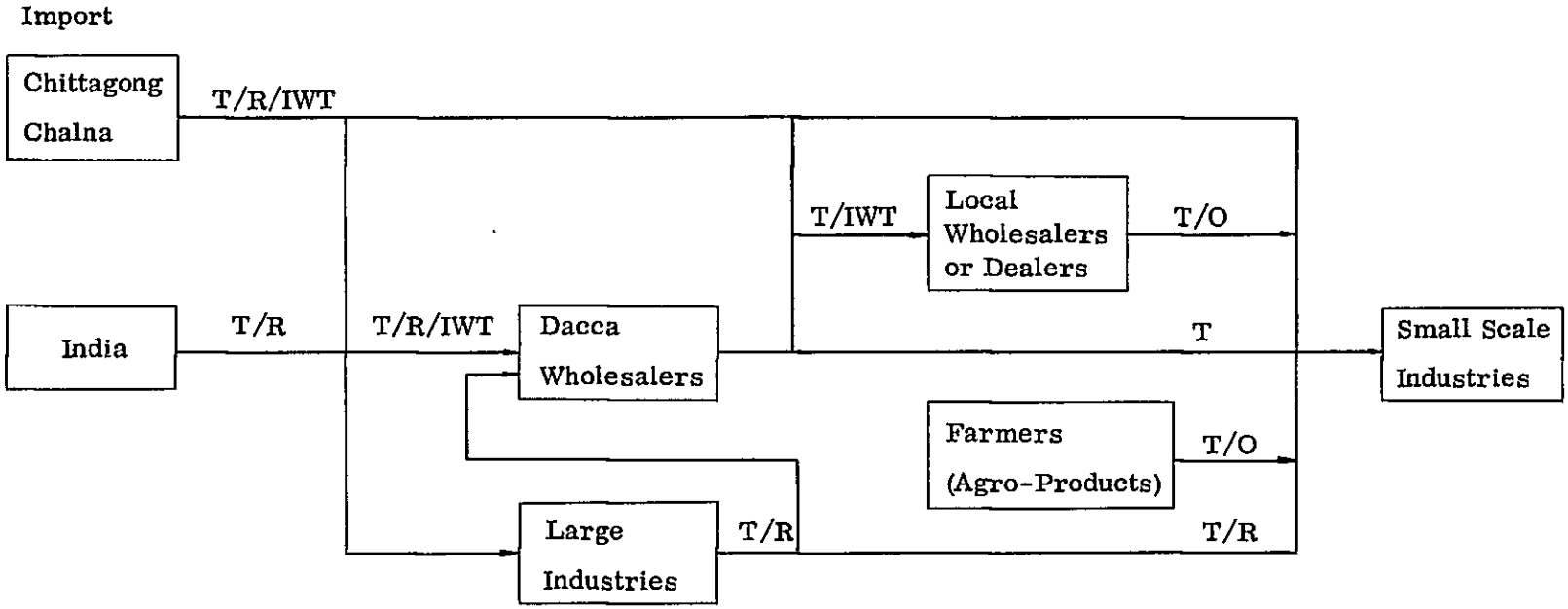
2.4 INFRASTRUCTURE DEVELOPMENT

2.4.1 Transportation

In absence of any survey, it is presumed that the transportation of raw materials for, and the products of, small scale industries is accomplished chiefly by road transport and partly by railway and inland water transport in view of the limited demand for transport. Trucks represent the majority of road transportation activities, but it is assumed that rickshaws, bullock carts, horse carts, and push carts are also in much use in small scale industries.

Raw materials and parts are supplied to small scale industries through the channels illustrated in Figure 2.4.1. As imported goods are supplied to industries, the unit quantity of transportation becomes smaller and, accordingly, shifts to more suitable mode of transportation take place. Because products from small scale industries are basically consumed locally, they are shipped out by trucks or other light carriers, or in rainy seasons, much by boats.

Figure 2.4.1 Mode of Raw Materials Transport for Small Scale Industries



T : Truck
R : Railway
IWT: Inland Water Transport
O : Others (Rickshaw and Carts)

Source: JICA Team

(1) Road Transport

Paved roads extend to a total of about 2,900 miles in Bangladesh. During the next 20 years, ferries will be replaced by bridges, existing roads improved, and feeder roads developed in rural areas. Of the three big rivers, early commencement of bridge construction over the Meghna for direct road connection between Dacca and Chittagong will be indispensable to economic development by a big stride. Although Rajshahi Division is much more disadvantaged than other three Divisions with regard to raw materials supply and products shipment inasmuch as more than a several hours is required for trucks to cross the Jamuna River via ferry connection, the cost and time of bridge construction over the Jamuna will be excessive and, therefore, the improvement of the existing ferry route is in urgent need.

Importation of trucks with a cargo carrying capacity in excess of seven tons into Bangladesh is prohibited for the protection of ferries and bridges, and the average carrying capacity of trucks now used in the nation is about five tons. However, over-loading is a common practice, and trucks are often seen to carry as much as ten tons. As a result, trucks with cargo are operated at a low speed but frequently involved in traffic accidents and breakdown. Sound private truck transport business has become difficult due to low freight charges which are artificially fixed to an extreme level in competition with the government-subsidized railway and water transport tariffs (see (2) and (3) below), and minute private enterprises with only one to a several trucks represent the majority of this industry. Small scale industries, which chiefly rely on truck transport, will possibly be affected adversely by this unhealthy situation of the trucking industry.

Along with agricultural promotion, the dispersion of small scale industries into rural areas will be required. Then, it will be essential that feeder roads be developed in rural areas in order to facilitate materials supply and products shipment. Although the construction cost is high of roads whose surface would not be submerged in rainy seasons in order for them to be always passable for vehicles, the rural industrial development is worth the cost.

In addition to the construction and upgrading of trunk highways and local roads, ferry-crossing time must be shortened and the truck utilization efficiency improved in order that the speed of truck transport, which will be in much use by small industries, can be increased. In this regard, the following are conceivable:

- Ferry-crossing time: In view that from 20 to 50% of total ferry-crossing time is spent for vehicles loading/unloading on and off the ferry boat, boats may be remodelled to handling capability of large vehicles (trucks and buses), or boats designed for this specific purpose built and placed in service.

- Truck utilization efficiency: In view that trucks are mostly owned by small private enterprises and that cargo transfers are being assigned by the trucking association, trucks terminals may be established near the two ports of entry and in Dacca (which are the three major centers of cargo movements) so that the crossing of cargo movements will be held to a minimum and that trucks will be assigned to jobs in most efficient manner without cargo over-loading.

(2) Railway Transport

The total railway track extention is currently approximately 590 miles for broad gauge and about 1,190 miles for meter gauge. The number of rolling stocks including engines is now on the decrease, and the rate of their operation is declining partly because of inadequate maintenance. However, railway remains to be extremely important as the means of transportation of bulk cargo, as long distance railway freight charges are held low under the government policy. Railway is playing a particularly important role in the transportation of agricultural products; for instance, in 1977/1978 period, the total quantities transported consisted of 14.1% wheat (corn), 13.4% sugarcane, 8.3% fertilizer, 7.9% raw jute, 7.5% rice, and 7.3% coal.

Railway transport is operated by the Bangladesh Railway. Railway tariff is established so low that a net loss of about 5% is incurred each year, which is supplemented with tax money under the subsidy system. Railway, which is suited for

the transportation of bulk cargo, would have only indirect impacts on small scale industries.

(3) Inland Water Transport

The Planning Commission estimates the size of navigable inland waterways as follows:

Table 2.4.1 Navigable Inland Waterways

(Unit: Miles)

	Dry Season	Rainy Season
Powered Boats	1,000	3,000
Country Boats	3,000	5,000

Source: Planning Commission

As of December 1978, a total of 533 commercial cargo boats (sans country boats) were in public ownership, and a total of 808, in private. Although the quantities of cargo carried compare 50-50 between publicly owned boats and privately owned, the rate of operation is lower in public sector. The public sector is operated by the Bangladesh Inland Water Transport Corporation (BIWTC), which also operates motor vehicle ferry boats.

Inland water transport, which is a major cargo transport sector along with road transport, offers the lowest unit transport cost and, therefore, expected to grow as a efficient means of cargo transport in the future. In view of the large transport capacity and that it does not necessarily cover the entire national territory with a close network, inland water transport would not be very suitable for use by small scale industries.

(4) Transport Cost and Tariff

Of domestic cargo transport, the public sector represents 100% of railway transport, 50% of inland water transport, and 5% of road transport. While the public sector tarrifs have been set assuming subsidy, road transport was not only

forced to fix the tariff unreasonably low in order to be competitive (see Table 2.4.2), but is also subject to various taxes. As a result, private participation in road transport industry has declined and trucks tend to be over-loaded with cargo.

Table 2.4.2 Cost vs Tariff for Cargo Transportation in 1977

(Unit: Tk/t. mile)

	Economic Cost				Tariff
	50 miles	100 miles	200 miles	400 miles	
Railway	2.20-2.63	1.44-1.76	0.85-1.17	0.65-0.97	0.82-0.88
Inland Water Transport	2.53	1.39	0.82	0.63	0.30-0.82
Road Transport	1.40-1.68	1.23-1.51	1.14-1.42	1.12-1.40	1.08-1.17

Source: BTS

In terms of transport cost, road transport is advantageous for a short distance (50 to 100 miles) conveyance, which small scale industries require. In other words, it should be worthwhile considering the establishment of a depot near the site of small industries to facilitate long distance transport of materials by the combination of inland water and railway transport up to the depot, where cargo can be transferred to factories in a small lot by trucks.

2.4.2 Electricity and Other Energy Supply

One of the most important but the most difficult requisites to the development of small scale industries is the securing of stable electric power and other energy supply. Small industries may be unable to afford the cost of a standby generator, which large industries can, and down time during power blackout would result in lower operation rates for higher production costs.

(1) Electric Power

Even though the generation capacity has a reserve ratio of nearly 40%, supply is unevently concentrated to the eastern part and power blackouts occur frequently

due to inadequate facility maintenance.

The supply imbalance between the east and the west can be summarized as shown in Table 2.4.3.

Table 2.4.3 Comparison of the Eastern and Western Electric Power Supply and Demand in 1977/78

	Total Eastern Zone	Total Western Zone	System Total
Installed Capacity (MW)	525.6	226.6	752.1
Maximum Demand (MW)	287.3	108.6	396.0
Generation (10^6 Kwh)	1,444.3	468.5	1,912.8
Load Factor (%)	57.4	49.2	55.5

Source: PDB

The east enjoys over twice the generation capacity and about thrice the power supply of the west. Also, eastern power generation facilities are operated with a high efficiency, as suggested by the load factor comparison. This is because:

- Big power consumption centers such as Dacca and Chittagong are in the east,
- A basic national power transmission grid has been completed in the east with a trunk line laid across the Meghna, and
- The east has natural gas fields and Chittagong Hill Tracts, where hydraulic generation is possible.

Basic power supply pattern in the west is that power is generated in Khulna, supplemented by gas turbine generator(s) in peak hours, and transmitted to the north. As development has advanced in the west, power demand has been on the increase. In the five years from 1973 to 1978, power generation (power demand) has increased by 10.6% per year in the west and by 8.0% per year in the east, for a national average of 8.6% per year. Naturally power shortage has been experienced

in the west, constituting a bottleneck to industrial development.

The east-west gap can only be closed by the interconnection of the east-west grids and the expansion of generation capacity in the west. Now that the fuel oil price has risen, exploitation of the eastern natural gas resource will be important to economical power generation, and, therefore, east-west interconnection will have to be promoted emphatically. In addition, the expansion of feeder connections for rural electrification will offer a substantial facilitation of the progress of small scale industries in rural areas.

(2) Other Energy Sources

Other energy sources usable by small scale industries include petroleum products, natural gas, coal and cokes, and biomass (straw, baggasse, fire wood, and jute sticks). Of these, petroleum products and natural gas would be particularly important.

- Petroleum products: Bangladesh Petroleum Corporation markets products refined from crude oil by Eastern Refining Limited in Chittagong and also imported light fraction of petroleum products for regulated prices with certain local variations.
- Natural gas: Gas pipeline has been laid to Dacca and one is being laid to Chittagong from the natural gas field on the east of Meghna whose reserve was estimated in 1979 at 8.1×10^{12} scf, or, at the current level of consumption, enough to last over 200 years.

Petroleum products are being distributed throughout the nation via inland water transport barges and tank rollies, namely, the southwestern part of Dacca and a majority of Chittagong Division. It has now become customary that industrial fuel used in the east is natural gas and that used in the west, fuel oil or coal.

(3) Energy Prices

A review of the structure of rates and prices of industrial use electric power, natural gas, and petroleum products reveals a number of problems as discussed below.

a) Power Rates

The following rate structure is currently in force:

- Low/Medium tension:	Home Use	Up to 400 units	Tk 0.40/Kwh
		Over 400 units	Tk 0.75/Kwh
	Public Use		Tk 0.75/Kwh
	Commercial Use		Tk 1.50/Kwh
	Agricultural Use		Tk 0.40/Kwh
- Low/Medium (via PBD transformer):			
	Commercial Use		Tk 0.75/Kwh
	Industrial Use		Tk 0.60/Kwh
- High tension (11 to 33 Kv):			
	Commercial/Industrial Use		Tk 0.50/Kwh
			plus Tk60.00/Kw
- Extra high tension (above 33 Kv):			Tk 0.45/Kwh
			plus Tk40.00/Kw

Rates for home use and commercial use low/medium tension power are held low by subsidy. Some small scale industries enjoy these low rates, but the majority of them receive power supply via a PBD transformer and, therefore, pay Tk 0.60 per kilowatt-hour, which is more disadvantageous than large industries which pay the high or extra high tension rates.

b) Natural Gas and Fuel Oil Prices

Natural gas price for industrial use is Tk 16.00 per 1,000 cubic feet, while fuel oil price is Tk 5.0 per gallon or, as converted to gas price at equivalent heat content basis, Tk 32.50 per 1,000 cubic feet, which is just about double the natural gas price. Upon visit to factories in Rajshahi Division, it was emphasized that their industrial heating cost was higher than that in the eastern area and, therefore, their products had little price competitiveness. If this disparity will continue, industries with much use of furnace will have no alternative but to locate themselves along the natural gas pipeline in the east.

