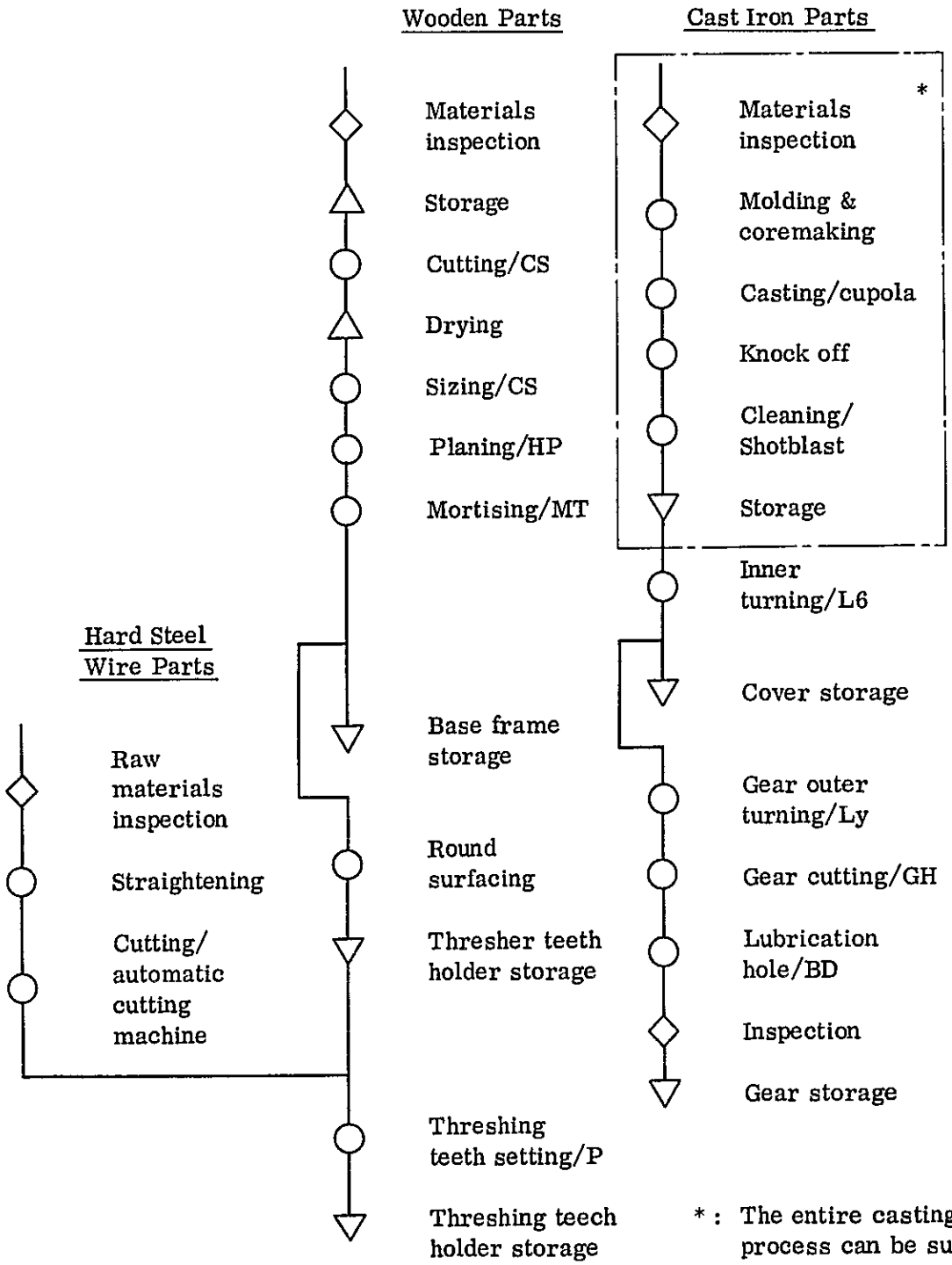
Pedal Thresher




Handcart / Pushcart (Bicycle Trailer Type)
1.110
1.000
800
350
450
275
375
425
800
650
500
750
720
650
6t
50
460
30R
300
G.L.
Stopper
(both sides)
Pipe Frame
Welding
13
40
500
6
800

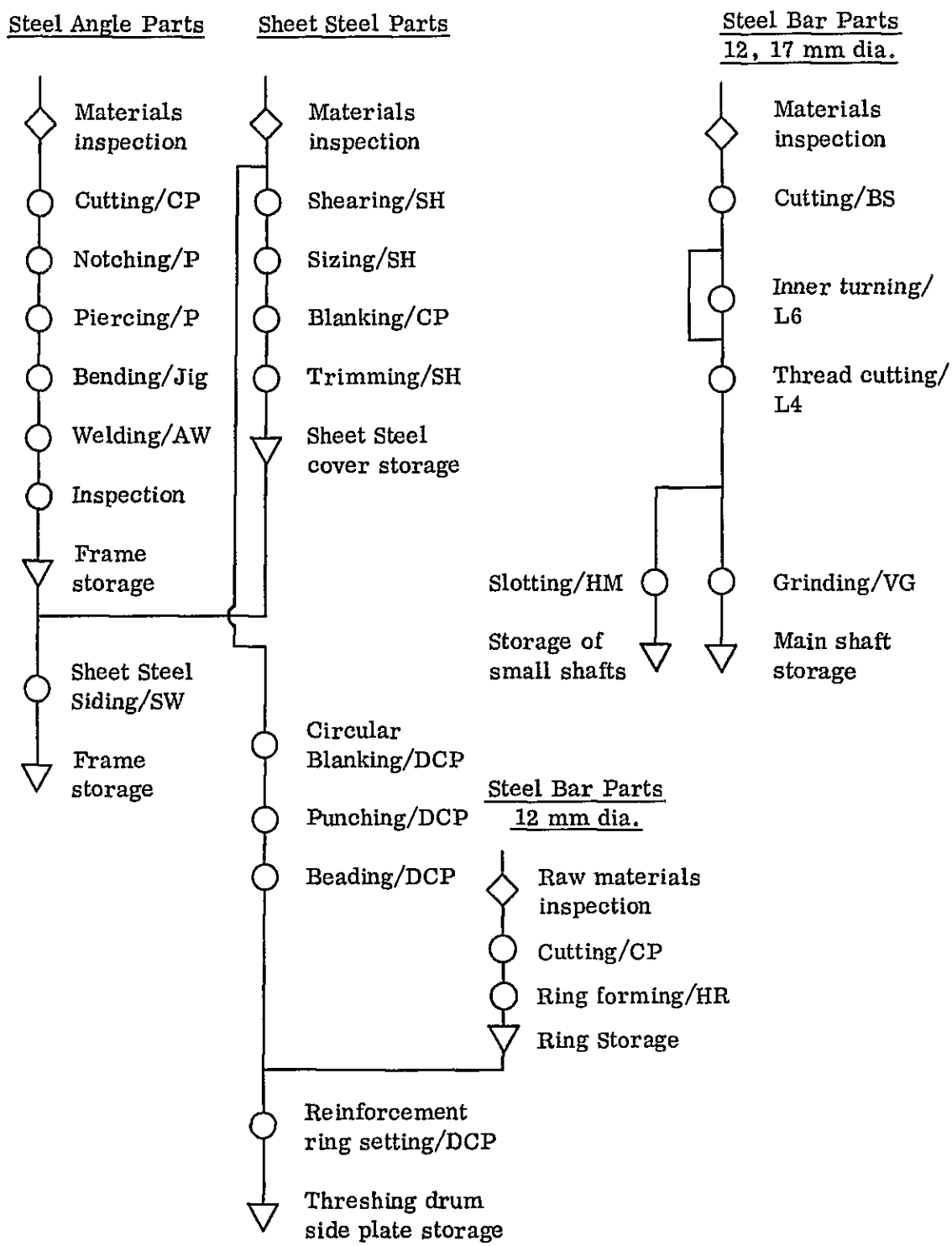
4. Production Process

Thresher Parts Manufacturing Process 1

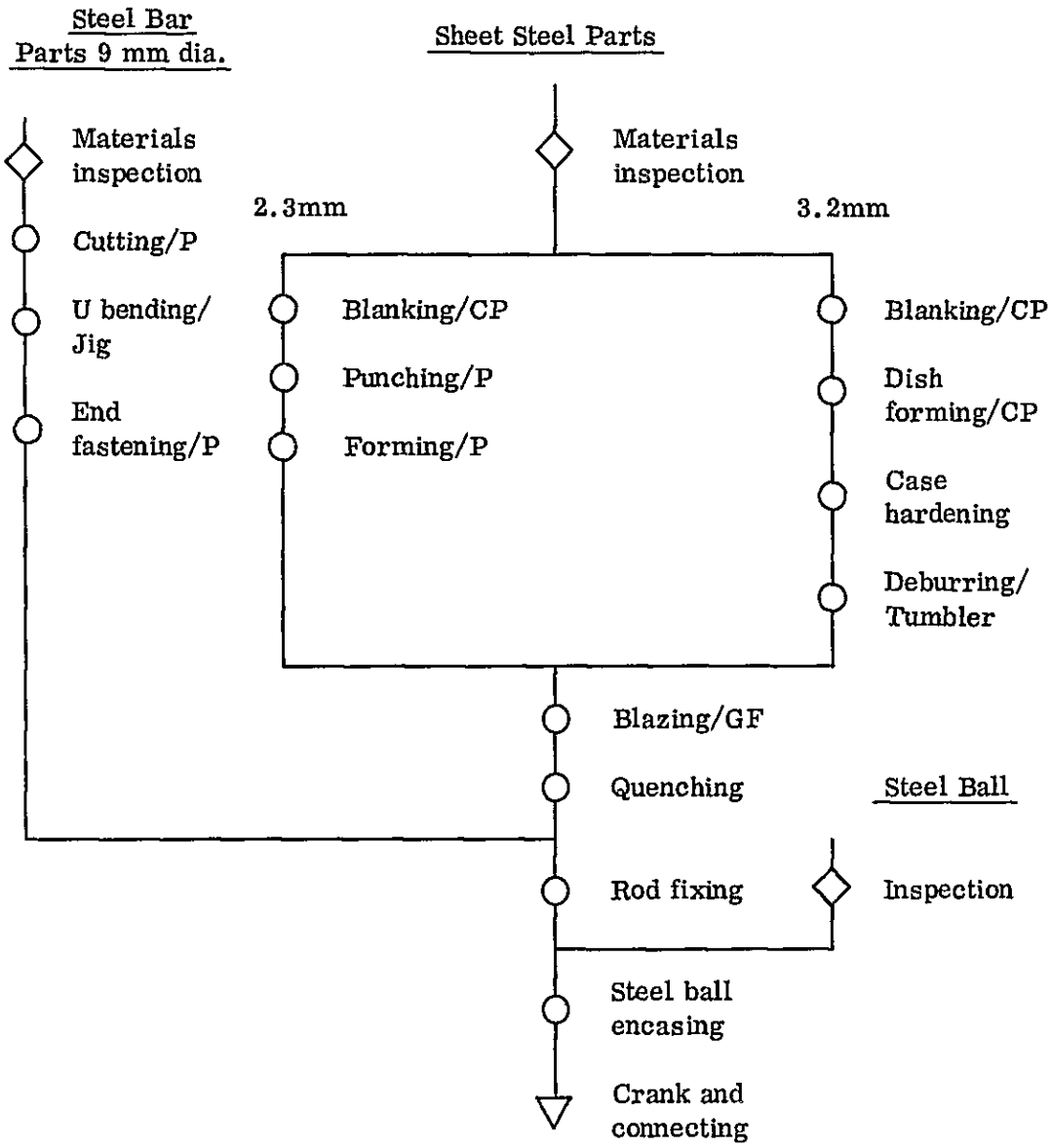


* : The entire casting process can be sub-contracted to outside foundries.