Again on equal heat content basis, this gas price amounts to only about 10% of power rates, making natural gas the most inexpensive energy for industrial heating.

Efforts should be made to eliminate the indicated inequity within the price structure of same energy and to reduce price disparities between different energy sources. Especially from the standpoint of small scale industries, it is desired that:

- The rate of low/medium tension power via PDB transformer for small scale industries be made at least comparable to high or extra high tension power rate, and
- Fuel price for small industries be reduced to approach industrial use pipeline gas price.

2.4.3 Industrial Estates

BSCIC operates 20 small/medium industrial estates. Generally, occupancy rate is high of estates located in urbanized and industrialized areas such as Dacca and Chittagong and is low of those in northern cities with a small consumer population in the neighborhood. In the future, unplanned and isolated small scale industrial locations should be avoided, and a flexible development strategy as discussed below should be taken:

- Construction of new estates in the vicinity of large cities and the reservation of some estates for use by industries in selected sub-sectors, and
- Construction of mini-estates in northern cities.

After inspecting BSCIC industrial estates in Tongi, Comilla, Chittagong, Kushtia, and Bogra, the Survey Team believes that the following will be essential to industrial estates to be constructed in the future:

- Allotment of estate quarters by industrial type,
- Common waste water treatment (in concentration of industries which possibly contaminate water),

- Provision of telephone and other common use telecommunication facilities, and

- Connection to gas pipeline or the establishment of a common fuel oil depot.

In addition to the encouragement of industries to locate themselves in the estate, supply of utilities, and the facilitation of daily operation of the locating industries, the industrial estate offices should desirably attempt to perform greater functions in providing technical, market, and management consultation in cooperation with the BSCIC Headquarters and District Offices.

2.5 BSCIC ACTIVITIES

2.5.1 Present Status

BSCIC was initially established as East Pakistan Small Industries Corporation (EPCIS) in 1957, was reorganized into Bangladesh Small Industries Corporation (BSIC) in 1971, and merged with Cottage Industries Corporation (CIC) in 1976 to become BSCIC in the present form. BSCIC still aims at the same following objectives for which it was originally established (with some shifts in priority orders between the objectives):

- Development of infrastructure, particularly of industrial estates, and their operation
- Private business investment promotion
- Technical and managerial services (counselling and extension)
- Financial advisory
- Technical and managerial training
- Market development
- Design/prototype development
- Pilot/demonstration projects implementation

(1) Industrial Estate

A total of 20 industrial estates have been established in the nation. Those in the environs of Dacca and Chittagong are nearly fully occupied, and in such areas the construction of additional estates will become imperative under future demand. In rural areas, on the other hand, some estates are noted of a low occupancy rate, and vacant plots were conspicuous at Kushtia, which was one of the estates visited by the Survey Team.

Essentials to successful industrial estate operation are appropriate site selection, accurate estimation of types of locating industries, systematic promotional efforts, and most importantly, the determination of estate size based on

accurate forecast of industrial land demand. In addition, prospective industries which seek factory sites in industrial estates might be offered assistance on their securing financial loans and other incentives.

(2) Private Business Investment Promotion

BSCIC has already prepared and distributed about 100 profiles on promising types of industry and invited entrepreneurs to participate in them. In addition, BSCIC is currently in the process of basic research into eight sub-sectors and of preparing 52 new industrial profiles. Along with BSCIC, BSB is now preparing 15 profiles and Department of Industries, 25 profiles.

Heretofore, industrial profiles offered only summaries of (a) product description, (b) general evaluation, (c) manufacturing process, (d) market, (e) location, (f) production capacity, (g) production facilities, (h) manpower, (i) raw materials requirement, (j) overhead expenses, (k) annual sales, (l) annual profitability, (m) sources of finance, (n) financial results, and (o) machine list. If possible, detailed explanations should be given on product, market (evaluation), and manufacturing process, because adequate advance understanding of the technical and market aspect of the project in the minds of prospective small industry entrepreneurs--many of whom have little technical background--is essential. Mere distribution of such industrial profiles is inadequate for the purpose of effectively promoting private business investments. Pre-investment consultations at Regional and District Offices, as well as the dispatch of a circuit counselling group to meet the local needs in this aspect, will be essential.

(3) Technical and Managerial Services

Although BSCIC provides technical and managerial counselling services to the existing small scale industries through its Counselling and Industrial Studies Department (CISD), but few of the CISD counsellors seem to be capable of giving effective advices on the specific managemental problems of the industries. Therefore, BSCIC should consider (a) the training of the current staff, (b) the recruiting of new experts in various fields, or (c) the formation of a counselling team in joint-operation with BITAC and BMDC. It is expected that demands of

small industries located in rural areas will rise for on-the-spot counselling in the future, and, when this occurs, it will become necessary that experts be trained or circuit counselling teams visit various localities as the demand calls for.

(4) Financial Assistance

Direct participation of BSCIC in loan business will shrink under IDA recommendation, and, therefore, BSCIC functions in this respect will, by necessity, become that of providing industrial profiles which will facilitate the entrepreneur's application for loans and of giving appropriate advices on the product, market, manufacturing technology, and so forth--the same actions needed for investment promotion.

(5) Technical and Managerial Training

Major technical training is that which is given by BSCIC to craftsmen and artisans engaged in cottage industries. The training-cum-production centers offer training in pottery, garment making, handloom weaving, bamboo works, and cane works as a part of the pilot project. As for managerial training, about 300 unemployed youths have been trained under the entrepreneurship development program jointly sponsored by BMDC, BB, and BSCIC, and the financing of a total of 84 projects have been sanctioned for the trained. Nevertheless, the technical and managerial training mechanism of BSCIC is still inadequate and, therefore, must be strengthened for small scale industries. When the training center advocated by BSCIC (to be discussed later) is realized, it will chiefly be engaged in managerial training. Technical training, on the other hand, covers too great a variety of fields for any one organization to meet all the needs. A system for BSCIC, TTCs, and public corporations to share the technical training functions should be worth considerating.

(6) Market Development

BSCIC has strived to develop markets for the products of cottage industries. BSCIC buys products from the craftsmen and artisans trained at the training centers and displays and sells the products or markets them via the Bangladesh Handicrafts Marketing Corporation (BHMC). Some of the products have been exported, and

their export values have since 1977 come to the total of Tk 8.5 million.

The establishment of a system under which the work of large corporations will be sub-contracted to small scale industries is one way to develop markets for small industries. For instance, such large public corporations as Jute Mill, Textile Mill, and Sugar Mill import some Tk 226 million worth spare parts each year, and a system for small industries to domestically produce some of such parts for these corporations will result in not only the saving of foreign exchange but also the expansion of small industries' markets. BSCIC is currently making efforts to establish such a sub-contracting system.

Other market development potentials include the organization of cottage industries--whose products come with ununiform qualities and therefore have little international competitiveness--into joint-action, cooperative small scale industries for the ultimate exportation of their products.

(7) Design/Prototype Development

A handicrafts design center is in operation and has provided designs and prototypes, while providing training. Nothing has been done for small scale industries, however, because such industries cover a great variety of fields and design/prototype development requires a large investment. The design of, and the development of appropriate manufacturing process for, products suited to small scale industries represent so-called "appropriate technology", and technical development in this area is urgently needed for Bangladesh. However, in order for BSCIC to start such activities, it will have to (a) concentrate the efforts on selected technical fields in order to successful in product development, (b) make adjustment with the similar activities engaged in by the early starters such as BCSIR, BARI, and CERDI, and (c) draw a demarcation from the activities of the proposed Appropriate Technology Institute, which will be discussed later.

(8) Pilot/Demonstration Project

Pilot/demonstration projects implemented by BSCIC cover the fields of pottery, tile, fruit processing, fish drying, tobacco processing, light engineering, and bee-keeping, all of which are near-cottage type activities. In the future,

projects in agro-related industries will increase. Good examples of this type of projects include salt manufacturing, which now actually has grown out of prototype stage and reached the level of satisfying the domestic demand. Industries which must be developed urgently but in which private investment may not be much hoped for will be selected for this project.

It will be desirable that successful projects will be eventually disinvested and transferred to private sectors. Likely candidates of this project are, specifically, such agro-related industries as the preservation of fruits and vegetables, cattle feed processing, wood working, and fuel (biomass, gas) production.

2.5.2 BSCIC's Future Activity

As it was indicated by the Sectoral Draft of the Second Five-Year Plan, BSCIC will play the following roles in addition to those which it has heretofore played (see under 2.5.1):

- Selection of, and assistance on the procurement of, new or improved tools and machinery,
- Assistance to other government agencies on the formulation of small scale industries development programs,
- Organization of joint workshops, seminars, exhibitions, and fairs, and
- Development of information service cells for small scale industries development purposes.

BSCIC needs to be reorganized and strengthened in order for it to be able to perform these functions effectively. District Offices are being strengthened and will probably perform some of private investment promotion, various consultation, and market development functions. Concurrently, the BSCIC Headquarters' "back-up" function needs to be strengthened.

In the Second Five-Year Plan, BSCIC suggests the following new activities:

a) Development of a nationwide network for the development of small scale industries in rural areas,

b) Industrial estate development,

c) A Handicrafts Design Center,

d) A salt industry development program,

e) Bee-keeping and honey processing,

f) Handicrafts market development,

g) Pilot projects,

h) A craft center for small and cottage industries,

i) A training institute for small scale industries,

j) A technical development center/prototype development center,

k) A common facility center for small scale and cottage industries, and

l) Research and appraisal.

Of these, a), i), j), and k), as well as the establishment of a subcontracting organization, will be new activities. New investment will be prerequisite to any of these activities, but greater problem involved will be the needs of the expertise which BSCIC is currently unequipped with; either the current staff will have to be re-trained, or experts recruited from outside. Another possibility is for BSCIC to concentrate its efforts on certain aspect of small scale industries development, e.g. software, and to seek the assistance of other organizations on all other aspects. This approach, however, will find its greatest difficulty in that almost no other organizations have ever had anything to do with small scale industries development so far.

CHAPTER 3 POTENTIALS OF SMALL SCALE INDUSTRY DEVELOPMENT

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3.1 REGIONAL CHARACTERISTICS

3.1.1 Geographical and Socio-Economic Settings

The land of Bangladesh can be topographically classified into the following three:

a) Eastern and northeastern hill tracts

b) Central and western delta and flood plain

c) Southwestern tidal low land

Of these, b) represents the largest area size and shows the highest population density. All of the four sub-divisions under study (Chandpur, Joydebpur, Kushtia, and Bogra) belong to b) above and have a similar topography. Joydebpur has no big rivers, while Chandpur faces the Meghna, Kushtia faces the Ganges, and Bogra faces the Jamuna.

The characteristics of these four sub-divisions, particularly of their sub-divisional centres (which the Survey Team visited), may be summarized as presented in Table 3.1.1.

In absence of sub-division-wise data on land utilization, district data are presented in Table 3.1.2.

Table 3.1.1 Geographical Characteristics of the Four Sub-Divisions and Sub-Divisional Centres

Characteristics	Chandpur	Joydebpur	Kushtia	Bogra
1. Topography	- Overall low-lying area - Sometimes flooded and eroded by the Meghna	- Primarily high-lying area - Sizable forest reserves	- Primarily high-lying area partly resulted from decrease of Ganges water level	- Eastern half is low-lying and the western part is mostly high-lying
2. Basic Regional Function	- Chandpur is an commercial port with good connection to Barisal, Dacca and other inland waterway ports	- Outskirts of the Dacca metropolitan area - One of industrial centres of the Dacca area - An important centre of governmental research organizations incl. BARI, BRRI and CERDI	- Centre of railway and road communication	- Centre of road communication - Centre of regional agricultural activity; BARD, Bogra
3. Major Development Projects in the Sub-Divisions	- IDA Chandpur Irrigation Project - ADB Mehgra-Donagoda Irrigation Project - UNDP Hajiganj Pilot Project		- Ganges-Kobadak Irrigation Project	- IDA-IRDP Projects - Re-Excavation of Ghazaria-Ichamati - Cement factory
4. Major Communication	- Inland waterway - Railway - Road	- Railway - Road	- Railway - Road	- Railway - Road

Source: Compiled by JICA Mission

Table 3.1.2 District-wise Land Utilization

(Unit: 1,000 Acres)

	Comilla	Dacca	Kushtia	Bogra	Nation Total
Total Area	1,660	1,844	877	961	35,281
Not Cultivable	269	397	142	215	6,626
Forest	2	65	-	-	5,449
Unused	163	135	102	43	2,761
Net Cropped	1,226	1,247	633	703	20,445
Total Cropped	1,946	1,818	1,078	824	30,441
Land Utilization (%)	79.3	67.6	72.2	73.2	57.9
Cropping Intensity (%)	158.7	145.7	130.7	153.3	148.9

Source: BBS

Notes:

1/ Commila encompasses Chandpur Sub-Division, in addition to Comilla Sadar South, Comilla Sadar North, and Brahmanbaria Sub-Divisions.

2/ Dacca encompasses Joyebpur (Gazipur) Sub-Division, in addition to Dacca, Sadar, Narayanganj, Munshiganj, Manikaganj, and Narsinghd Sub-Divisions.

3/ Kushtia emcompasses Kushtia Sub-Division, in addition to Chuadanga and Meherpur Sub-Divisions.

4/ Bogra encompasses Bogra Sub-Division, in addition to Jairpurhat Sub-Division.

All these four districts show a higher land utilization than the national average. Dacca, which has large low lands in southern part, and Kushtia, where irrigation of the high-lying area is underdeveloped, show a lower crop intensity than the national average.

The four districts are profiled in Table 3.1.3. Bogra Sub-Division has the largest area size of the four, and the remaining three have about comparable sizes of land. The 1974 population census showed that, of the four, Chandpur had the

highest population density and Bogra and Joydebpur a low density--but all higher than the national average. Chandpur Sub-Division is the most heavily populated area in the nation, except for the two largest cities of Dacca and Chittagong. Joydebpur, where urbanization has advanced since 1974, must have a fairly high population density by now.

Table 3.1.3 Profiles of the Four Sub-Divisions

	Chandpur	Joydebpur	Kushtia	Bogra	Nation Total
Area (sq. miles)	658	681	623	1,127	55,598
No. of Villages	1,413	843	n.a.	1,883	64,000 Approx.
Population in 1974 (1,000)	1,544	979	1,023	1,606	71,479*
Average Population Density in 1974 (per sq. miles)	2,347	1,438	1,642	1,425	1,286*

Source: BBS

Note: * 1976/77 estimation: 80,815 for population and 1,455 for population density.

3.1.2 Agriculture

Agriculture, which utilized 77% of total labor force (1974 population census), was the most important sector of the Bangladesh economy, constituting 56.8% of total GDP in 1977/1978, when primary products (agriculture and fishery) including jute represented 93% of the nation's total export value. Agro-products processing contributes to about 40% of the gross value of industrial production. In the four sub-divisions under study, too, agriculture is naturally the largest economic sector.

No sub-division-wise data could be obtained during this survey, and the following discussions will be based on district-wise data.

Table 3.1.4 shows value added from agricultural sector in each district. Of the four, Comilla District achieved the largest agricultural value added, and Kushtia District, the smallest.

Table 3.1.4 District-wise Value Added from Agricultural Sector in 1977/78

(Unit: million Tk)

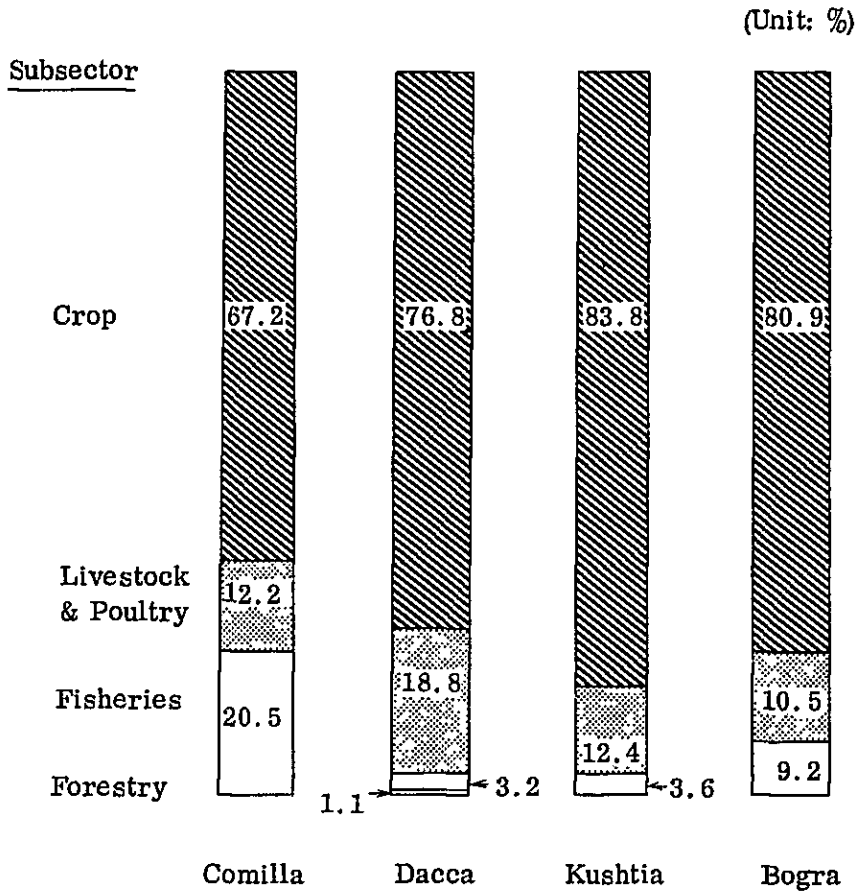
	Comilla	Dacca	Kushtia	Bogra	Nation Total
Crops	3,462	3,277	1,259	1,940	39,450
Livestock & Poultry	631	802	187	254	7,773
Fisheries	1,058	138	55	221	6,917
Forestry	2	48	-	-	4,066
Sub-Total	5,153	4,265	1,501	2,415	69,793
Land Productivity (Tk per acre)	2,648	2,346	1,392	2,930	2,293

Source: BBS

Likewise, Comilla showed the highest agricultural land productivity (measured in terms of agricultural value added per unit of land), and Kushtia, the lowest--lower than the national average. In other words, agricultural development is most advanced in Comilla and least advanced in Kushtia, as reflected by the cropping intensity data.

A comparison of agricultural sub-sectors (see Figure 3.1.1) indicates that Comilla has a well balanced agricultural activities, with an important contribution from fishery activities around Chandpur. In Dacca District, livestock, poultry, and vegetable productions are high--a characteristic of urban type agriculture. Crop raising is the major agricultural activity in Kushtia District, but the crop productivity is low and agricultural development is most retarded of the four Districts. In Bogra, too, crop raising is the major agricultural activity but livestock and fishery activities are also high -- a pattern close to that of Comilla.

Figure 3.1.1 Composition of Value Added from Agriculture Subsectors in the Four Districts



The ratios of contribution to the nation's total agricultural value added in each agricultural sub-sector of each of these districts are shown in Table 3.1.5.

Table 3.1.5 Contribution of the Four Districts to Total Agricultural Value Added

(Unit: %)

	Comilla	Dacca	Kushtia	Bogra	Nation Total
Crops	8.8	8.3	3.2	4.9	100.0
Livestock & Poultry	8.1	10.3	2.4	3.3	100.0
Fisheries	15.3	2.0	0.8	3.2	100.0
Forestry	0	1.2	—	—	100.0
Sub-Total (A)	7.4	6.1	2.2	3.5	100.0
Rural Population (B)	8.5	8.2	2.6	3.3	100.0
Total Cropped Area (C)	6.4	6.0	3.5	2.7	100.0
A/B	0.87	0.74	0.85	1.06	1.00
A/C	1.16	1.02	0.63	1.30	1.00

Source: Tables 3.1.2 and 3.2.1

Each district is commented on as follows:

- Comilla produces 7.4% of the total agricultural value added in the nation but has 8.5% of the nation's total agricultural population, and, therefore, labor productivity is lower than the national average. However, land productivity is fairly high.
- Dacca produces about 5% of the total value added, but, due to the demographical conditions, shows the lowest labor productivity of the four districts. Land productivity is close to the national average.
- Kushtia shows the lowest labor and land productivities of the four due apparently to the retarded land and irrigation development.
- Bogra shows the highest labor and land productivities of the four as a result of highly efficient agricultural activities.

Value added in each of these districts by crop is listed in Table 3.1.6.

Table 3.1.6 Value Added from Agricultural Crops by District 1976/77

(Unit: Tk millions (%))

	Comilla	Dacca	Kushtia	Bogra	Nation Total
Creals	2,093.0 (77.6)	1,724.6 (64.6)	407.4 (47.6)	1,080.4 (74.8)	28,488.8 (72.2)
Drugs & Narcotics	23.0 (0.9)	39.3 (1.5)	77.5 (9.1)	10.6 (0.7)	898.8 (2.3)
Fibres	119.6 (4.4)	261.6 (9.8)	67.0 (7.8)	55.0 (3.8)	2,318.4 (5.9)
Fruits	38.2 (1.4)	130.0 (4.9)	42.2 (4.9)	79.4 (5.5)	2,040.7 (5.2
Oilseeds	65.5 (2.4)	82.0 (3.1)	14.5 (1.7)	9.8 (0.7)	818.2 (2.1)
Pulses	8.0 (0.3)	24.4 (0.9)	22.2 (2.6)	7.0 (0.5)	390.9 (1.0)
Spices	78.4 (2.9)	44.3 (1.7)	26.6 (3.1)	51.1 (3.5)	998.4 (2.5)
Sugarcane	4.9 (0.2)	64.8 (2.4)	164.4 (19.2)	82.9 (5.7)	1,696.4 (4.3)
Vegetables	162.4 (6.0)	279.6 (10.5)	28.5 (3.3)	67.4 (4.7)	1,459.8 (3.7)
Others	2.3 (0.1)	18.5 (0.7)	4.5 (9.6)	1.3 (0.0)	339.7 (0.9)
Sub-Total	2,695.5(100.0)	2,669.1(100.0)	854.8(100.0)	1,444.8(100.0)	39,450.1(100.0)
Value Added per Cropped Area (Tk/Acre)	1,385.1	1,468.2	792.9	1,753.4	1,296.0

Source: BBS

- Comilla is a typical rice and wheat (corn) producing area, along with Bogra. In addition, vegetable production is high and a part of the crops is shipped to Dacca area. Crop production per unit of land is somewhat higher than the average.

- Dacca: In addition to rice, agricultural activities cover fruits, jute, vegetables, and oil seeds, showing a diversified agricultural development pattern.

- Kushtia: In comparison with other three districts, the ratio of grain production, particularly wheat production, is high. Sugar cane production is very high (about 10% of the nation's total production). Also, tobacco leaves and herbs for medical use are much produced. Production per unit of land under crop is very low and much improvement is necessary.

- Bogra shows a cropping pattern very close to the average pattern of the nation. Fair quantities of fruits, sugar cane, and vegetables are produced. The agro-products are seemingly much consumed within the District and immediately adjacent areas rather than being shipped to other districts. A high land (under crop) productivity has already been accomplished, and, therefore, the future agricultural development efforts should be directed to diversification, with emphasis on cash crops growing.

3.1.3 Industry

Medium and large scale industries are concentrated in the vicinity of the port of entry and such large cities as Dacca, Chittagong, and Khulna. This concentration is clear from the number of manufacturing industries registered in the four districts, which encompass the four sub-divisions under study, presented in Table 3.1.7.

Tabl 3.1.7 Registered Manufacturing Industries in the Four Districts in 1972/73

(Unit: Nos (%))

	Comilla	Dacca	Kushtia	Bogra	Nation Total
Number of Registered Industry	70 (3.5)	1,104 (55.8)	4 (0.2)	19 (1.0)	1,980 (100.0)
Number of Employees	4,964 (2.7)	77,830 (42.7)	346 (0.2)	1,114 (0.6)	182,092 (100.0)

Source: BBS

The data is as of 1972/1973, and it is possible that additional manufacturing industries have been registered in three of these districts other than Dacca since that time. Nevertheless, it is believed that medium and large industries are still much concentrated in the three largest cities.

The two industrial sub-sectors which showed the largest and the next largest number of registration in the three districts (other than Dacca) are discussed below, from which it is clear that specific types of medium and large scale industries are located in rural areas.

- Comilla: 42 textile and 15 chemical/chemical products out of the total of 57 (81% of total registration).
- Kushtia: 2 machinery (50%).
- Bogra: 8 food and 6 chemical/chemical products out of the total of 14 (74%).

Statistics on small scale industries are shown by sub-division in Table 3.1.8. Among these industries, the number of food processing firms is overwhelmingly high (72% on nationwide basis). Rice mills and flour mills represent the majority of food processing activities.

Sub-divisions may be too small a territory for the formulation and enforcement of any strategy, but if they are to establish a strategy for the development of small industries, the strategy should conform to the following objectives:

Table 3.1.8 Number and Employment of Small Industry Units, 1977

	Chandpur		Joydebpur		Kushtia*		Bogra*		Nation Total	
	Estab.	Empl.	Estab.	Empl.	Estab.	Empl.	Estab.	Empl.	Estab.	Empl.
31. Food	458	2,584	168	632	354	1,286	400	1,930	17,356	95,008
32. Textile	1	49	32	456	4	58	3	49	1,426	12,199
33. Wood	12	106	24	158	17	119	11	110	870	7,365
34. Paper	18	66	7	56	5	21	32	349	1,086	7,643
35. Chemical	3	106	9	127	2	43	12	457	528	5,716
36. Non-metal	-	-	8	160	1	69	-	-	214	8,092
37. Basic metal	1	8	21	155	22	134	11	151	1,743	11,061
38. Metal & machinery	-	-	2	11	18	46	8	49	664	4,554
39. Others	-	-	5	11	4	9	8	57	138	501
Sub-Total	493	2,919	276	1,766	444	1,785	485	3,152	24,025	152,145

Source: Preliminary Survey of Small Industries 1977/78 after BSCIC

Note: * District-wise data

- The achievement of sub-divisional self-sufficiency,
- The raising of degree of products processing within the sub-division,
- The strengthening of linkage among industries existing within the sub-division, and
- The fosteration of industries which will be characteristic to the sub-division.

a) Chandpur: Food processing is by far the greatest of industrial activities, and, except for wood working and paper products, almost no other important industries exist. Industrialization is retarded, probably because Chandpur is a domestic trading port and is close to fairly industrialized Comilla. The industrialization strategy should include:
   - To provide goods and services to neighboring agricultural areas (examples are: textile, fish processing, light engineering, and consumers chemical products),
   - To facilitate the domestic trading port functions (examples: boat manufacturing, marine engine repair, and fishing gear),
   - To ship goods to the other sub-divisions via the domestic trading port (example: general consumer goods).

b) Joyebpur is a part of the Dacca Industrial Zone and has fairly diversified industries. Has a well developed transport access to the highly populated Dacca and is situated on the route to the northern area. In not be allowed to encourage disorderly industrial development.

The strategy should be:

   - To establish a manufacturing centre for the supply of consumer goods consumer durables (examples: process food, textile, paper products, and electrical appliances) to Dacca Market,
   - To strengthen linkage with Tongi Industrial Zone and other existing industries (examples: metal working, light engineering, chemical products)
   - To foster selective, specific industries.

c) Kushtia has a relatively well balanced small scale industrial structure, but industrial development has recently advanced at a slow pace because of the limited sub-divisional markets and retarded agricultural development.