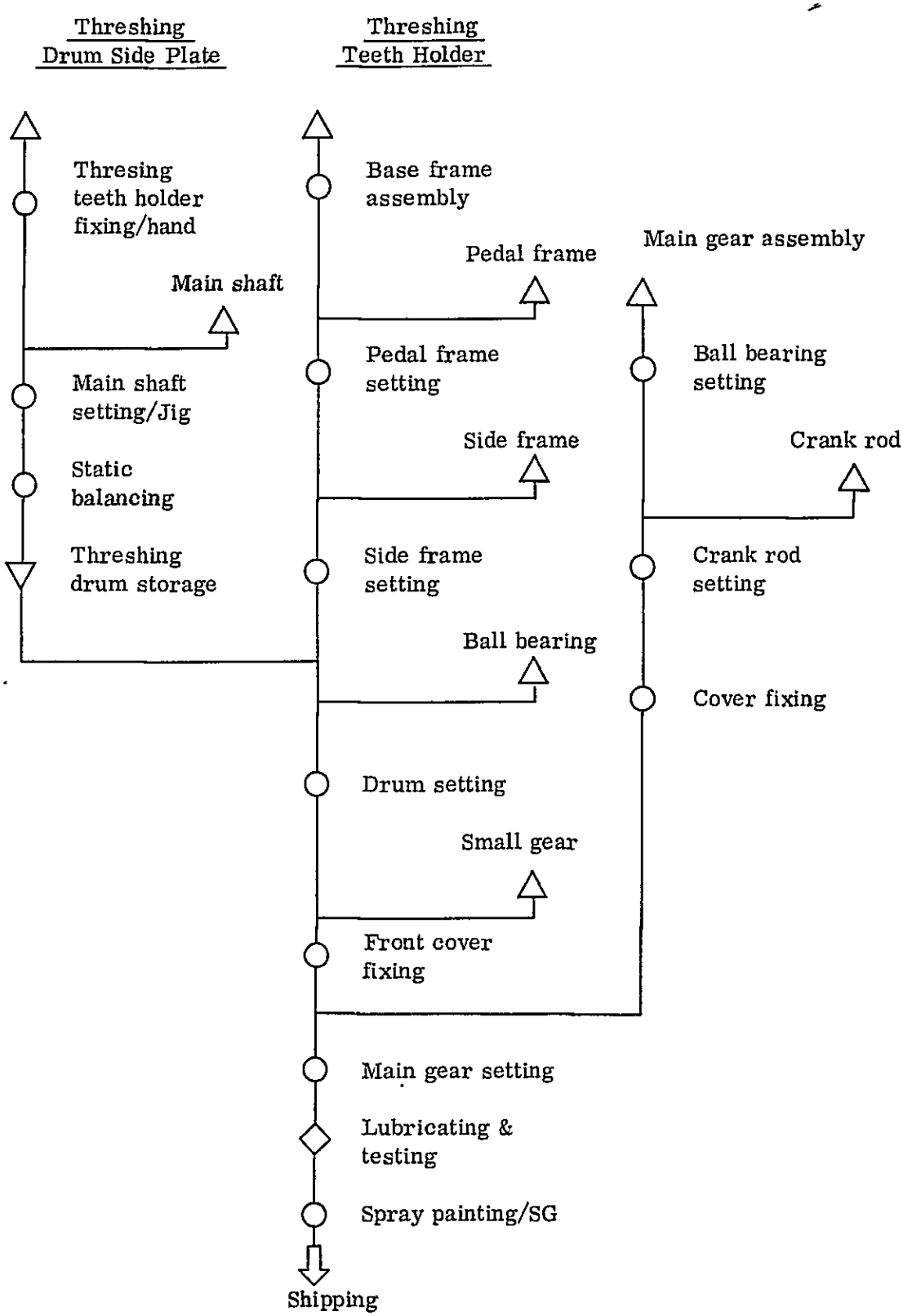
Thresher Parts Manufacturing Process 2



Thresher Parts Manufacturing Process 3



Thresher Assembly Process



5. Unit Fabrication Time

(minutes per a unit of product)

Operation	Time (min)
- Wood working	70
- Sheet metal working	52
- Turning & Grinding	105
- Painting	12
- Assembly & others	188
Total	427

6. Production Volume & Workforce Requirements

1)	Unit fabrication time	427 min.
2)	Annual production volume	3,000 units
3)	Total annual production time including idle time	
	" 1) x 2) ÷ 0.40*	53,375 hours
4)	Total annual manhour per worker	
	260 days x 7 hours	1,820 hours
5)	Direct workforce requirements at one shift	
	3) ÷ 4)	30 workers

* Mnaufacture of other products using same machinery is taken into account.

7. Production Cost (in Taka per product)

1)	Materials	
	- Steels	317
	- Castings	80
	- Wood	114
	- Machine parts including ball bearing	135

	- Paint	42
	Sub-Total	688
2)	Direct labor cost	
	- Production workers	27
	- Supervisors	4
	Sub-Total	31
3)	Other direct & indirect costs	
	Assuming 20% of 1) & 2) above	144
4)	Dies & tools cost	30
5)	Total production cost	
	The total 1) through 4) above plus 5% thereof as other costs	Tk. 938

I - 2 WEEDER

1. Product Specifications

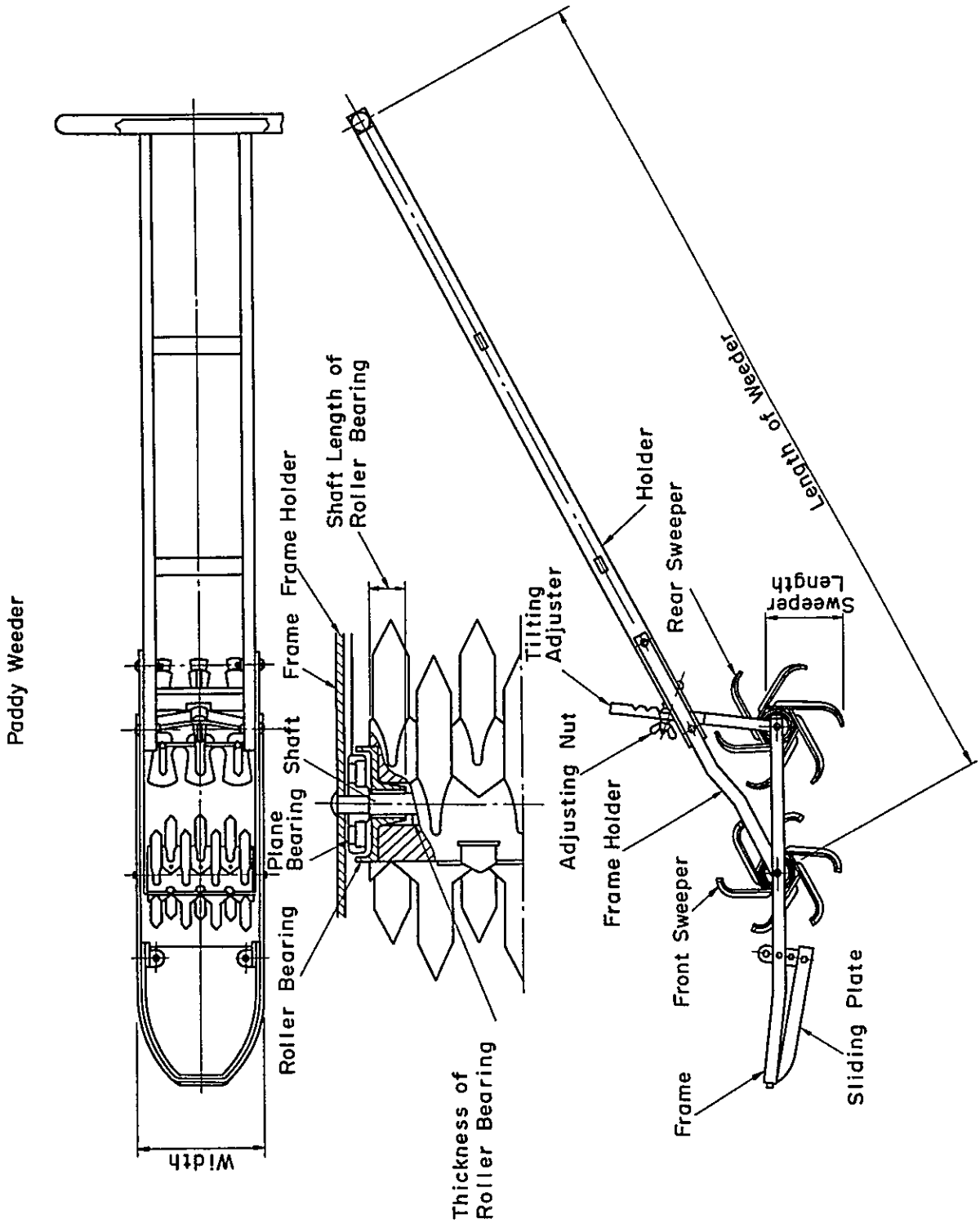
- Engineering arrangement: See Figure
- Net weight: 5 kg
- Rated capacity: Not specified but, according to experience in Japan, with a unit of the product hoeing & weeding 1/2 - 3/4 acre of paddy field can be achieved in a day.
- Power requirements: None - hand driven

2. Material Requirements

	Type	Specification	Quantity & Weight per Product
1)	Wood	Well seasoned pine or other wood of comparable property	20 x 30 x 2,500
2)	Steel plate	0.6t, SPHL or SPHD 1.0t, SPHC or SPHD	
3)	Steel strip	2.8t x 18, SS41 or SRB39	
4)	Steel bar	10 dia, SS41 or SRB39	
5)	Cast iron parts	FC15	
6)	Nut	FC15	
7)	Rivet		

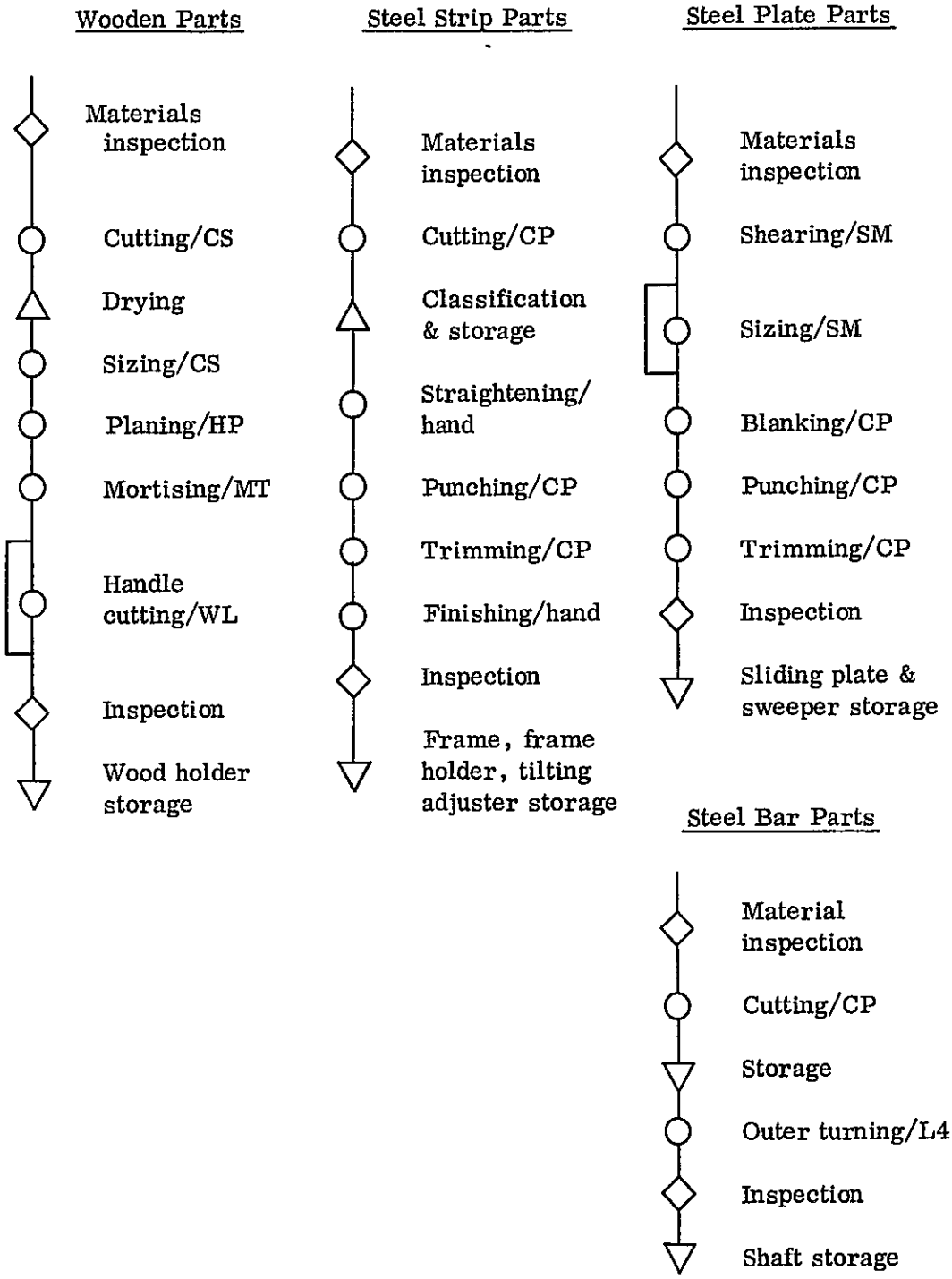
3. Production Facilities Required

- Crank press CP
- Shearing machine SH
- 4' Lathe L4
- Bend drill BD
- Wood circular saw CS
- Hand planer HP
- Mortising machine MT
- Wood lathe WL
- Air compressor/spray gun SG

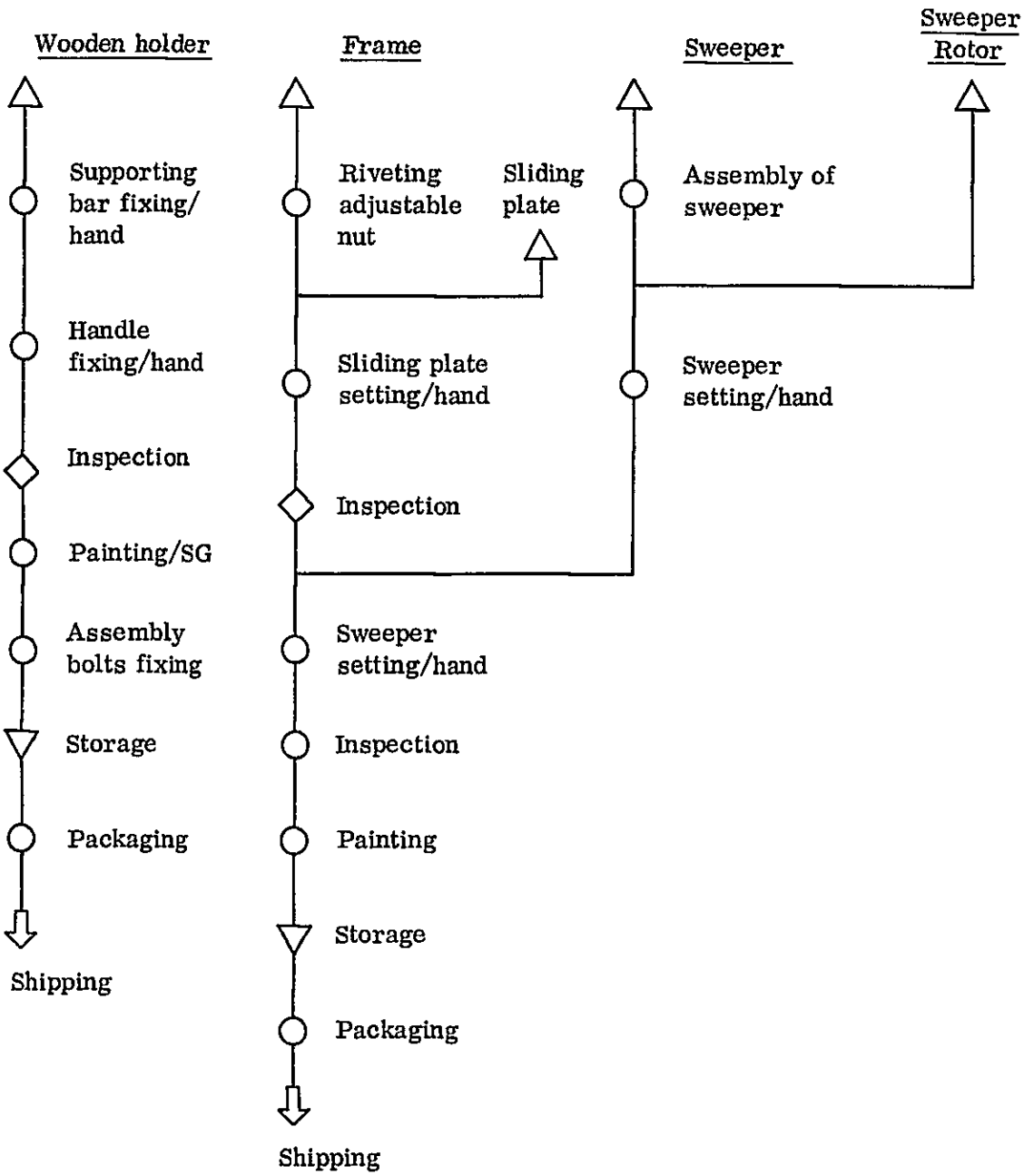

Paddy Weeder
Width
Roller Bearing
Plane Bearing
Shaft
Frame
Frame Holder
Shaft Length of Roller Bearing
Thickness of Roller Bearing
Tilting Adjuster
Adjusting Nut
Frame Holder
Holder
Length of Weeder
Rear Sweeper
Sweeper Length
Front Sweeper
Frame
Sliding Plate

4. Production Process

Paddy Weeder Parts Manufacturing Process



Paddy Weeder Assembly Process



5. Unit Fabrication Time

(Minutes per unit of product)

Operation	Time
- Wood working	79
- Sheet metal working	42
- Turning & grinding	10
- Painting	8
- Assembly & others	45
Total	175

6. Production Volume & Workforce Requirement

1) Unit fabrication time — 175 min.

2) Annual production volume — 3,000 units

3) Total annual production time

1) x 2) ÷ 0.30* — 29,170 hrs.

4) Total annual manhour per worker

260 days x 7 hours — 1,820 hrs.

5) Direct workforce requirements at one shift operation

3) ÷ 4) — 17 workers

* Manufacture of other products using same machinery is taken into account. Some idle time is also considered.

7. Production Cost (in take per unit of product)

1)	Materials	
	- Steels	38
	- Castings	8
	- Wood	18
	- Paint	25
	- Others (bolts, nuts etc.)	10
	Sub-total	99
2)	Direct Labour Cost	
	- Production workers	11.1
	- Supervisors	1.5
	Sub-total	12.6
3)	Other Direct & Indirect Costs	
	Assuming 15% of 1) & 2) above	17
4)	Dies & Tools Cost	10.4
5)	Total Production Cost	
	The total of 1) through 4) above	
	plus 5% thereof as other costs	Tk. 146

I - 3 GRAIN DRYER

1. Product Specifications

- Engineering Arrangement: See Figure
- Net weight: 650 kg
- Max. loading capacity: 2,100 kg of paddy
- Fuel requirement: 4 litres per hour of kerosene

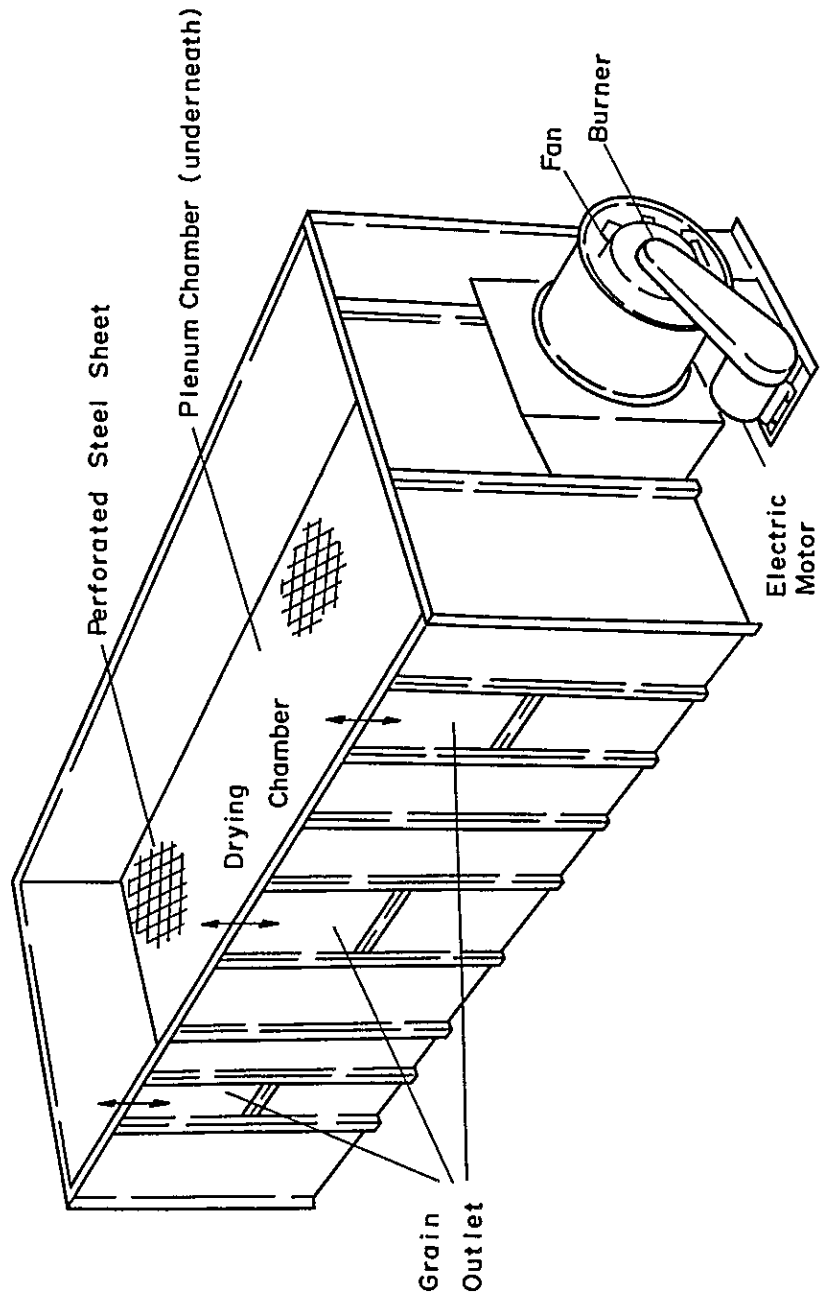
2. Materials

	Type	Specifications (mm)	Quantity & Weight per Product
1)	Steel plate	1.2t, SPEC	
2)	Perforated steel plate	0.6t, SPC, 0.2 dia. x 3 pitch perforated	
3)	Wood		
4)	Fan & burner set		1 set
5)	Paint		