The strategy should include:

- To supply consumer goods (textiles, garments, process food) to the sub-divisional inhabitants,
- To strengthen selective, specific industries (such as metal working and light engineering),
- To modernize the facilities of the existing industries.

d) Bogra is located near the centre of Rajshahi Division, has a good communication network, and has a high potential for industrialization so as to serve as a supply source for the surrounding sub-divisions. In addition to food processing, various other industries already exist, which should be fostered for growth. The strategy should be:

- To produce goods to satisfy demands in the sub-division and surrounding areas (examples: textile, garments, food processing other than rice milling, and building materials),
- To supply products and services to neighboring agricultural areas (examples: light engineering and metal working).

3.2 DEVELOPMENT POTENTIALS OF AGRO-SUPPORTING AND AGRO-BASED INDUSTRIES

3.2.1 Selection of Important Industries

In this Study, agro-supporting and agro-based industries are defined as follows:

a) Agro-supporting industries:

- Fertilizer ISIC 35120
- Insecticides and fungicides ISIC 35121
- Agricultural tools, implements, and machinery ISIC 38111, 38220, 38221, 38223, 38224, 28226
- Irrigation equipment ISIC 37101, 38210, 38294
- Agro-product processing machinery ISIC 38225, 38241, 38244

b) Agro-based industries

- Sugar refining ISIC 31181
- Edible oil processing ISIC 31151
- Dairy products ISIC 31121, 31122
- Processed fruits and vegetables ISIC 31130, 31131, 31132
- Meat ISIC 31111, 31112, 31113
- Grain processing ISIC 31160
- Cattle feedstuff ISIC 31221
- Leather processing ISIC 32310, 32331, 32332

Potentials for the development of these agro-related industries in a small scale are reviewed in Table 3.2.1.

Table 3.2.1 Selection of Agro-Supporting and Agro-Based Industries

Industry	Present Status	Appropriateness for Small Scale Industry Development
- 35120 (ISIC) Fertilizer	. Approx. 48% self-sufficient. . Another urea plant under construction. . A TSP complex in operation.	. Highly capital intensive. . Not appropriate for small scale industries (SSI) development.
- 35121 Insecticides and Fungicides	. Mostly imported.	. Relatively capital and technology intensive. . Not very much appropriate.
- 38111 Hoes, Shovels and Sickles	. Largely manufactured by local blacksmiths. . Partly manufactured by relatively modern process.	. Can be made labour-intensive with less investment. . Appropriate.
- 38221 Ploughs	. Simple types are manufactured locally.	. Can be made labour-intensive with less investment. . Appropriate, depending on types of plough.
- 38222 Seeders	. Hand operated seeders are manufactured by more than a dozen of engineering companies.	. Can be made labour-intensive with less investment. . Appropriate, as far as hand-operated seeders concerned.
- 38223 Power Tillers	. Prototypes are manufactured by a few companies incl. BMTF. . Small scale commercial production will start soon.	. Relatively capital and technology intensive. . Not appropriate, but in future possible.

(Continued)

	Industry	Present Status	Appropriateness for Small Scale Industry Development
- 38224	Thresher	. Pedal threshers are assembled by a few manufactures -- 2,000 units/year. . Power threshers were assembled by Comilla Cooperative Karkhana.	. Labour intensive and less capital intensive operation. . Appropriate.
- 38226	Tractors	. No commercial operation. . A few plans of local knock down assembly.	. Capital and technology intensive. . Not appropriate.
- 37101	Steel Tubes and Pipes	. Bangladesh National Tubes Ltd. and Karim Pipe Industries.	. Capital intensive. . Not appropriate, however, pipe fitting manufacture (foundry) is appropriate.
- 38210	Diesel Engines	. Bangladesh Diesel Plant: 5,000 units/year, in future 8,000 units/year . Bangladesh Diesel Corp: 100 units/year . Bangladesh Machine Tool Factory: 10,000 units/year . A few more companies are planning manufacture of diesel engines	. Capital and technology intensive. . Not appropriate.
- 38294	Pumps	. Approx. a dozen manufacturers in centrifugal pump production: 20,000 units/year . Many manufacturers of hand pumps.	. Pump manufacturing is essentially foundry practice and less capital intensive. . Appropriate.
- 38225	Dairy Processing Machinery	. Totally imported.	. Technology and capital intensive operation. . Not appropriate.
- 38241	Leather Processing Machinery	. Totally imported	. Small machinery may be locally manufactured but markets are small.

(Continued)

	Industry	Present Status	Appropriateness for Small Scale Industry Development
- 38244	Oil Expellers, Rice Hullers and Sugar Cane Crushers	. Small number of oil expellers and rice hullers are manufactured by one or tow companies incl. Essential Products. . Most of oil expellers and rice hullers are imported from India. . Sugar cane crushers are manufactured by a few companies.	. Those simple machines can be manufactured by simple technology with less capital investment. . Appropriate, only for simple machinery.
- 31181	Refined Sugar	. At present 15 large mills with capacity of 179,000 tons/year. . There are many local "gur" manufacturers.	. Small sugar mills are possible, depending on the Government's policy on establishing the "Sugar Zone".
- 31151	Edible Oil Processing	. There are a large oil mills with capacity of 22,500 tons/year and numerous small oil mills.	. Small oil mills are appropriate for development. . Crushing capacity seems to balance with oil seed supply.
- 31121 31122	Butter and Cheese Milk	. A few modern dairy farms are in operation, others are local farms. . Approx. 14,000 tons produced in 1978/79.	. Modern dairy farms are capital intensive. . Not very much appropriate, except for cottage-type.
- 31130 31131 31133	Dried Fruits and Jam Canning of Fruits and Vegetables Fruits Juice	. There are only four canning and fruits preservation factories.	. Capital and technology intensive. . There must be a system of growing and collecting fruits and vegetables. . Not appropriate, except for small units mainly supplying domestic market.

(Continued)

	Industry	Present Status	Appropriateness for Small Scale Industry Development
- 31111	Meat Processing and Freezing	. Approx. 230,000 tons of meat were processed in 1978/79, mostly in a primitive way.	. Modern slaughter houses are needed, which are capital intensive. . Not appropriate.
- 31112	Poultry Meat	. Approx. 65,000 tons of poultry meat were processed in 1978/79. . Numerous poultry farms in operation.	. Modern poultry farms are relatively capital intensive. . Appropriate only for small poultry farms.
- 31113	Preserved Meat	. No such processing.	. Not appropriate, because small scale operation can not warrant hygiene.
- 31160	Polished Rice and Wheat Flour	. Perhaps several tens of thousands units of rice and flour mills are in operation incl. cottage type.	. Modern flour mills are capital intensive. . Appropriate
- 31221	Cattle Feedstuff	. Small commercial operation. . A few companies are planning feedstuff manufacturing.	. Raw material supply will be a problem. . Appropriate.
- 32310	Finishing Hide and Skin	. Production of hide and skin are somewhat stable, 10,000,000 per year. . Mostly out-of-date processing.	. Appropriate, but modern processing technology is needed.
- 32331	Shoes and Bags	. Several shoes manufacturers.	. Marketing incl. export is important.
- 32332	Other Leather Goods	. Many cottage-type leathercrafts manufacturers.	. Appropriate, except for shoes manufacturing.

Source: JICA Mission

Development of agro-based industries is closely related with agricultural development. These industries should be located in the most suitable area in the Country, not limited to the four sub-divisions under study. In this view, agro-supporting industries will be brought under close examination. Of the agro-supporting industries, fertilizer and agricultural chemical manufacturing industries are highly capital- and technology-intensive and, therefore excluded from consideration. Likewise, power tillers, tractors, and diesel engines do not fall in the category of small scale industries in view of their capital- and technology-intensive nature.

Accordingly, farming tools and implements and simple agro-product processing machinery are the only agro-supporting industries which may be started with a small capital and a relatively simple technology. As viewed from industrial side, they may be classified as metal working/light engineering industries consisting of foundry, machine shop, forging shop, and sheet metal and welding shop.

Metal working/light engineering (MW/LE) industry covers the following four areas by the International Standard Industrial Classification (ISIC):

- 381 (metal products except machinery)
- 382 (machinery except electrical)
- 383 (Electrical machinery and apparatus)
- 384 (Transport equipment)

MW/LE activities include:

a) Production of agricultural tools and other metal products,

b) Production of agricultural machinery and other light machinery, except household electrical appliances,

c) Production of light transport equipment,

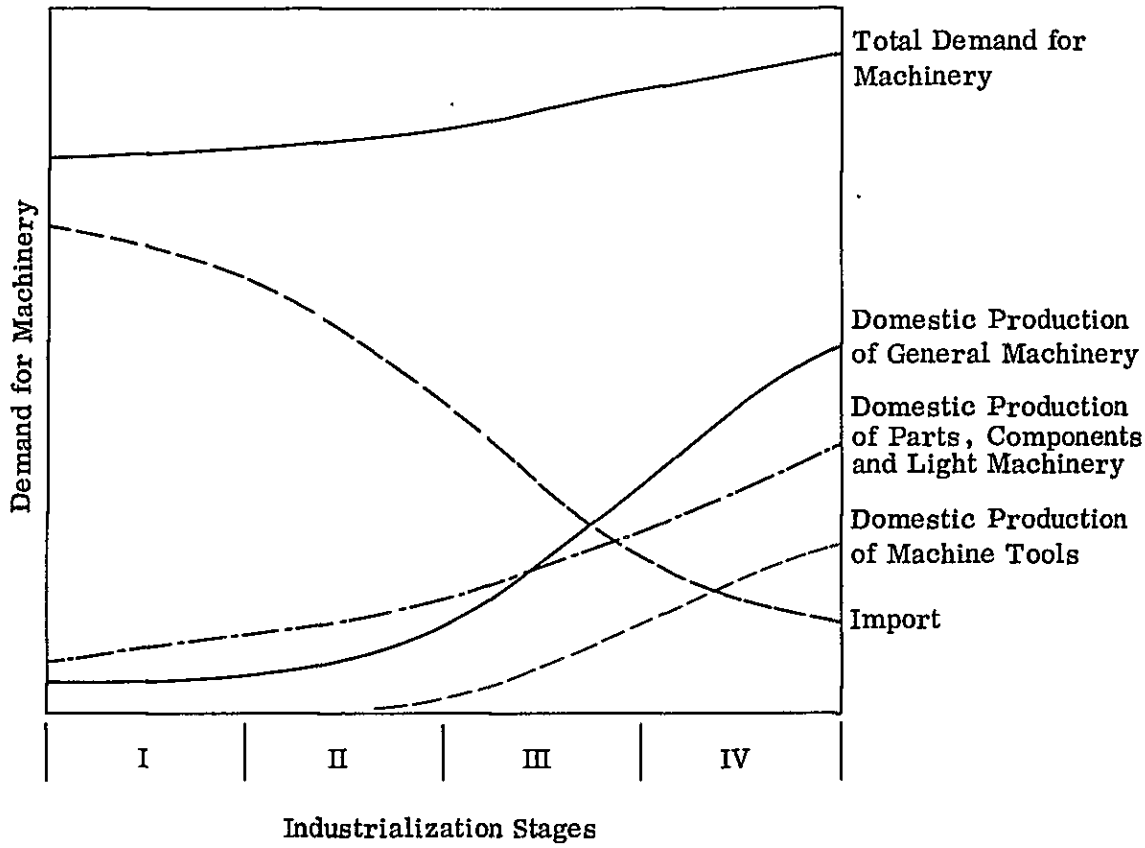
d) Production of machine parts and components, and

e) Repair of light machinery and transport equipment.

From machinery importation and production standpoints, the process of industrialization may be typically expressed as presented in Fig. 3.2.1. That is,

industrialization goes through the following stages:

Figure 3.2.1 Schematic Industrialization Process as Viewed from Metal Products and Machinery Industry Development



(Source) JICA Mission

I. Most of machinery and parts are being imported
II. Light machinery and parts are domestically produced,
III. Ordinary machines are domestically produced, then
IV. Machine tools are domestically produced.

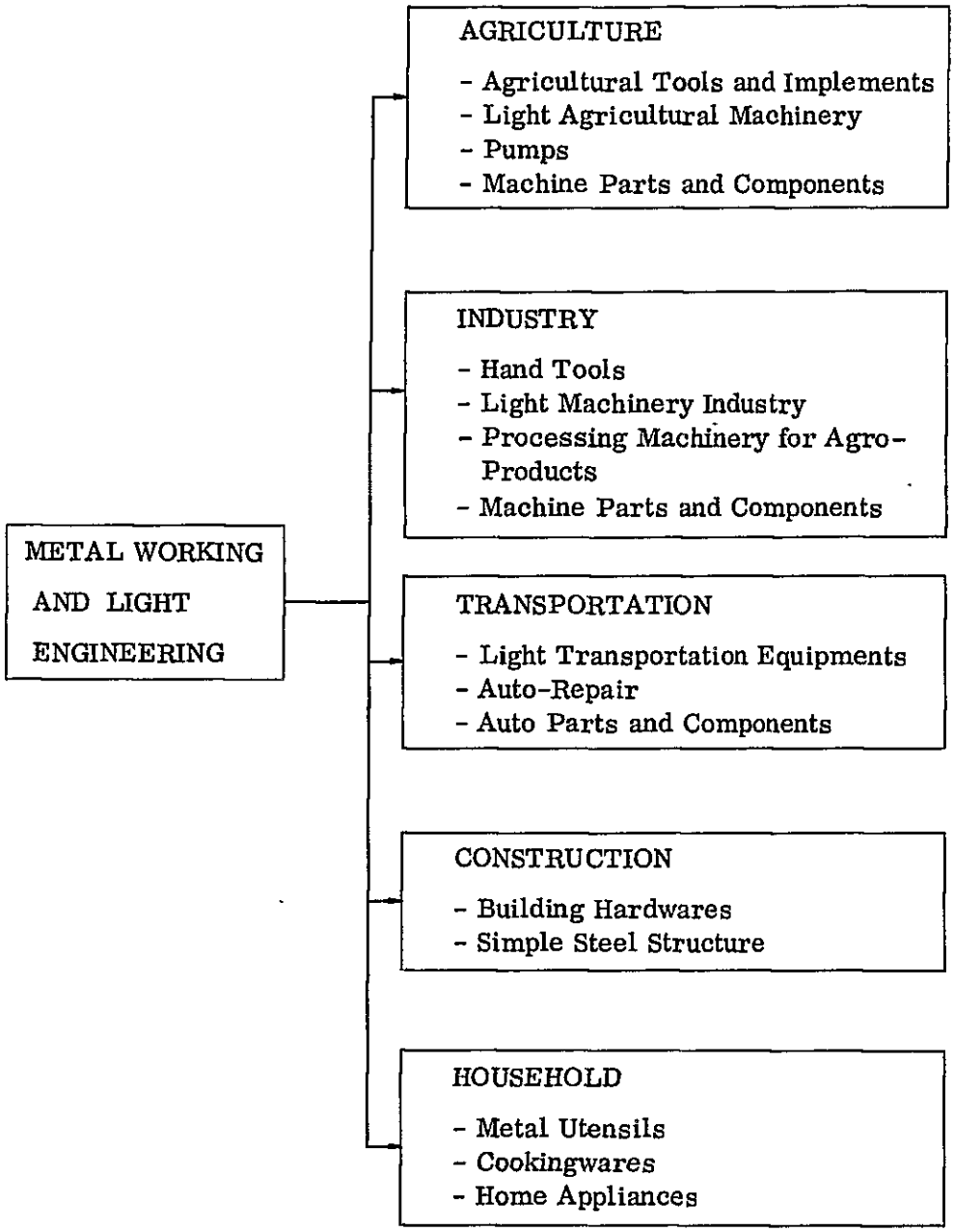
MW/LE industry plays the central role in the state II of industrialization, and Bangladesh is about to reach this state.