3. Production Facilities Required

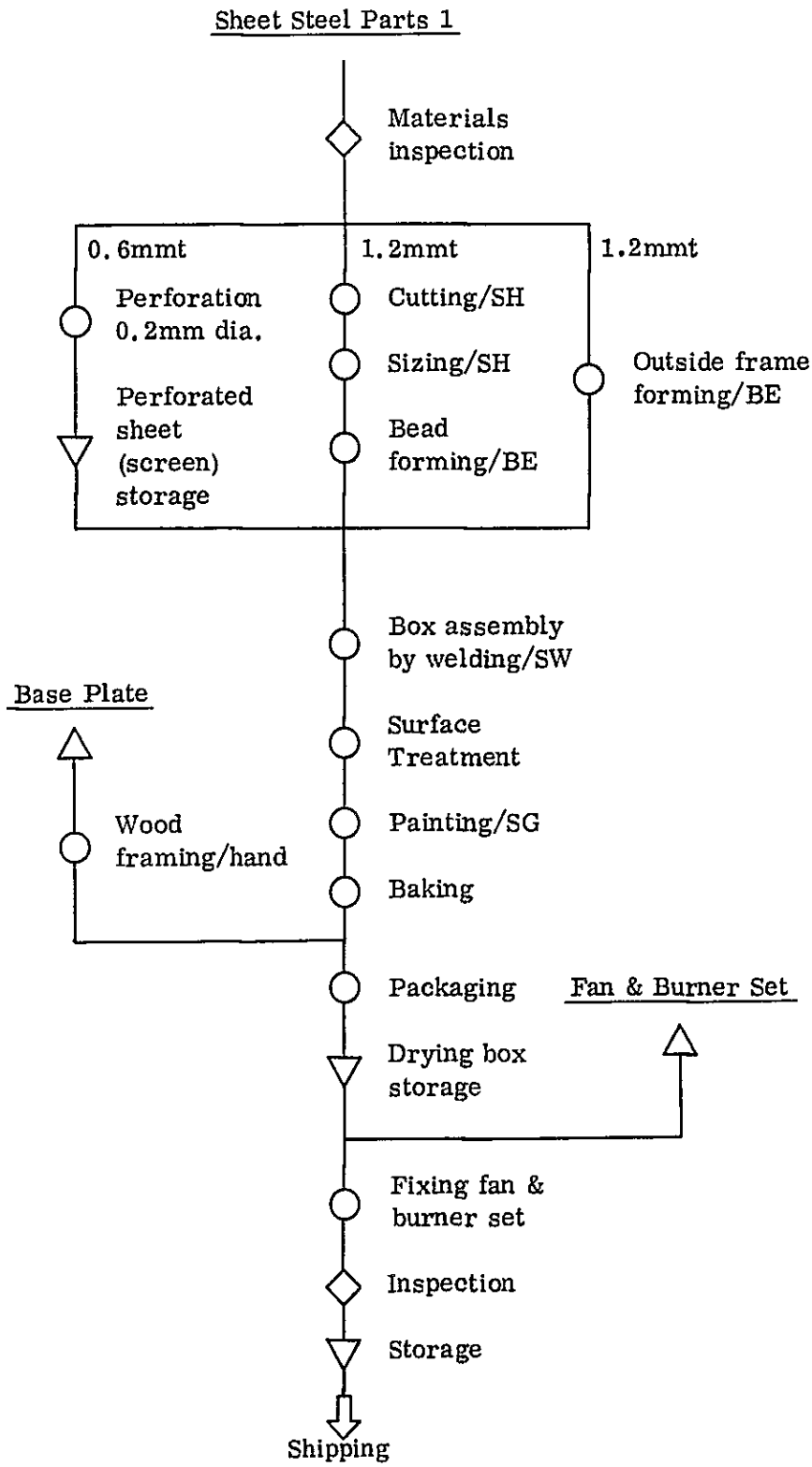
- Square shearing machine SH
- Sheet bending machine BM
- Spot welder SW
- Air compressor/spray gun SG

Static Type Grain Dryer



4. Production Process

Static Type Paddy Drier Manufacturing Process



5. Unit Fabrication Time

(Minutes per unit of product)

Operation	Time
- Sheet metal working	165
- Painting	85
- Assembly & others	115
Total	365

6. Production Volume & Workforce Requirements

1)	Unit fabrication time	365 min.
2)	Annual production volume	100 units
3)	Total annual fabrication time 1) x 2) ÷ 0.20*	3,042 hours
4)	Total annual manhour per worker 260 days x 7 hours	1,820 hours
5)	Direct workforce requirements at one shift operation 3) ÷ 4)	2 workers

* Manufacture of other products using same machinery is taken into account. Some idle time is also considered.

7. Production Cost (in taken per unit of product)

1)	Materials	
	- Steels	1,730
	- Wood	30
	- Paint	200
	- Fan and burner set	1,050
	Sub-total	3,010

2) Direct Labour Cost

- Production workers 23

(Entrepreneur participates in the production process as a supervisor)

3) Other direct & indirect costs

Assuming 15% of 1) & 2) above excluding the cost of the fan and burner set 297

4) Total production cost

The total of 1), 2) & 3) above plus 5% thereof as other costs Tk. 3,496

I-4 SICKLE

1. Product Specifications

Design of the product is expected to be given by an agricultural research institute. In the analysis which follows, a saw sickle of a Japanese model (Yonezawa Sickle) is assumed to be manufactured.