The fact that machine parts imported during 1977/1978 amounted to Tk 572,580,000 in total is one evidence that MW/LE industry, when developed, will

accomplish a very substantial import substitution. Likewise, the fact that this amount of parts importation is more than twice the existing MW/LE production capacity of Tk 450 million shows that this industry has great potentials for future growth and, therefore, is very promissing.

Furthermore, the fosteration of MW/LE industry will result in the creation of horizontal industrial linkage (that is, MW/LE and other subsectors will be linked through the supply of machines and parts - see Fig. 3.2.2), which will greatly contribute to the buildup of a stable industrial structure in Bangladesh. The strengthening of this very important subsector will result not only in the promotion of metal products and machinery industries, but also in the acceleration of agro-based industrial development.

Figure 3.2.2 Industrial Linkage of ME/LE Sub-Sector with Major Economic Sectors



Source: JICA Team

3.2.2 Long List of Products Possibly Manufactured by the Small Scale Metal Working and Light Engineering Industries

Metal working and light engineering (MW/LE) industries are known to develop extensive linkages with other sectors of economy as well as agriculture (refer to Figure 3.2.2). According to the JICA Team's field survey in Dacca, Chittagong, Joydebpur, Comilla, Chandpur, Kushtia and Bogra, it was observed that there are a considerable number of products presently manufactured by small scale MW/LE industry units in Bangladesh. However, these industries were found to produce more or less identical types of products such as hand pumps, centrifugal pumps and fittings, small agricultural machines (namely, rice mill, flour mill and oil mill) and their parts, various spare parts and components for large machines and equipments, sewage pipes and fittings, metal furniture, and building hardwares (namely, steel window frame and grill, steel doors and gates, and metal fixtures).

Although the production activities appear thriving at this moment, there are two distinctive problems envisaged. One is that qualities of these products are not necessarily regarded as satisfactory by any standard and the other is that not as many varieties of products as desired are manufactured.

It is by no means possible to draw up a full list of products presently manufactured by the small scale MW/LE industries based upon the above Survey results. Consequently, in an attempt to select products which have been manufactured and will be manufactured in the near future by the small scale MW/LE industries, three sources of information, namely the above-mentioned Survey results, the Industrial Investment Schedule for Two Years (1978-80) for Private Sector, and Import Statistics, are employed.

At the initial stage of selection, all the metal products and light machinery possibly manufactured at small scale MW/LE industries in Bangladesh are listed up unconditionally. Then they are screened for the final selection of products based on such generalized criteria as market size, technology level, import substitution and so forth. The selected products are finally categorized in an organized list table.

For the purpose of present discussion, the production activities of MW/LE industries may be categorized into two groups. One group consists of manufacturing various items such as tools and implements, simple machinery and equipment, machine parts and others, and the other group includes repairing service of machinery and automobiles. Although the latter activities are by all means important in Bangladesh in term of mobilizing machines and equipment at higher capacity utilization at varied factories and mills as well as efficient use of automobiles, they are not specifically dealt with in this study on the ground that these activities are too diversified to be quantified and identified.

The products which are finally selected in the long list include:

- Those which are presently manufactured and still require quality grade-up,
- Those which will be manufactured by small scale MW/LE industries,
- Those which will be introduced in the near future and possibly manufactured by utilizing machinery and technologies accessible and obtainable by the small scale MW/LE industries, and
- Those which have and will have relatively large demand and market.

A long list of products thus selected is shown in Table 3.2.2. The products are categorized according to a certain criteria such as capital goods vs consumer goods, the finished products vs the semi-finished products, the machinery and equipment vs tools and implements and their final use.

Table 3.2.2 Long List of Metal Working and Light Engineering Products

Category	Final Use	Finished Products		Semi-Finished Products
1. Capital Goods				
a. Machinery and Equipment	- Agriculture	1) Rice Mill 2) Flour Mill 3) Oil Mill 4) Sugar Cane Crusher 5) Centrifugal Pump	6) Paddy Dryer 7) Tractor 8) Power Tiller 9) Cotton Decorticating Machine	Parts and Components for 1) - a)
	- Transport	10) Auto-Rickshaw 11) Rickshaw 12) Bicycle	13) Tricycle* 14) Push Cart 15) Bullock Cart	Parts and Components for 10) - 15)
	- Textile	16) Sawing Machine 17) Power Loom	18) Other Machines for Jute and Textile Mills	Parts and Components for 16) - 18)
	- Electrical	19) Electric Motor 20) Transformer	21) Watt-Hour Meter	Parts and Components for 19) - 21)
	- Wood Working	22) Circular Saw 23) Planner	23) Martisier Machine 24) Spindle Sander	Parts and Components for 22) - 24)
	- Metal Working and Machining	25) Drilling Machine	26) Lathe 27) Hacksaw	Parts and Components for 25) and 26)
	- Other Machinery and Vessels	27) Boiler 28) Water Tank	29) Gas Cylinder	

- continued -

Category	Final Use	Finished Products	Semi-Finished Proudcts
2. Consumer Goods			
a. Tools and Implements	- Agriculture	30) Hand Pump 34) Seed Drill 31) Plough 35) Paddy Thresher 32) Weeder 36) Hand Hoe 38) Sickle 33) Winnower 37) Spade 39) Rake	Parts and Components for 30) - 39)
	- Wood Working	40) Hammer 42) Saw 44) Vice 41) Plane 43) Chisel 50) Wood Binder	
	- Metal Working	51) Hammer 55) Wrench 58) Grinder 52) Metal Saw 56) Pliers 59) Hand Drill 53) Chisel 57) Vice 60) File 54) Screw Driver	
b. Others	- Household Items	61) Metal Utensil 64) Pressure lamp 62) Hurricane Lantern 65) Cooking Stove 63) Cutlery	
	- Building Hardware	66) Sanitary Pipe and Fitting 74) Washer 67) Window Frame and Grill 75) Nail 68) Gate 72) Bolt and Nut 76) Screw 69) Fence 73) Rivet 77) Hinge 70) Steel Container 78) Meshed Metal Wire 71) Lock and Padlock 79) Metal Furniture	
	- Electrical	80) Electric Heater and Stove 81) Switch 82) Plug and Socket	

(Source) JICA Team

3.3 SELECTED INDUSTRIES FOR PRIORITY PROMOTION/METAL WORKING AND LIGHT ENGINEERING

3.3.1 Identification of Industries for Priority Promotion

(1) Criteria for Screening Industries

Each of products or industries listed in the foregoing section has its own business prospects and the importance to the national economy in general and to the industrialization in particular. All of them may deserve attention of agencies concerned with industrial development of the Country. It would, however, be worthwhile to have a shorter list of industries so that promotion activities could efficiently achieve the purpose.

Considering the economic situation of Bangladesh and the national aspirations for the development stated in various documents, following criteria have been adopted as a conceptual framework for further screening of the industries listed in the preceeding section. These criteria are:

- National project supporting criterion
- Welfare criterion
- Resource utilization criterion
- Foreign exchange saving criterion
- Employment generation criterion
- Industrial dispersal criterion
- Industrial linkage criterion
- Specific technology criterion
- Technology application criterion

The national project supporting criterion is to select industries promotion of which is vital for supporting important programmes and projects set forth under the new Five Year Plan. The programmes and projects are such as the Food Production Doubling Programme and the programme to uplift the living standard of

people in the villages.

The welfare criterion aims at identifying industries which will contribute to the welfare of the general populace through supplying devices for water supply and other essential services, improving means of transportation in towns and villages, supporting directly or indirectly the supply of daily necessities (foods, cloths, home appliances etc.), and others.

The resource utilization criterion is intended to choose industries which will contribute to the fuller utilization of resources currently under-utilized. This type of industries include manufacturing of spare parts for other industries whose capacity lies idle due to the difficulties in obtaining necessary spare and manufacturing of improved sugar milling machine and oil milling machinery for existing small mills so that the sugar and oil content wasted by the existing processes can be extracted further.

The foreign exchange saving criterion is to select industries which will save foreign exchange through import substitution. Export potentials in the future are also to be taken into account.

The employment generation criterion is to choose industries for which labour intensive technologies are applicable.

The industrial dispersal criterion aims at identifying industries where many small production units can be viably established in many places of the Country. If it is not economically justifiable to do so, the divisibility of the production process is to be examined whether some portion of the production process, the production of some components or assembly operation, can be separately undertaken.

The industrial linkage criterion is to select industries which will have a higher degree of linkages with other industries.

The specific technology criterion is intended to choose a set of industries through promotion of which a set of specific technologies can be upgraded so that a sound technology base for the future development of the metal working and light engineering (MW/LE) industries will be created. It is also envisaged that units which are specialized in one of these specific technologies or another will be

promoted in due course of time. The specific technologies mentioned above are;

- machining
- casting
- forging
- sheet metal working
- welding
- heat treatment
- surface treatment

The technology application criterion aims at identifying industrial technologies involved which have the possibility to proceed to the production of more technologically sophisticated products. One example is the production of sickles and other hand operated cutleries. The technology for industrial production of these products has the possibility to proceed to the production of cutleries for industrial use such as blades of wood working planers and sugar cane shredders.

(2) Further Screening of the Long List

In the following paragraphs the metal working and light engineering products listed in Table 3.2.2 will be further screened in the light of the criteria mentioned above. Firstly, let us consider the following 4 criteria:

- National project supporting criterion
- Welfare criterion
- Resource utilization criterion
- Foreign exchange saving criterion

For the standpoints of these four criteria a number of products in the long list (Table 3.2.2) can be regrouped into several categories which are receiving the keenest attention. These categories are;

- agricultural tools and implements,
- irrigation and water supply equipment,

- agro-processing machinery,
- low cost rural transportation equipment, and
- spare parts for various machinery.

Now let us examine products which are regrouped in these categories and which could possibly be manufactured by small-scale metal working and light engineering industries.

a) *Agricultural Tools and Implements*

Although the production of agricultural tools and machinery is statistically classified as the activity of the manufacturing sector, the development planning of this sub-sector is primarily the task of agencies concerned with the agricultural development. That is, selection and development of agricultural tools and machinery to be produced by the sub-sector belong to the jurisdiction of the agencies responsible for agricultural development. In this study, therefore, extensive interviews were conducted with administrative and extension officers at the central and the district government levels, agricultural scientists and engineers of BARI, BARRI, CERDI and universities, etc. Following discussion is based on the findings of these interview and the Team's observation on existing production capacity of the sub-sector.

Table 3.3.1 summarizes the agricultural tools and implements commonly used in Bangladesh at present. In the paragraphs which follow, the present status of the use and production of agricultural tools and implements shown in Table 3.3.1 will be briefly described and the role expected to be played by the small scale metal working and light engineering industries will be discussed. In case of some products in the table, it can be assumed that there is more or less established design of products and the Team is mainly concerned with upgrading the quality of products. These are sickles, weeders and dryers. In case of other products, the improved design of the products will be worked out by agricultural research instituties and the Team is concerned with building up the capacity of the sub-sector to produce those of improved design. These products are spades, hoes and other hand tools and animal-drawn ploughs.

Table 3.3.1 Agricultural Tools and Implements Currently Used in Bangladesh

Farming Operation	Tools and Implements commonly used	Suggested improvement
Land preparation	- Hand tools such as 'Koddal' (Alenhoe)	- Design improvement and deversification
	- Animal-drawn implements (plough etc.)	- Design improvement
		- (Introduction of power tillers and tractors)
Planting and Transplanting	- Manual operation with no special equipment	- (Introduction of manually operated seed drills)
Weeding	- Hand tools such as 'Nirani'	- Introduction of hand-pushed weeder
Crop protection	- Not performed	- Introduction of knap sack type sprayer
Harvesting	- Sickles	- Quality up-grading
Threshing	- Hand beating or treading with cattle	- Introduction of pedal thresher
Drying	- Sun-drying with no special equipment	- Introduction of mechanical dryer

Source: Compiled by JICA Team

Note: Different opinions are heard among persons concerned with agricultural development of the Country as to whether immediate actions should be taken toward the suggested improvements shown in parenthesis in the above.

— Land Preparation

Virtually all land preparation operations are carried out with bullock-drawn or manual implements and tools. Experts concerned with the Country's agricultural development are of the opinion that there is a good prospect for increasing agricultural productivity by improving the design of the local implements. A special attention has been given to the possible improvement of bullock-drawn ploughs in order to attain reversing as well as deeper tillage.

Another area for attention is diversification of hand tools. Farmers in Bangladesh typically have only one kind of tools, namely 'Koddal' or Alen hoe, which is used for almost any farming operation. It is pointed out that if farmers use more adequate hand tools according to the nature of farming operations and local conditions of soil etc., farming could be substantially intensified.

Certain number of power tillers and tractors have been introduced but different opinions are heard whether the use should be expanded progressively. Those who favour the use of such equipment argue that, although Bangladesh has not reached the stage to resort to mechanization for manpower saving, the day will come soon when the introduction of power tillers and tractors becomes economically justifiable in order to complete necessary farming operations at right timing.

Most of the animal-drawn and manual equipment used for land preparation is produced by local artisans. Some of the equipment such as spades are also manufactured by medium/large-scale industries which employ more capital intensive technology.

The economic and social situation of Bangladesh would dictates that production activities of such equipment should be left to the artisans (the cottage industries) as much as possible. It can be argued, however, small-scale industries with some simple, mechanized production facilities should be promoted. This point will be further discussed in 3.3.1 - (3).

— Planting and Transplanting

Planting and transplanting are almost exclusively performed by hand. Certain types of manually operated seed drills are manufactured locally on an experimental basis. Opinion among experts concerned with agricultural development does not seem to have well established as to whether use of such equipment should be encouraged in the immediate future or not.

— Weeding

Weeding is performed mostly with traditional hand tools such as "Nirani". A rotary, hand-pushed weeder of Japanese origin has been manufactured by the Comilla Cooperative Karkhana Ltd. The firm has produced some 8,000 such weeders in the past three years and sold to farmers in the nearby areas. According to the firm the sales are expanding to other areas such as Sylhet and Mymensingh. A few other firms have started production of similar weeders. The quality of the weeders presently produced is not satisfactory (see 4.1.1). Since the use of such weeders is believed to increase the paddy yield significantly, promoting small-scale industries to manufacture weeders of better quality will be very necessary.

— Crop Protection

A limited number of knap sack type pesticide sprayers have been in use. A trial production of such sprayers has been commenced. Since demand for this equipment is expected to increase as more HYV rice is planted, needs will arise to promote small scale industries to undertake production of such sprayers.

— Havesting and Threshing

Harvesting of paddy and other major crops is done almost exclusively with sickles. Threshing is performed by traditional way of hand beating or treading by cattle. Pedal threshers of Japanese model have been introduced and the use of such threshers are getting popular.

Production of the traditional saw sickles is undertaken by blacksmiths. Products in various qualities are found in the market depending on the skill of

the producer and the nature of material used (see 4.1.1). A question similar to the case of spades and other hand tools arises as to the role to be played by modern small scale metal working and light engineering industries. This question will be taken up later in 3.3.1-(3).

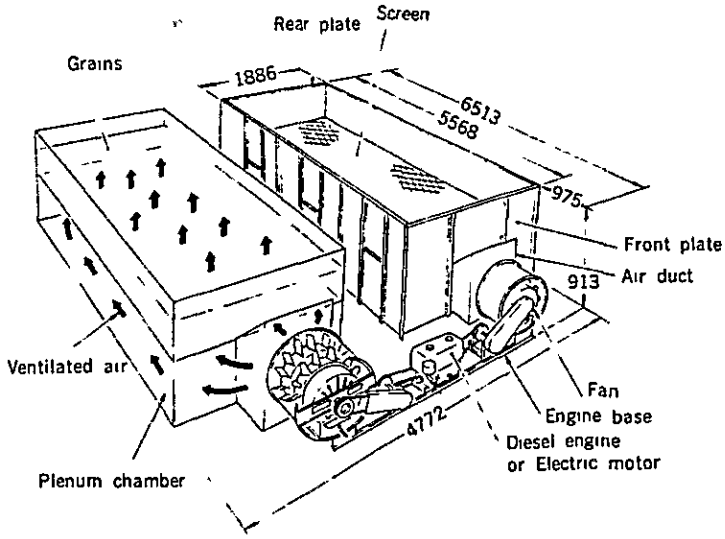
The pedal threshers are fabricated by the Comilla Cooperative Karkhana Ltd. and also by a few other workshops. In order to reduce post-harvesting losses the government is going to take several steps for promulgating the use of the pedal threshers. The quality of the pedal threshers being produced at present is, however, very unsatisfactory (see 4.1.1). Up-grading the quality of the products is required urgently. This is one of the areas which calls for intensive promotion of small scale metal working and light engineering industries.

— Drying

Cereal grains as well as other agricultural products are sun-dried spreading them on metalled roads or other surfaced open space. With this method of drying, the rate of drying cannot be adequately controlled. Losses due to bird attack is not negligible and the quality of the commodity is debased due to mixing of foreign materials. Even during the rainy season sun-drying is practiced intermittently since mechanical drying equipment is almost nonexistent.

This is a keen interest in developing the mechanized drying capability in order to decrease post-harvest losses in view of increasing production of the Boro and Aus crops which are harvested during the wet season. Production of such drying equipment is also an area where small scale metal working and light engineering industries can find a good prospect. An exemplified design of a grain dryer is shown in Fig. 3.3.1.

Figure 3.3.1 Flat-Type Twin Grain Dryer



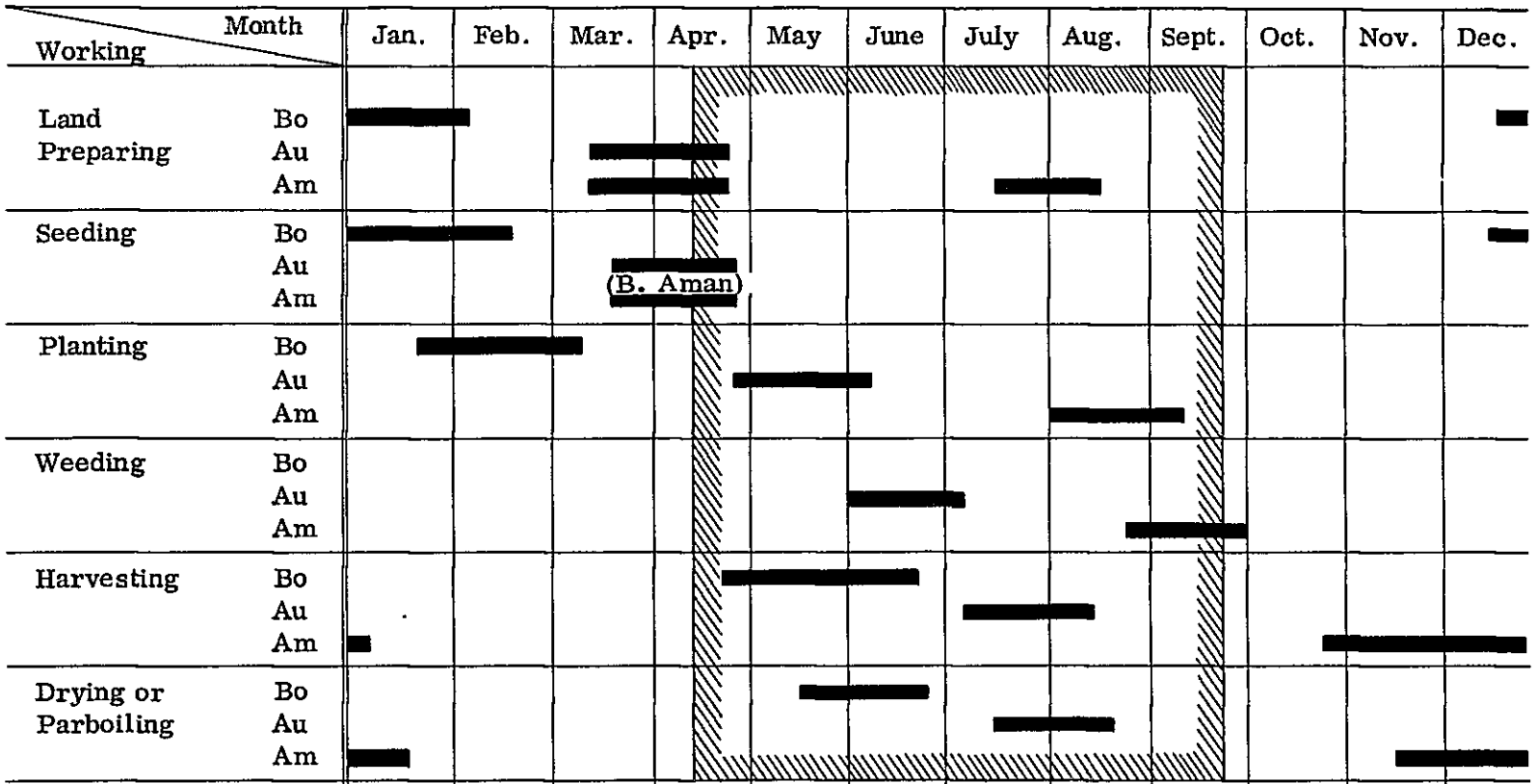
The Table 3.3.2 summarizes the principal seasonal farm working pattern in Bangladesh based on the three types of paddy cropping.

b) Irrigation and Water Supply Equipment

Irrigation has been the area which has received much of the government's efforts in agricultural development. It is estimated that approximately 11,000 deep tubewells (DTWs), 20,000 or so shallow tubewells (STWs) and over 50,000 low lift pumps (LLPs) have been installed in the Country. These power-driven pumps altogether irrigate about 8,500 km^2 or nearly one tenth of the total cultivated land.

Besides, 90,000 hand pumps, known as MOSTIs (manually operated shallow tubewells for irrigation), have been installed for irrigating some 200 km^2. The same hand pumps are extensively used for supplying drinking water. Under the Rural Water Supply Programme sponsored by UNICEF, 250,000 hand pumps have been installed so far for this purpose.

Table 3.3.2 Diagram of Principal Paddy Farm Working in Bangladesh



Working		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Monthly Labor Requirement (man-days/acre)	Bo	12	27	3	3	11	17	0	0	0	0	0	4
	Au			7	13	2	2	12	9	0	0	0	0
	Am		(B. Aman)	(7)	(13)	(2)	7 (1)	15(1)	21(0)	4 (0)	4 (6)	16(14)	10(0)

Source: JICA Team

Note: Bo: Boro, H.Y.V., Au: Aus, Am: Aman, H.Y.V.
Variety total: Bo. 77; Au. 45; Am. 77

Rainy Season

Centrifugal pumps are manufactured locally. Table 3.3.3 gives a list of the manufacturers. Centrifugal pumps produced by them are mostly of 1/2-2 cusec capacity. The total production is 24,000 units per year according to BKB.

Table 3.3.3 Manufacturers of Centrifugal Pumps

Name of Manufacturer	Annual Production Capacity
Bangladesh Machine Tools Factory	5,000
KSB Pump (BD)	5,000
Farmland Engineering	5,000
Prantic Engineering	3,000
General Electric Co. (BD)	2,500
Ittefaq Industrial Corp.	1,000
Balaka Engineering Co. (BD)	1,000
Auto Equipment	500
Krishikol	500
Rupali Engineering	500
Total	24,000

Source: BKB

Hand pumps are also fabricated by local firms. At present UNICEF procures 5,000 hand pumps annually from 8 foundries, 4 in Dacca and one each in Chittagong, Comilla and Khulna. There are a number of other hand pump manufacturers.

Prime movers for irrigation pumps are produced by local firms, mostly on a knock-down basis. The total production capacity of these firms is 5,100 diesel engines of 2 to 18 HP and 35,000 electric motors of up to 30 HP, according to BKB.

Steel tubes for STW and LLP are also manufactured locally by the Bangladesh National Tubes Ltd., an enterprise of Bangladesh Steel and Engineering

Corporation. The company is supplying almost all the requirements of the Country for the steel tubes.

There will be an increasing demand for irrigation and water supply equipment in the coming years. The new Five Year Development envisages to introduce additional 100,000 STWs and 20,000 LLPs during the plan period. There are programmes to install some 500,000 units of new hand pumps under the sponsoreship of UNICEF and USAID. Besides, there will be sizable replacement requirements for existing pumps.

Manufacturing of centrifugal pumps and hand pumps is an area where small scale metal working and light engineering industries can find an opportunity for expanding their business.

c) Agro-processing Machinery

— Rice Milling

There is an estimate that over 80% of paddy produced in the Country is processed by traditional method of husking with 'dekhi', a foot operated mortar and wood pestle and the rest is processed by powered rice mills. According to the Census of Small Industries, 1978/79, there are 12,242 small scale rice mill units in the Country. Altogether employing 59,484 workers, the industry is the most important branch of small scale industries in terms of the number of units and employment. Rice mills of medium/large scale are found in urban areas.

Although there are a number of local small firms which produce components and complete sets of mill equipment for rice as well as other grains, many imported machines, mostly from India and Pakistan, are still being used. Mill equipment commonly used is small 'Engerberg' husking machines of approximately 1/4 ton per hour capacity (larger mills install a number of such machines).