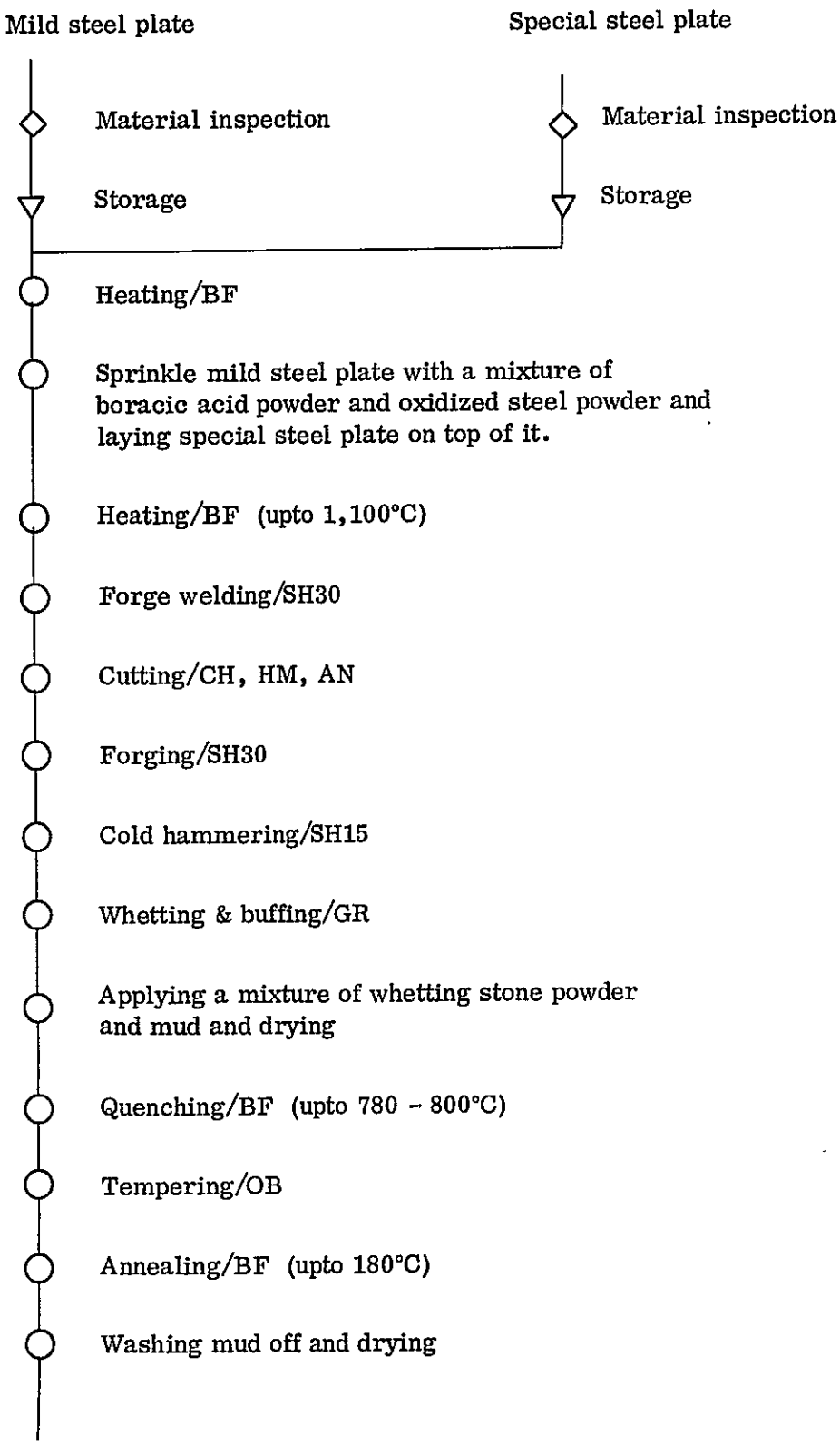
2. Materials

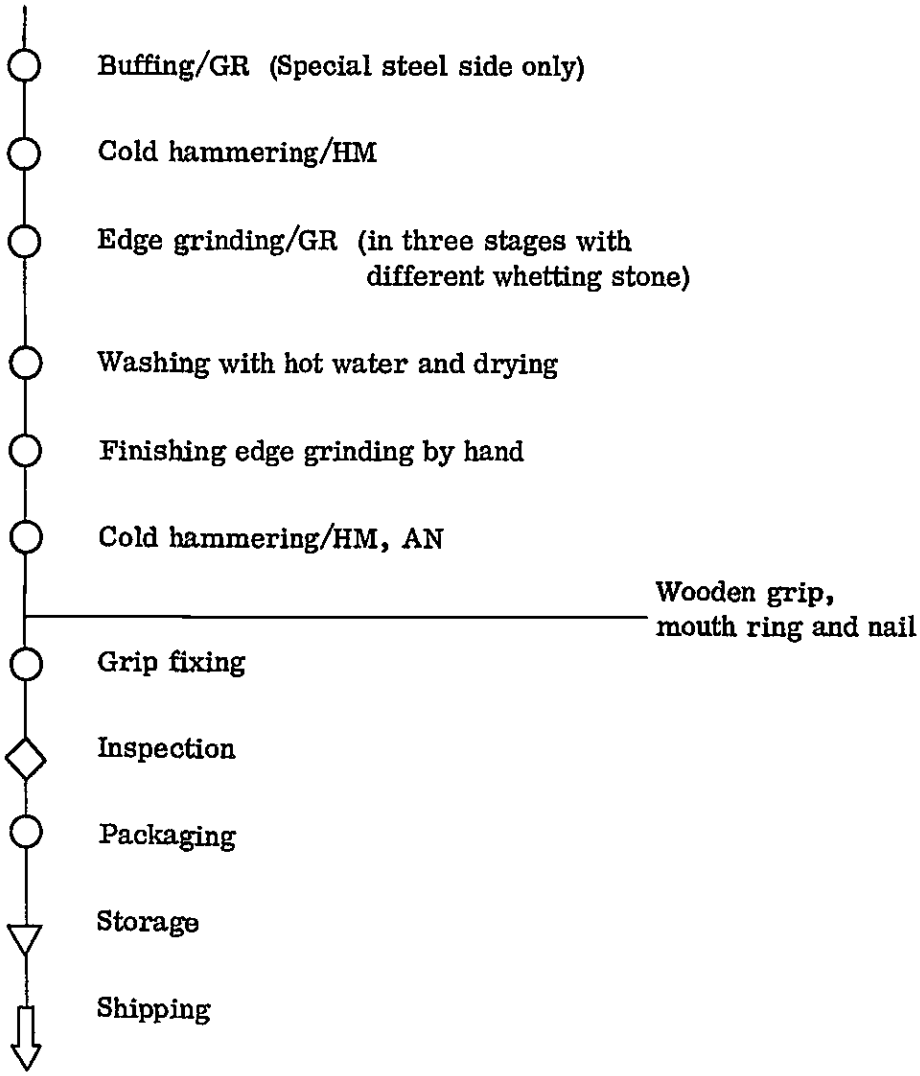
Type	Specification	Quantity & weight per product
Mild steel plate	SS34 or SAE 1005	130 g
Special steel plate	FKU3 (JES)	20 g
Mouth ring		
Nail		
Wooden grip		
Boracic acid powder		
Oxidized steel powder		

3. Production Facilities Required

- Spring hammer 30 kg SH30
- Spring hammer 15 kg SH15
- Twin head grinder GR
- Bracksmith's furnance BF
- Oil bath OB
- Hammers HM
- Chisel CH
- Anvil AN

4. Production process





5. Unit Fabrication Time (case of Japanese blacksmiths)

(minutes per unit of product)

Operation	Time
- Forge welding & machine hammering	16
- Whetting, buffing & edge grinding	9
- Heat treatment	2.4
- Others	2.1
Total	29.5

6. Production Volume & Workforce Requirements

Much dependent on the skill. From the unit fabrication time given above a skilled blacksmith and his assistant can produce about 14 pieces a day.

Sickles of simpler designs are also produced, an average daily production volume being about 50 pieces per worker.

7. Production Cost (in taka per unit of product)

1) Materials	
- Steel	1.5
- Others (mouth ring etc.)	1.2
Sub-total	2.7
2) Direct labour cost	
- Skilled blacksmith	1.2
- His assistant	0.6
Sub total	1.8
3) Other direct & indirect costs	
Assuming 15% of 1) & 2) above	0.7
4) Total production cost	
The total of 1) through 3) above plus 5% there-of as other costs	Tk5.5

I - 5 BULLOCK DRAWN PLOUGH (MACHINE FORGED)

1. Product Specifications

Design of the product is expected to be given by an agricultural research institution. In the analysis which follows, a plough of Japanese origin found in Bogra assumed to be manufactured. Only metal part of the plough is produced under this project.

2. Materials

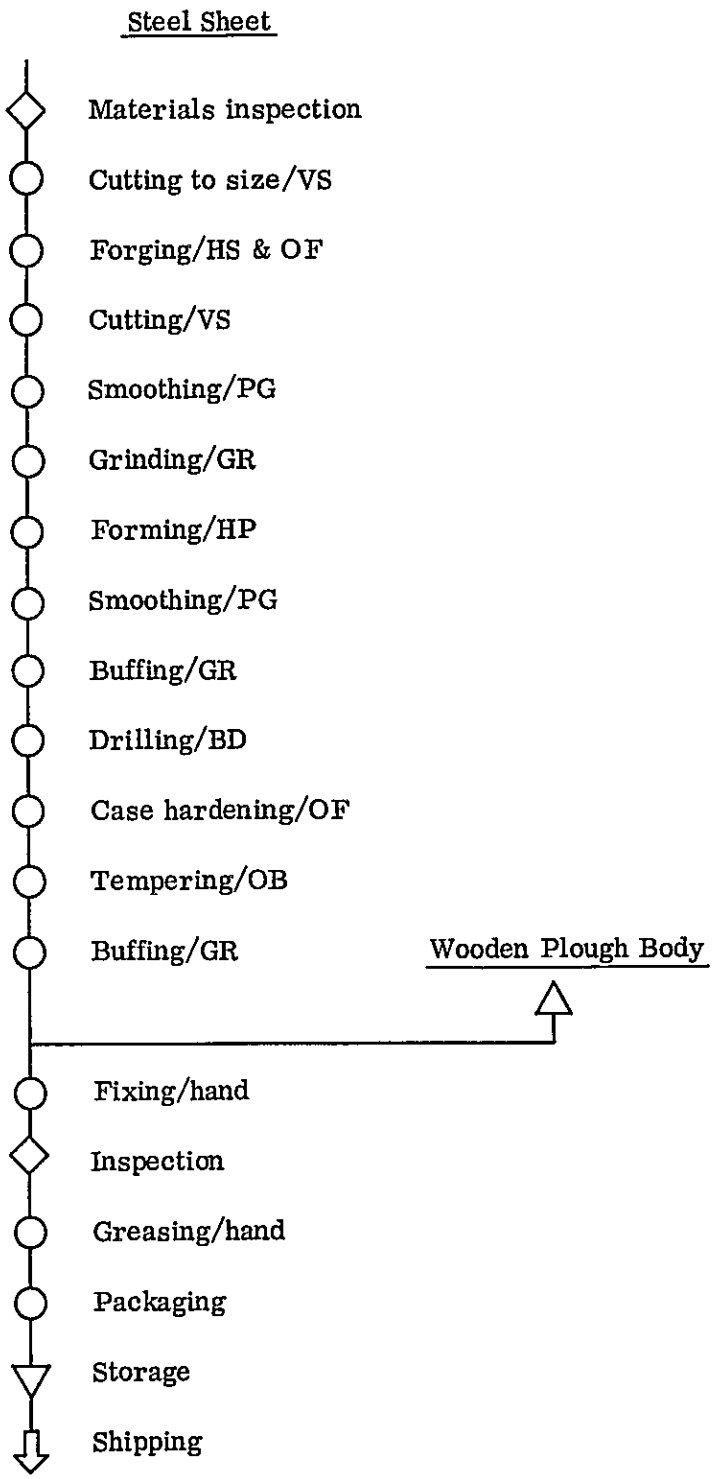
- Steel plate, SS34, 4.5t x 3' x 6'

3. Production Facilities Required

- Vibro shearing machine	VS
- Hand operated press	HP
- Twin load grinder	GR
- Portable grinder	PG
- Bench drill	BD
- Oil bath	OB
- Spring hammer	HS
- Oil furnace	OF

4. Production Process

Bullock Drawn Plough Production



5. Unit Fabrication Time

(Minutes per unit of product)

Operation	Time
- Cutting	4
- Forging	3
- Grinding, buffing	10
- Drilling	1
- Heat treatment	10
- Others	3
Total	31

6. Production Volume & Workforce Requirements

1) Unit fabrication time — 31 min.

2) Annual production volume — 10,000 units

3) Total annual fabrication time

1) x 2) ÷ 0.40* — 12,920 hours

4) Total annual manhour per worker

260 days x 7 hours — 1,820 hours

5) Direct workforce requirements at one shift operation

3) ÷ 4) — 7 workers

* Manufacture of other products using same machinery is taken into account. Some idle time is also considered.

7. Production Cost (in Taken per unit of product)

1)	Materials	
	- Steel plate	40
2)	Direct labor cost	
	- Production worker	2.0
	- Supervisors	0.6
	Sub-total	2.6
3)	Other direct & indirect costs	
	Assuming 15% of 1) & 2) above	6.4
4)	Total production cost of metal part	
	The total of 1), 2) & 3) above	
	plus 5% thereof as other costs	Tk. 52

I-6 BULLOCK DRAWN PLOUGH (HAND FORGED)

1. Product Specifications

Design of the product is expected to be given by an agricultural research institute. In the analysis which follows, a ploug of a Japanese model is assumed to be manufactured.