Serious shortcomings of this Engerberg machines are pointed out; the rate of milling losses is high and bran cannot be separated from husk. There is a keen interest in finding machines of more suitable type with a view to reduce the losses and extracting oil from bran. The task does not seem to be simple, however. An alternative fuel may have to be found for parboiling in which a

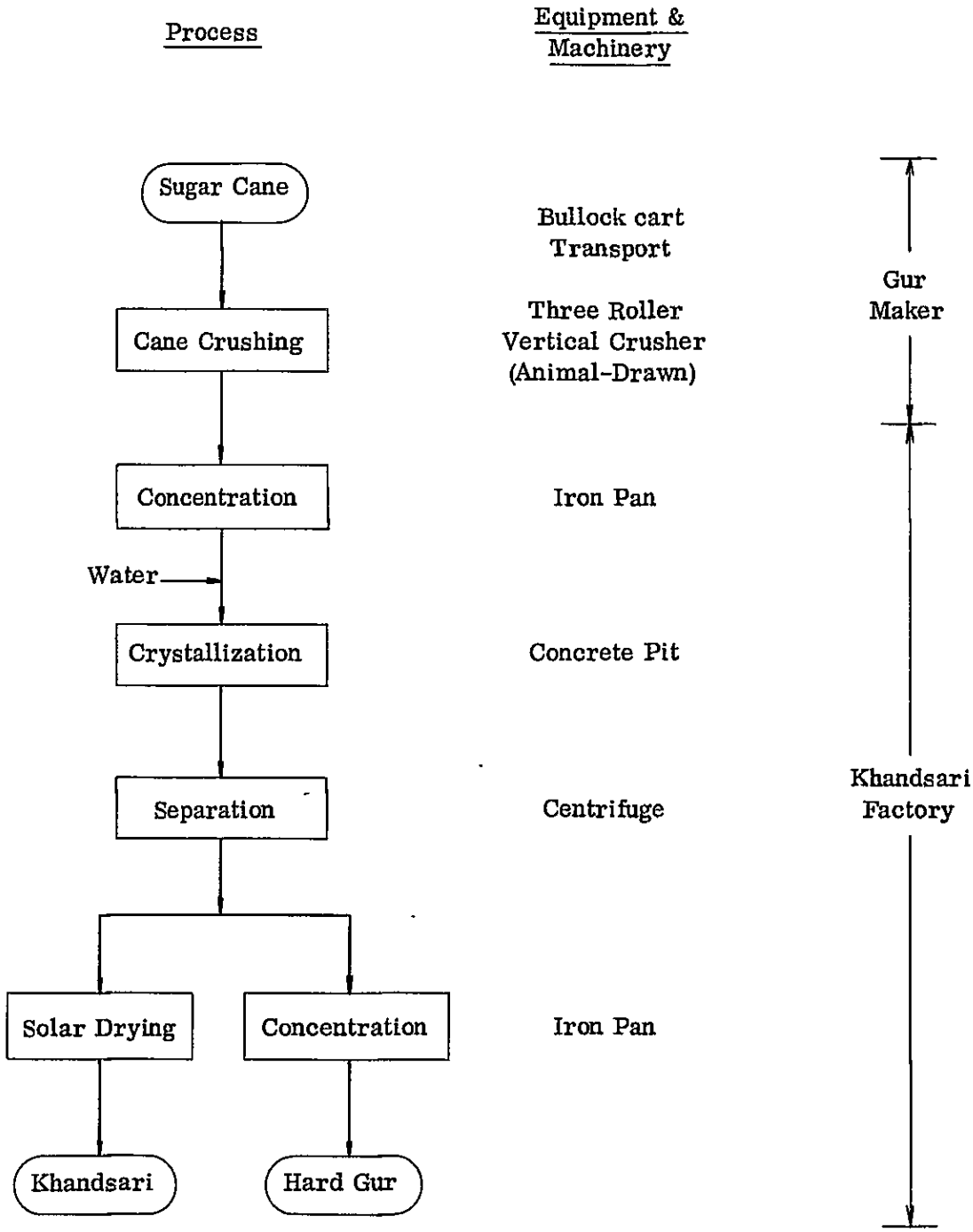
mixture of husk and bran is currently used. A rice bran oil mill requires a good system of collecting bran from a number of small rice mills. Thus improved rice mill equipment cannot be introduced without successful changes in the entire system involving harvesting, parboilding, and collection and distribution. If these questions are solved, the modernization of rice mills will offer another prospective market for small scale metal working and light engineering industries.

— Cane Sugar Production

The sugar industry in Bangladesh consists of the modern and traditional sectors. The modern sector refers to modern sugar mills operated under the Bangladesh Sugar and Food Industries Corporation (BSFIC). The corporation has 15 mills in operation and another one under construction. The total sugar cane crushing capacity of the existing 15 mills is 1,968,000 tons in the 1978-79 crop year and the total sugar production capacity 164,000 tons. The traditional sector produces 'Gur' (concentrated sugar cane juice as traditional sweetening agent) and 'Khandsari' (raw sugar) utilizing simple technology (see Fig. 3.3.2). There are establishments which undertake only the Gur making (hereafter refered to as Gur making units) and other establishments which perform the further processing of Gur and produce Khandsari (hereafter Khandsari factories).

Most of the Gur making units are sugar cane growers themselves. They crush cane with a bullock-driven three roller vertical crusher. The cane juice thus obtained is purified by removing cane dust and other foreign articles manually. The juice is then concentrated by heating in an open pan for several hours. The concentrated juice, is poured in earthen pots for delivery. Gur is marketed as it is for domestic consumption or it is sold to Khandsari factories. The entire production processes described above are typically performed in farming field by 4 or 5 workers. Cane waste and rice straw are used as fuel for heating and boiling the juice. According to the Survey of Cottage Industries 1962 there were 17,881 Gur making units in Bangladesh, in which a total of 63,665 persons were engaged. Characterized as cottage industries, about 3/4 of the work force was family members (more recent statistics are not available).

Figure 3.3.2 Traditional Production Process of Cane Sugar



Source: JICA Team

Khandsari factories buy Gur as raw material and process it further. Gur is diluted with water and stilled to get crystallized, and then fed to a centrifuge for separation. The product raw sugar crystals are sun-dried in an open space and is rolled by a ground-leveler to ensure the uniformity of the grain size. After this process the product, raw sugar, is ready for delivery. Molasses, the by-product of centrifuging, is concentrated by boiling so that it will become solid when it gets coller. The concentrated molasses, 'hard Gur', is sold in the market for use similar to the unprocessed Gur. Khandsari factories are much smaller in number and larger in scale than the Gur making units. As compared to Gur making units they are characterized by factory-type operation and resort to mechanical motive power.

The rate of recovery of sugar content in the cane is 55 - 60% by the traditional method and 90 - 94% by the modern process. There is some possibility to increase the efficiency of the traditional sugar making by slightly modifying the process without investing so much. One such modification is to add a cutting or shredding operation prior to the crushing. The operation is to cut the cane into small pieces in order to facilitate extraction of juice in the crushing operation which follows. It is expected that this modification alone would improve the efficiency of the overall system substantially as evidenced by improved efficiency by about 10% in Japan. In order to introduce the cutting or shredding operation the crusher is also to be altered to a horizontal type. There still exist in Japan sugar mills which are almost identical to the traditional sugar mills found in Bangladesh except that they have a sugar cane cutting or shredding device before crushing. There may be some other improvements which could possibly increase the efficiency of the traditional sugar making industry.

Manufacturing of sugar cane cutting machines or shredding machines for use by the traditional mills can be carried out by small scale metal working and light engineering industries. Production facility for manufacturing the sugar cane cutting and shredding machines can be further utilized for producing paper and wood cutting machines. Thus establishing such small scale industries will open up the road for production of cutleries for industrial uses.

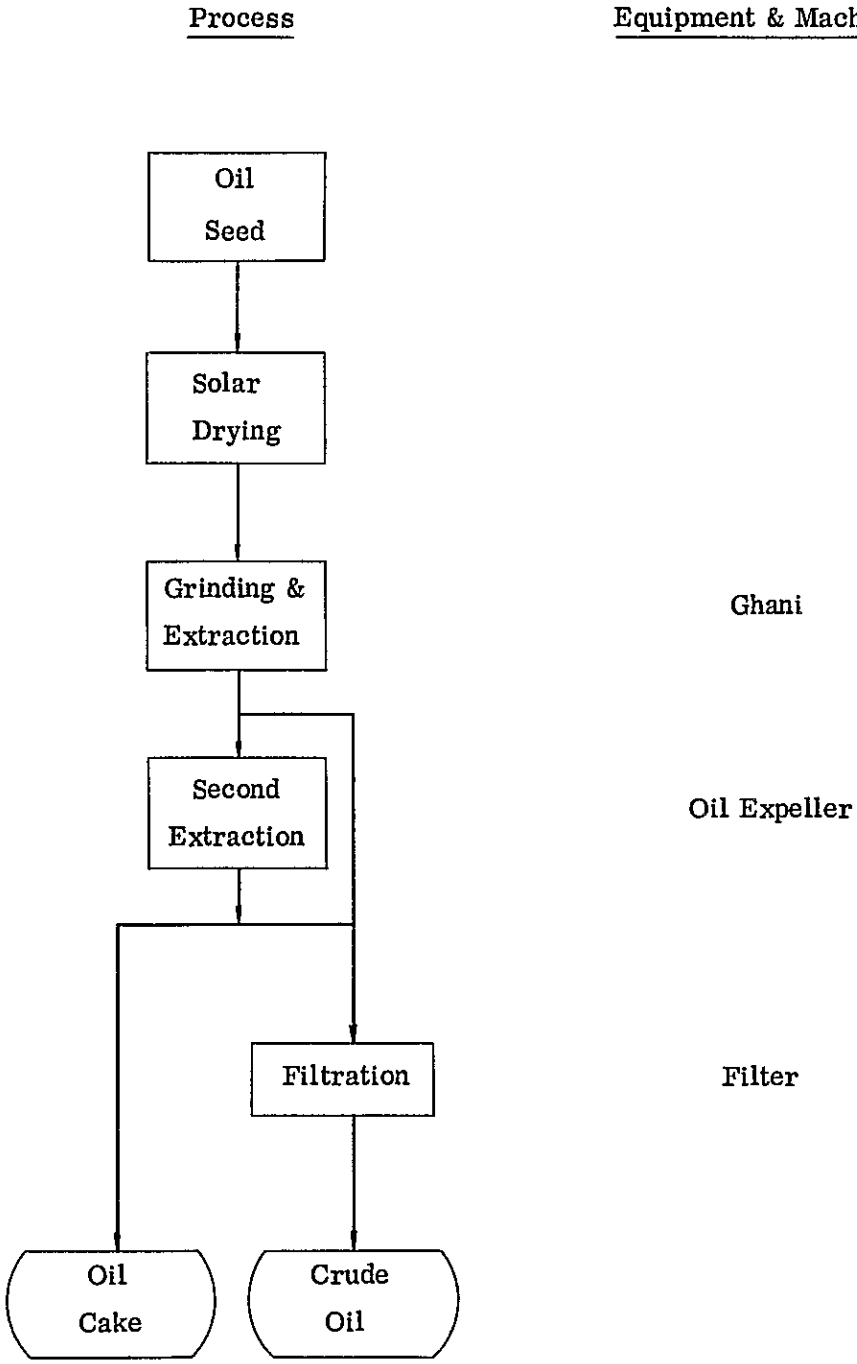
BSFIC considers that a good prospect exist to increase sugar cane production by utilizing land suitable for growing no crops but sugar cane such as a portion of river bed free from water in the dry season. Such land plots exist sporadically and constructing modern sugar mills of the conventional size, say, 1,000 ton per day crushing capacity, is not economically feasible due to high transportation cost of sugar cane collection. Construction of mini modern sugar mills may be an answer. A number of very small mills having crushing capacity of 50 - 250 ton per day exist in several places in the world. Construction of such mills may become economically feasible also in Bangladesh. Equipment of such a mill will cost more than US$1 million, if vacuum distillation process is resorted to, and is beyond the scope of small scale industry (and thus out of the scope of this study). Establishing more traditional sugar mills may also be an answer to cope with the expected increase of cane growing areas.

— Oil Milling

The edible oil milling industry occupies an important position in the cottage and small scale industries of Bangladesh. The Census of Small Industries, 1978/79 has revealed that there are 577 small scale oil mills altogether employing 4,561 persons. According to the Survey of Cottage Industries, 1962 the number of oil mills classified as cottage industries was 25,060 in which 65,280 persons were engaged. The industry was the most important cottage industry of the country after the handloom industry in terms of the number of units (more recent statistics are not available).

Most important oilseed crops grown in Bangladesh are rape and mustard seed. Apart from a few exceptional cases mechanical extraction process in utilized. Production process of conventional oil mills is illustrated in Fig. 3.3.3. After being sun-dried in an open space, oil seed is fed into a machine called 'Ghani'. The Ghani grinds seed with mortar and pestle driven either mechanically or by animal. Oil cake left in the Ghani is then fed to an expeller. The cake is passed through it twice. Some of the factories had a filtering machine by which oil is cleaned.

Figure 3.3.3 Production Process of Conventional Oil Mill



Source: JICA Team

One of the oil mills visited by the Team has 32 ghanis, one expeller and one mechanical filtre. The milling capacity of the factory is 4,800 lb a day on a 3 shift basis, producing 18,000 lb of oil and 3,000 lb of oil cake. Other factories had similar set-up. Most of the machines used by these factories are imported ones but a number of local manufacturers exist which produce components and complete sets of such equipment.

The efficiency of oil extraction of these conventional oil mills can possibly be improved substantially by making inexpensive modifications to the existing process. One possible modification is to introduce a pre-heater in place of sun-drying. Another is to introduce cooking process between the crusher and the expeller. The structure of the crusher could also be modified. Improved production system envisaged here is illustrated in Fig. 3.3.4.