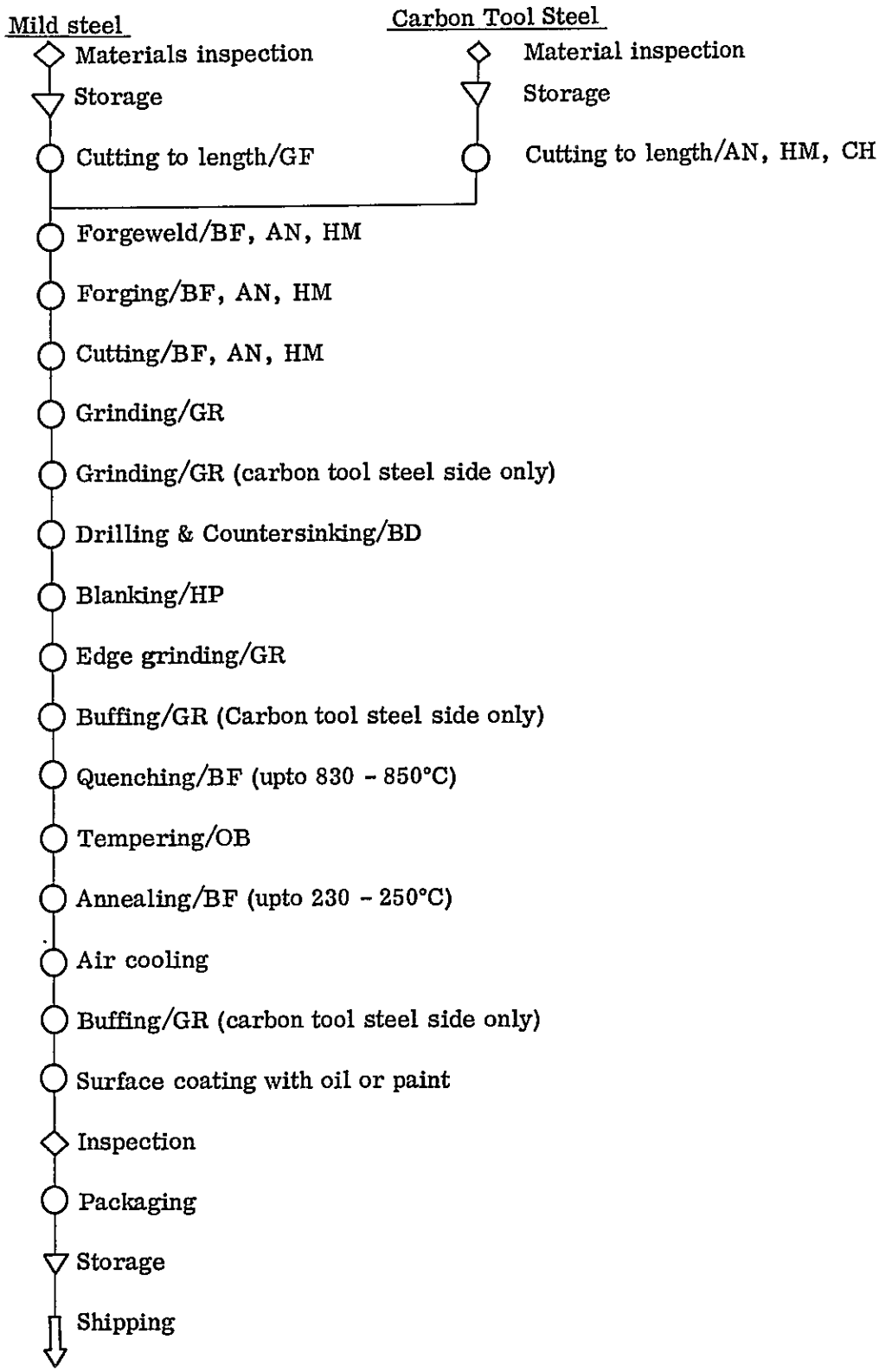
2. Materials

Type	Specifications (mm)	Quantity & weight per product
Mild steel	SS34, 12t×130×69	845 g
Carbon tool steel	SK5, 3t×130×31	95 g

3. Production Facilities Required

- Hand screw press. HP
- Bench drilling machine BD
- Blacksmith's furnance BF
- Oil bath OB
- Twin head grinder GR
- Gas flame cutting set GF
- Anvil AN
- Hammers HM
- Chisel CH

4. Production Process



5. Unit Fabrication Time

(minutes per unit of product)

Operation	Time
- Cutting	5
- Forging	10
- Grinding & buffing	15
- Heat treatment	7
- Others	8
Total	45

6. Production Volumes & Workforce Requirements

About 10 pieces could be produced by two workers (Skilled blacksmith and his assistant).

7. Production Cost (in taka per unit of product)

1) Materials

- Steel	18

2) Direct labour cost

- Skilled blacksmith	1.7
- Assistant	0.8
Sub-total	2.5

3) Other direct & indirect costs

Assuming 15% of 1) & 2) above	3.1

4) Total production cost

The total of 1) through 3) above plus 5% there-of as other costs	Tk 24.8

I - 7 HANDCART/PUSHCART (BICYCLE TRAILER TYPE)

1. Product Specifications

- Engineering arrangement	See Figure
- Net weight	2.5 kg
- Rated loading capacity	200 kg in weight
- Maximum loading capacity	250 kg in weight
- Dimensions of loading space	870mm in width x 120mm in length x 340mm in depth
- Driving force required	Manual 40 kg at maximum loading

2. Material Requirements

	Type	Specification (mm)	Quantity & Weight per Product
1)	Wheel set[1/] (including tire, tube, hub & ball bearing)	Rim & tire: WO-1 #28 x 1-3/8, SPCC, chromium plated, 1.2t. Spike: #14 x 40 pcs, SWRM, chromium plated, 2 dia.	2 sets, 3 kg
2)	Welded steel tubing	Inside diameter 15, wall thickness 2t SPHC	16,800mm, 16 kg
3)	Steel plate	6t, SS41P	150 x 1,000mm, 5.3 kg
4)	Steel bar	19 dia, SS41B	340mm, 0.89 kg
5)	Lock nut & washer	M16, SS41B	8 sets, 0.58 kg
6)	Split pin	3 dia x 30, SWRM	4 pcs, 0.1 kg
7)	Welding rod q	3 dia, SWRY	0.5 kg

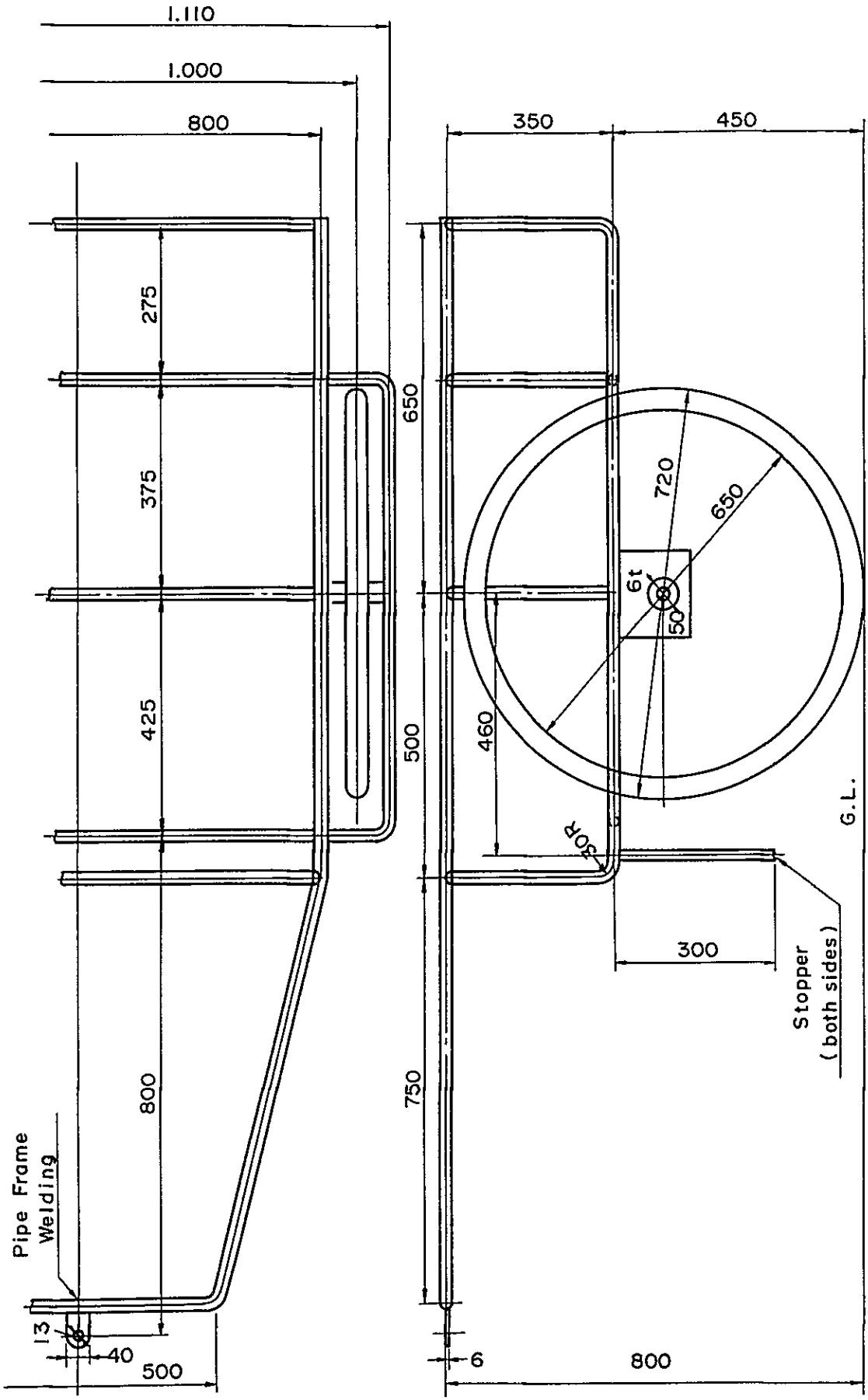
Note: 1/ --- Ideally, wheel sets of following specifications are to be used, which are not available locally at present:

Rim & tire	:	BE1 #28 x 1-1/2
Spoke	:	#11 x 40 pcs.
Hub diameter	:	40

3. Production Facilities Required

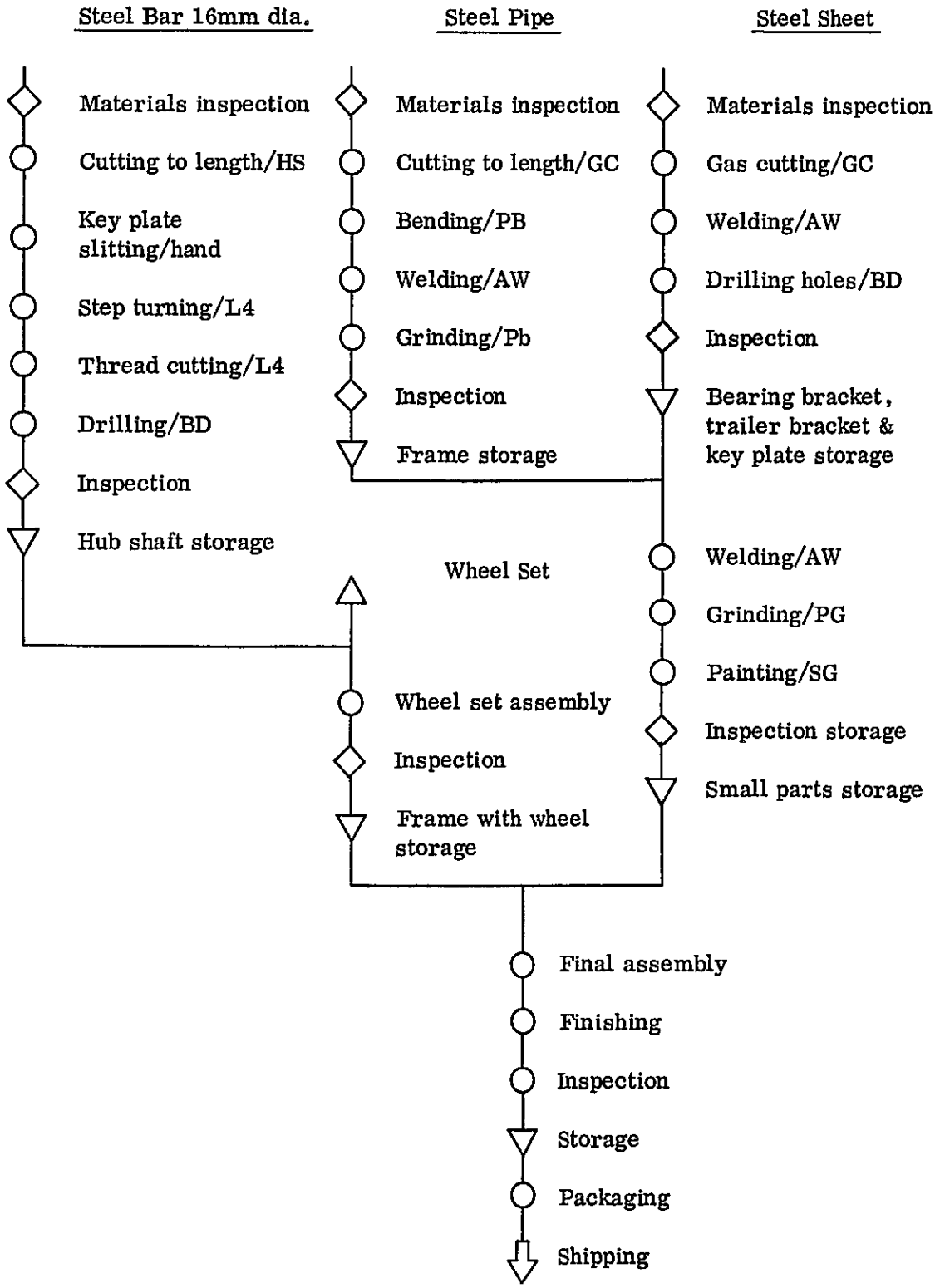
Hack sawing machine	HS
Gas flame cutting set	GC
Pipe bender	PB
Portable grinder	PG
Air compressor/spray gun	SG
4' lathe	L4
Bench drill	BD
Arc welder	AW

Handcart / Pushcart (Bicycle Trailer Type)



4. Production Process

Handcart Production



5. Unit Fabrication Time

(Minutes per unit of product)

Operation	Time
- Sheet metal & pipe working	80
- Turning, grinding, drilling	40
- Painting	15
- Assembly & others	85
Total	220

6. Production Volume & Workforce Requirements

1)	Unit fabrication time	220 min.
2)	Annual production volume	1,000 units
3)	Total annual fabrication time including idle time 1) x 2) ÷ 0.20	18,340 hours
4)	Total annual manhour per worker 260 days x 7 hours	1,820 hours
5)	Direct workforce requirements at one shift operation 3) ÷ 4)	10 workers

7. Production Cost (in take per unit of product)

1)	Materials	
	- Wheel sets	215
	- Steel balls	2
	- Steel tubing	222
	- Steel plate & steel bar	80
	- Others	10
	Sub-total	529

2)	Direct labour cost	
	- Production workers (at Tk. 3. 8 per hour)	18. 6
	- Supervisors	6. 9
	Sub-total	25. 5
3)	Other direct & indirect costs	
	Assuming 15% of 1) & 2) above	84
	(Other direct costs include costs of electricity, fuel, depreciation, etc.)	
4)	Total production cost	
	The total of 1), 2) & 3) above plus 5% thereof as other costs	Tk. 670

I - 8 WHEELBARROW

1. Product Specifications

- Engineering drawing	See Figure
- Dead weight	19 kg
- Rated loading capacity	100 kg in weight
- Maximum loading capacity	120 kg in weight
- Capacity of loading pan	35 litter
- Driving force required	Manual 28 kg at maximum loading on rough road

2. Material Requirements

	Type	Specifications (mm)	Quantity & Weight per unit of Product	
1)	Wheel set[1/]		1 unit	
2)	Handle grip	O.D. 26/I.D. 20[2/] length 100, rubber	2 units	0.05 kg
3)	Steel plate	6.0t, SPHC	100x300mm	1.06 kg
		1.2t, SPHC	1,100x700mm	6.04 kg
4)	Welded steel tubing	O.D. 21/I.D. 15, SPHC	6,000mm	5.7 kg
5)	Steel bar	19 dia., SS41B	170mm	0.27 kg
6)	Lock nut & washer	M16, SS41B	4 sets	0.29 kg
7)	Split pin	3 dia., x 30, SWRM	2 pcs.	0.05 kg
8)	Ovalhead bolt (with washer & nut)	M6 x 40, SS41B	4 sets	0.2 kg

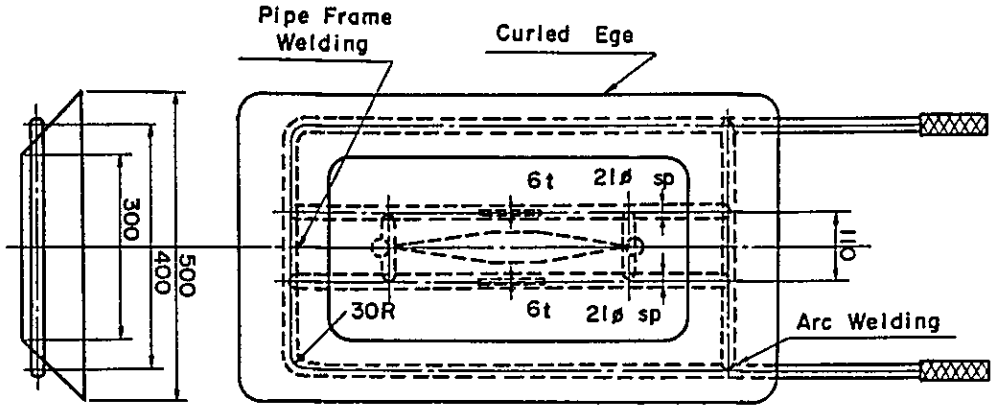
Note: 1/ Wheel set includes wheel, solid rubber tire, hub & ball bearing. Wheel is made of steel plate and is to be supplied by a large firm equipped with a 100 ton crank press. Bicycle wheel of 20" diameter is an alternative, which is not produced in Bangladesh at present.

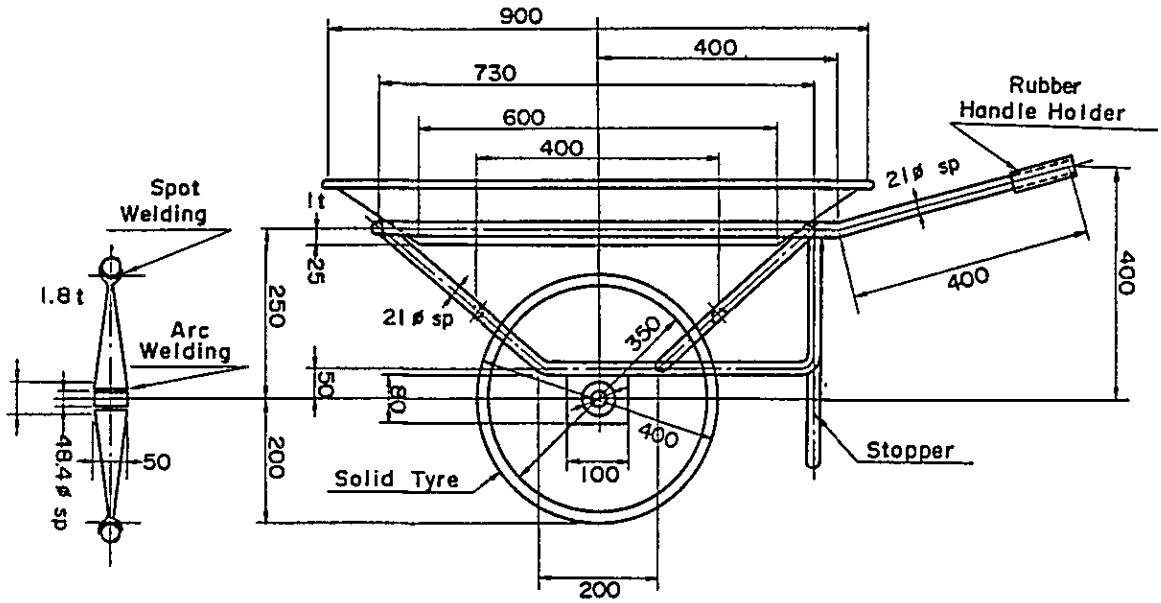
2/ O.D. stands for outer diameter & I.D. for inner diameter.

3. Production Facilities Required

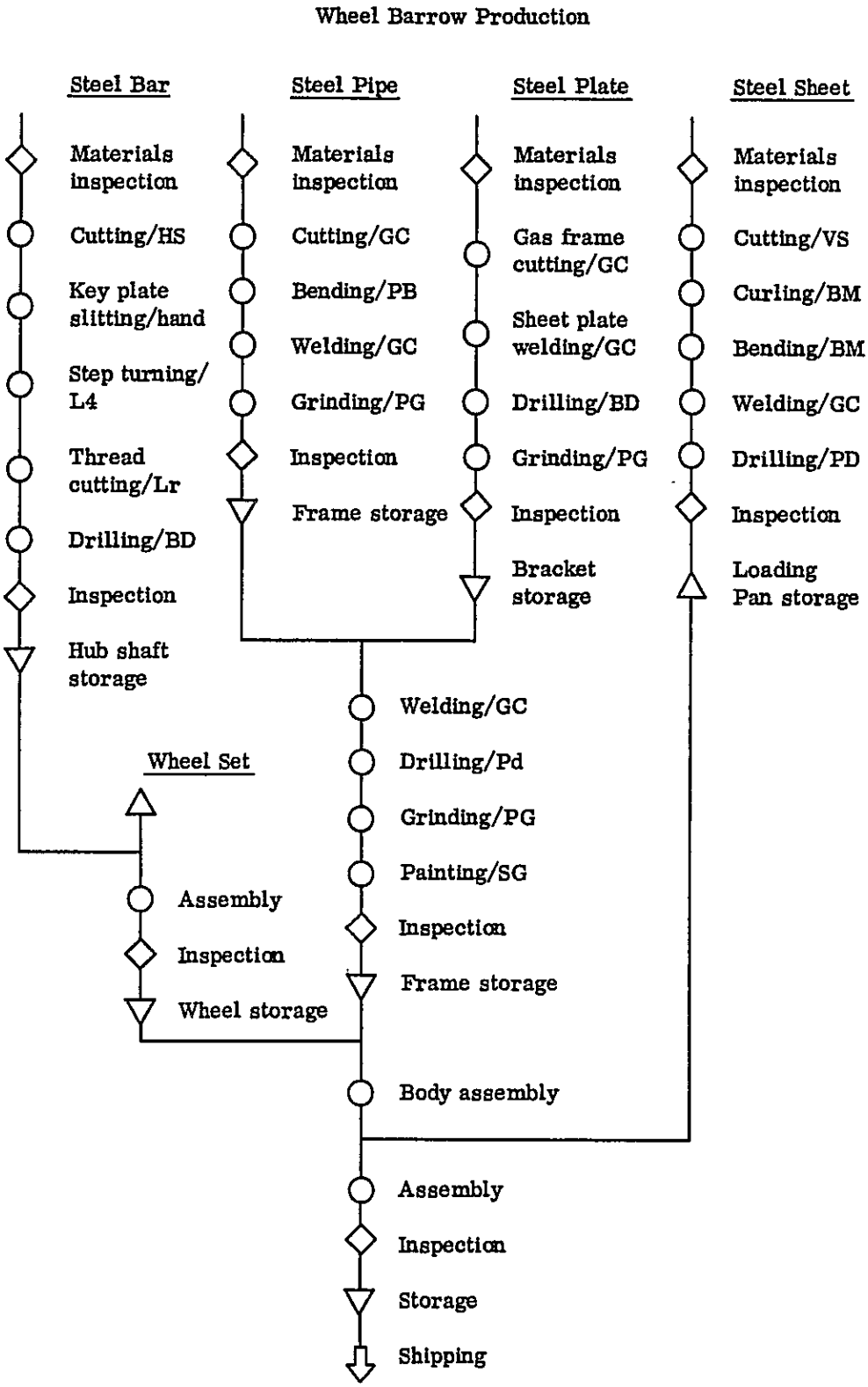
- Hack sawing machine	HS
- Vibro shearing machine	VS
- Sheet bending machine	BM
- Pipe bending machine	PB
- Gas flame cutting/welding set	GC
- Portable drilling machine	PD
- Bench drill	BD
- Portable grinding machine	PG
- 4' lathe	L4
- Air compressor/spray gun	SG

Wheel Barrow





4. Production Process



5. Unit Fabrication Time

(Minutes per unit of product)

Operation	Time
- Sheet metal & pipe working	100
- Turning, grinding & drilling	45
- Painting	15
- Assembly & others	70
Total	Tk. 230

6. Production Volume & Workforce Requirements

1) Total fabrication time — 230 min.

2) Annual production volume — 1,000 units

3) Total annual fabrication time

1) x 2) ÷ 0.20* — 19,170 hours

4) Total annual manhour per worker

260 days x 7 hours — 1,820 hours

5) Direct workforce requirements at one shift operation

3) ÷ 4) — 11 workers

* Manufacture of other products using same machinery is taken into account. Some idle time is also considered.

7. Production Cost (in taken per unit of product)

1) Materials

- Wheel set	130
- Steels	120
- Others	10
Sub-total	260

2)	Direct labour cost	
	- Production workers	19.4
	- Supervisors	3.9
	Sub-total	23.3
3)	Other direct & indirect costs	
	Assuming 15% of 1) & 2) above excluding the wheel set	23
4)	Total production cost	
	The total of 1), 2) & 3) above plus 5% thereof as other costs	Tk. 322

I-9 CENTRIFUGAL PUMP

1. Product Specifications

- Engineering arrangement: See Figure
- Size, rate capacity, power requirements and weight:

Suc. & discharge dia (inch)	Capacity (M^3/min.)	Head* (m)	Power (HP)	Weight (kg)
2" × 2"	0.5	15	2.1	35
3" × 3"	0.4 - 1.4	15	4.8	55
4" × 4"	0.8 - 2.0	15	6.5	85
6" × 6"	1.5 - 3.6	15	11.0	110

* Models with head of 10 m and 20 m are also to be produced.

2. Material Requirements

Type	Specification	Quantity & Weight per Product
Cast iron parts	FC 15 - 20	35 - 1,100 kg*
Steel bar	S45C to be annealed	3 - 7 kg*
bearing		
Packing		
Bolts and nuts	S35C	

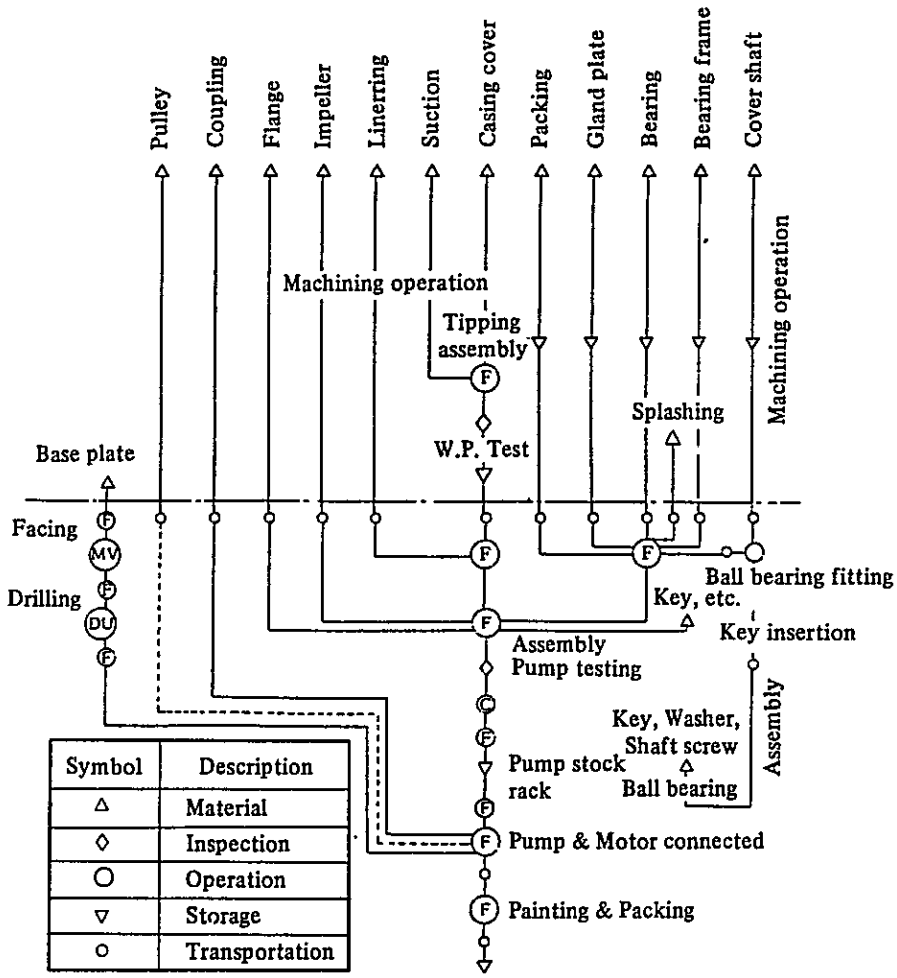
* Quantity varies depending on the model

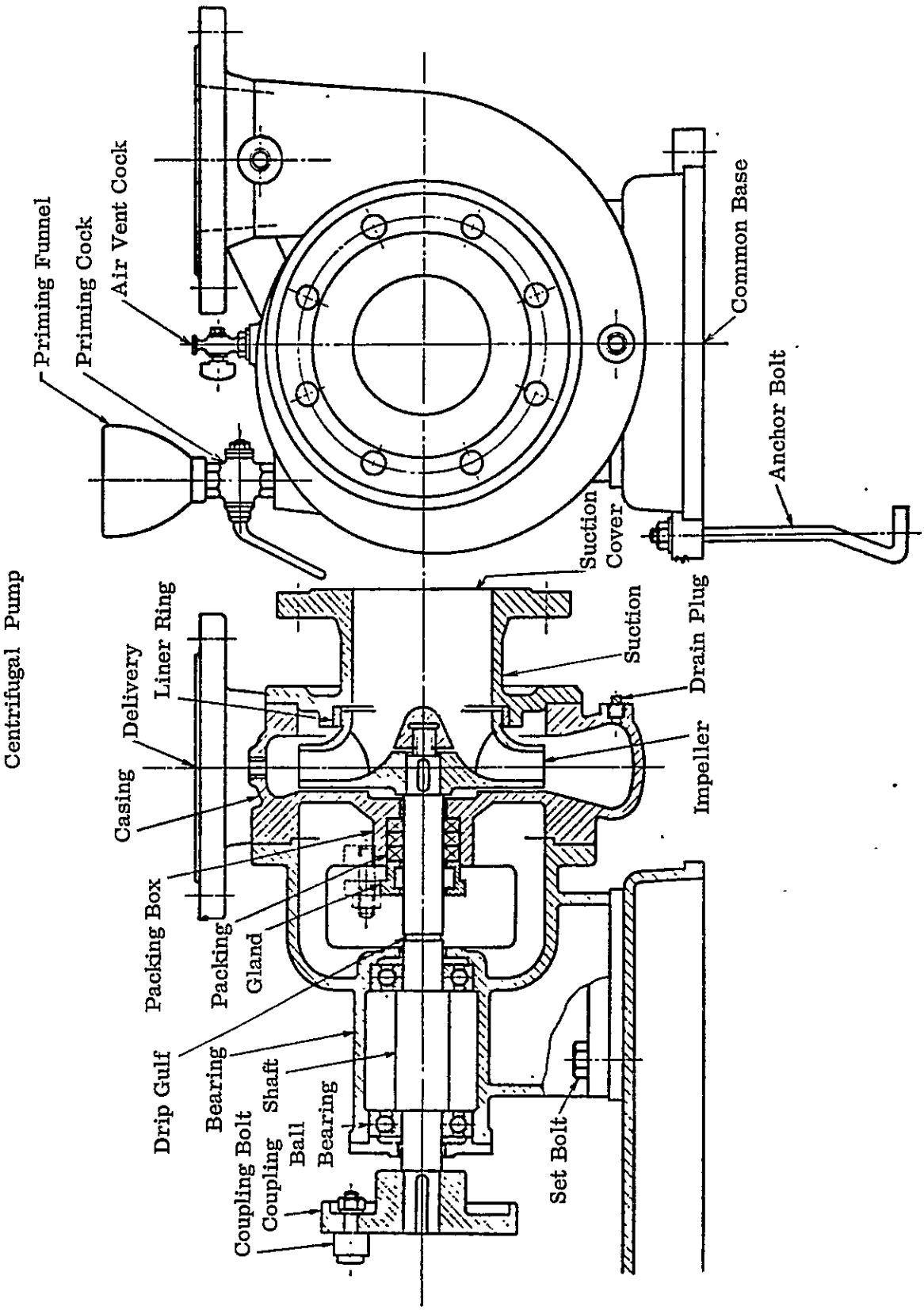
3. Production Facilities Required

- Engine lathe 650 mm
- Precision lathe
- Face lathe 1,200 mm required only for the model 6"×6"
- Planing machine 1,400 mm

- Vertical milling machine
- Radial drilling machine
- Bench drilling machine
- Slotter
- Hack sawing machine
- Universal tool grinder
- Carbide tool grinder
- Testing equipments

4. Production Process




Centrifugal Pump
Priming Funnel
Priming Cock
Air Vent Cock
Common Base
Anchor Bolt
Suction Cover
Liner Ring
Delivery
Casing
Packing Box
Packing
Gland
Drip Gulf
Bearing
Shaft
Ball Bearing
Coupling Bolt
Coupling
Suction
Drain Plug
Impeller
Set Bolt

5. Unit Fabrication Time

(hours per unit of product)

Operation	Time*
- Machining	15.5
- Testing	2.0
- Finishing and assembling	4.0
- Test running**	3.5
- Painting and others	2.5
Total	27.5

* Case of the model 4" × 4"

** On 20 % sampling basis

6. Production Volume & Workforce Requirement

1) Unit fabrication time	27.5	hrs.
2) Annual production volume	1,250	units
3) Total annual production time 1) × 2) ÷ 0.75*	45,833	hrs.
4) Total annual manhour per worker 260 days × 7 hours	1,820	hrs.
5) Direct workforce requirements at one shift operation 3) ÷ 4)	25	workers

* Manufacture of other products using same machinery is taken into account. Some idle time is also considered.

7. Production Cost (in taka per unit of product)*

1) Materials	
- Castings	850
- Steels	53
- Others (ball bearings, packing, bolts, nuts etc.)	650
Sub-total	1,553
2) Direct Labour Cost	
- Production workrs	36.6
- Supervisors	10.6
Sub-total	47.2
3) Other Direct & Indirect Costs	
Assuming 15 % of 1) & 2) above	240
4) Total Production Cost	
The Total of 1) through 4) above plus 5% thereof as other costs	Tk1,932

* Case of the model 4" × 4"

8. Remarks

This project assumes that castings are supplied by a foundry. It is emphasized here that the quality of castings produced by existing fountries in Bangladesh is not satisfactory for producing centrifugal pumps of the desired quality at the desired productivity. Intensive guidance should be given to existing as well as proposed foundries by concerned agencies.

II MEMBER LIST OF THE JICA SURVEY TEAMS

1. First Stage Survey (November, 1979)

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2. Second Stage Survey (January to March, 1980)

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   10) Yasuhiro TAGA
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