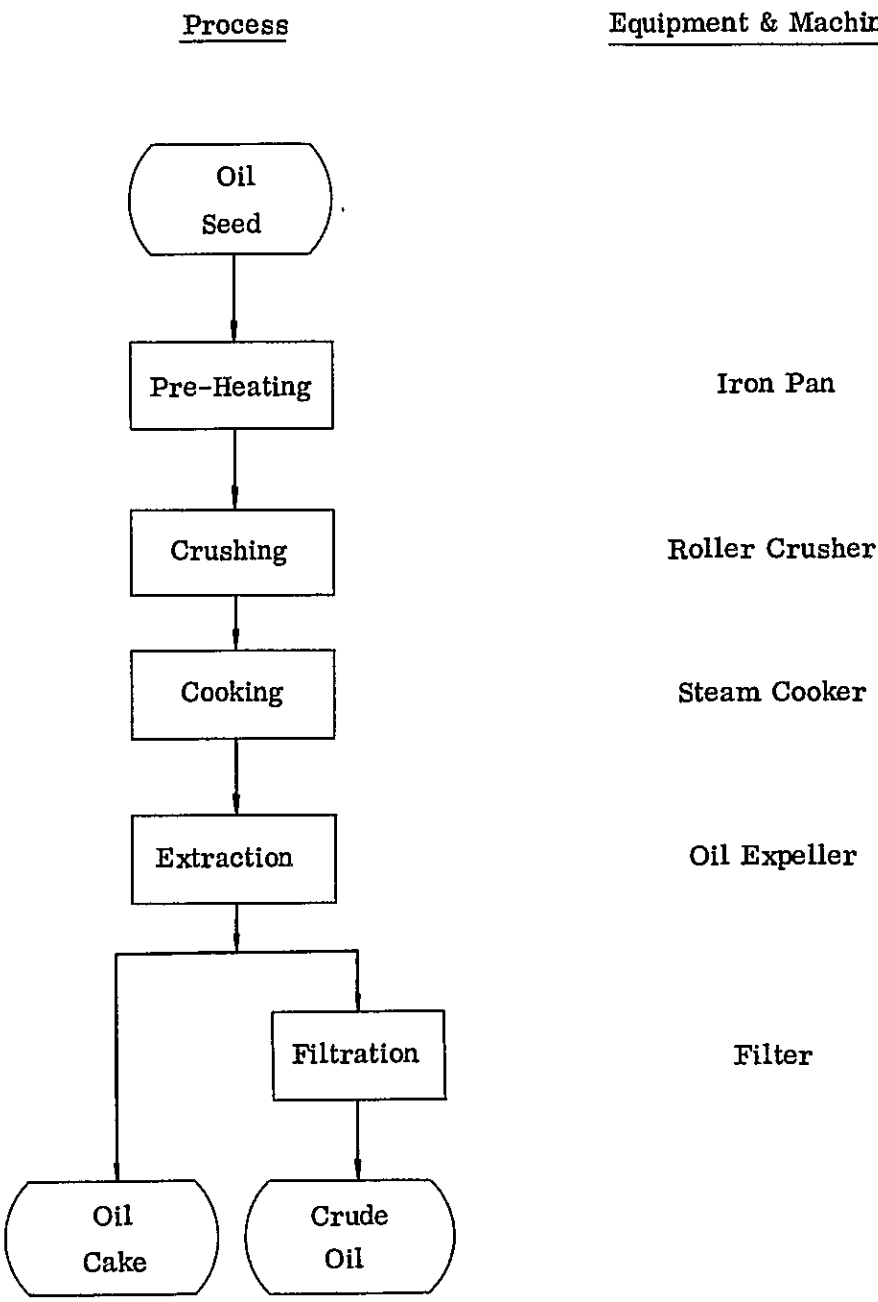
In the simplest form, the pre-heater can be one like a large frying pan, the crusher can be a slightly modified Ghani and the cooker can be one like a large rice steamer.

Crusher, pre-heater and cooker proposed for improving the efficiency of conventional oil mills can be manufactured by small scale metal working and light engineering industries, if appropriate design and production technology could be developed. Commercial production of these machines and equipment by local small scale workshops would have to wait until such development work will be completed by research institutes such as the Sugar Industry Research Laboratory and BSCIR. A few oil mills still exist in Japan which can be a model for such development.

d) Low Cost Transport Equipment.

Transport modes for carrying goods and materials used in Bangladesh are summarized in Table 3.3.4 by source of power and by distance of trip. Traditional means of transportation as those shown in the tables are still extensively used in Bangladesh. Particularly in rural areas, the predominant method of short distance movement of goods and materials is head loading or shoulder loading with a carrying pole. Bicycles, bullock carts and row boats are also common.

Figure 3.3.4 Improved Production Process of Small Oil Mill



Source: JICA Team

Table 3.3.4 Transportation Modes for Carrying Goods and Materials Currently Used in Bangladesh

Source of Power	- Short Distance < 10 km	- Medium Distance 10-50 km	- Long Distance > 50 km
Human Power	- Head loading - Shoulder loading with a carrying pole - Handcart - Bicycle - Rickshaw - Row boat	- Rickshaw - Bicycle - Row boat	
Animal Power	- Bullock-cart - Horse-cart	- Bullock-cart - Horse-cart	
Wind Force		- Sailing boat	- Sailing boat
Mechanical Force	- Motorized rickshaw - Pick-up - Passenger car* - Motor cycle - Boat with outboard engine	- Motorized rickshaw - Pick-up - Passenger car* - Motor cycle - Bus* - Truck - River barge	- Pick-up - Truck - Bus* - Train - River barge - Cargo boat

Source: JICA Team

Note* : These vehicles are often heavily loaded with goods and materials.

Developing appropriate means of rural transportation is very important in this Country since the provision of such transportation facilities constitutes an essential infrastructure pre-requisite for rural economic development. With increased emphasis placed by the government on economic and social development of rural areas, the movement of goods and materials within, to and from rural areas is likely to increase significantly in the near future. Unless appropriate means of transportation are provided, such development may be severely affected.

It is pointed out that in areas where a flood control and irrigation scheme has been implemented, river boat as traditional means of transportation have to be substituted by other appropriate transport equipment.

In view of the production capability of the small scale metal working and light engineering industries and considering conditions prevailing in the rural areas of the Country where roads are narrow and rough, if they exist at all, and very low income level of the population, following discussion will be limited to overland transportation equipment for short distance, to carry light and medium load of up to about 200 kg and driven by muscle power.

As seen in Table 3.3.4, transportation equipment presently used in Bangladesh for above-mentioned purpose ranges from head and shoulder loading to handcarts and rickshaws.

— Bicycles

Bicycles have become fairly popular in towns and villages of the Country and the demand for them seem to be increasing steadily. It is estimated that about 80,000 units of bicycles are sold in Bangladesh annually. There are a number of local firms which manufacture components and assemble complete sets of bicycles. The domestic production can, however, meet only one half of the demand at best and the balance is dependent on imports. Imported bicycles are acknowledged by consumers for higher quality at lower prices. Even for those fabricated locally, supply of certain components such as rims and lugs are dependent on foreign products.

A keen interest is shown by public and private sectors in increasing the production capacity of the local industry to cope with the increasing demand. Needs are felt to improve the quality and to decrease the price of bicycles domestically produced (see 4.1.4). Production of components is also to be promoted.

— Rickshaws

Rickshaws commonly seen in Bangladesh are designed for carrying passengers. While rickshaws are very often used to carry goods and materials in

their passenger seats, there are also varieties of rickshaws designed for load carrying, although the number of such rickshaws is much smaller than that of human-carrying rickshaws. These rickshaws carry load of upto 250 kg or so.

Needs are felt to improve the design of wheels and other parts of the load carrying rickshaws as well as that of the overall structure (see 4.1.4). These rickshaws are fabricated predominantly by the cottage industry sector. While the assembly process will continue to be left in the hand of the cottage industries, small scale industry is expected to supply various components to these assemblers. Most of such components will be common to bicycles.

- Handcarts

Several types of handcarts or pushcarts are found in Bangladesh. Some have wooden wheels and a wooden shaft. Some others utilize rear wheels of a rickshaw. Yet some others make use of wheels and a shaft of a dismantled motorcar. Chasis are usually made of wood and those made of steel are rare. While bullock-drawn carts are also used for human traction, carts designed for human drawing as well as for drawing by bicycles are not common. Wooden components of these carts are, in general, robustly constructed at the expence of excessive dead weight.

It is worthy of attention to develop adequate design of handcarts for use in rural areas. A possible model for such improvement is bicycle trailers extensively used in several countries. By attaching to bicycle frame, they can substitute for the carriage of goods and materials offered by rickshaws. They can also be used for manual operation independent of bicycles and will replace the role traditionally played by head and shoulder loading and conventional handcarts.

Wheelbarrows may find more widespread use in rural areas, if they are designed for reasonably comfortable use in muddy places. It is recommended that public research institutes undertake design develoment of such handcarts and wheelbarrows and promote small scale industries to manufacture them.

e) Spare Parts for Various Machinery

A considerably large amount of foreign exchange is spent annually for importing spare parts and other components of various industrial production facilities in the Country. The amount is estimated to exceed Tk 30 million counting only those imported by the public corporations such as Jute Mills Corporation, Textile Mills Corporation and Sugar and Food Industries Corporation.

As pointed elsewhere, the difficulty of obtaining spare parts in desired quantity and at right timing is one of the main reasons for the low level of capacity utilization of existing production facilities.

Thus, promoting the production of the spare parts and components by local industries is receiving keen attention of agencies concerned with industrial development. If it can be promoted successfully, its economic significance could be substantial through foreign exchange saving, resource mobilization of existing production facilities and constructing a sound linkage among industrial subsectors.

BSCIC is going to take steps to encourage public enterprises to procure spare parts and components from local industries on one hand and encourage small scale industries to embark on manufacturing of such spare parts on the other hand.

Much difficulties are however anticipated in achieving such development. The procuring industries will demand the quality and the price of the spare parts to be comparable to imported ones. They need to be assured the spare parts are supplied in desired quantity at right timing. On the other hand, commercial benefits have to be assured to the manufacturers of the spare parts. Considerable promotional efforts will, therefore, become necessary.

(3) Further Examinations

Discussion in the foregoing paragraphs has concerned with the four of the nine criteria for screening industries. Although remaining five criteria have also been considered through various stages from that of preparing the Table 3.2.2 (long list of industries), there are several questions worthy to make further examinations.

Almost all of the industries so far named have possibilities to satisfy the employment generation criterion and the industrial dispersal criterion. That is, those industries could possibly be established by adopting more labour intensive technology and in a way to disperse a number of establishments to various places of the country. Certain government measures would, however, be necessary so as to induce industries to be established in such a manner.

Most of the industries discussed in the previous paragraphs have industrial and technical linkages only with agriculture and rural sectors. They do, however, have future prospects for enlarging their business to products for use by other industries.

Within the small scale industry sector, several industrial units each specialized in one or two specific technologies could be established independently so that they altogether manufacture some of the products discussed in this section (see Table 3.3.5). In this way, these industries can satisfy the criterion.

Table 3.3.5 shows specific technologies contained in each of the industries discussed in the above. Typical products of the industries which employ forging and heat treatment as major technological components are animal-drawn and manual agricultural implements which have traditionally been produced by local artisans. One would argue that, under the economic and social conditions of the Country, such production activities should be left in the hands of artisans. It can be argued also that modern small scale industries should be promoted in this area. The latter argument has following grounds.

As the economy progresses the demand for products will increase which cannot be easily produced by local blacksmiths, components and implements of power tillers and tractors for an example. Introduction of simple mechanized forging technology is a logical process of technological development. It is also expected that if the products supplied by local artisans at present were produced by the modern industry with improved design and equality but in limited quantity it will stimulate farmers to demand such improved products and artisans to upgrade their products.

Table 3.3.5 Major Technological Components Contained in Production of Selected Products

	Forging	Casting	Sheet metal work and welding	Press work	Machining	Heat treatment	Surface treatment
Hand tools[1/]	o					o	
Hand-pushed weeder			o	o	o		o
Pesticide sprayer			o	o	o		o
Pedal thresher			o	0		o	
Grain dryer			o	o			o
Hand pump		o			o		
Centrifugal pump		o			o		
Sugar mill equipment[2/]		o			o		
Oil mill equipment[3/]		0	o		0		o
Handcart (Pushcart)			o				o
Wheelbarrow			o				o
Bicycle parts		o		o	o	o	o

Source : JICA Team

Notes : Only metal working technologies are dealt with in this Table (Some products need wood working and other technologies).

1/--- Hand and animal-drawn agricultural tools and implements such as spade, hoe, plough and sickle.

2/--- Cane cutter, shredder and crusher.

3/--- Pre-heater, cooker and tank.

Thus it is proposed here that small scale forging industries with some mechanized hammers are promoted which manufacture animal-drawn and manual agricultural tools and equipment. Their production should, however, be limited in quantity so as not to disturb the business of the blacksmith and they should be guided to embark on manufacturing of non-traditional products as soon as possible, such as tractor implements and sugar cane cutters.

The modern forging industry could also manufacture carpentry tools such as saws and planes, industrial hand tools such as screw drivers, wrenches and files.

The iron foundry seems to have a good business prospect as the government places increasing emphasis on installation of more hand pumps and centrifugal pumps. As seen in Table 3.3.5, other products will require some casting components. The industry could also embark on malleable iron casting to produce pipe filting etc. which are imported at present.

These products offer a good business prospects to machining workshops since most of iron casting products require their services. Such independent machining workshops would better be promoted as industrial units separate from foundries because the dusty environment of foundries is not favourable to machining operations.

Industry which contain sheet metal work and welding as the main technological components may deserve special attention. In a more industrially developed society, sheet metal work/welding technology compete with forging and casting as an alternative production method for a certain range of products. In Bangladesh, however, this technology has been somewhat behind of others. Starting from the use of thin plate, say less than 2 mm in thickness, the industry could proceed to products which require thicker plate such as gas cylinders, pressure vessels and chemical reaction tanks.

Press work tends to be regarded as a labour saving technology. But it is indispensable for certain products in order to ensure the accuracy and the uniformity of vital dimensions and its use will increase gradually. For the sound development of this technology, the industrial community should be equipped with the die making capability. Public institutions such as BITAC and BMTF are expected to play the role of supplying dies to small scale industries in the initial stage.

Heat treatment is performed to only a limited extent, except that blacksmiths perform quenching and tempering on most of their products, often with unsatisfactory results. Development of this capability is very important for some of the products discussed in the above.

Surface treatment other than hand painting is also rarely exercised. Other surface treatment technologies such as electro-plating should be developed gradually. It is recommended that surface treatment shops would be promoted not as constituent workshops of large factories but as independent industrial units specialized in the operation. Adequate care should, however, be taken to protect the environment from possible water contaminations by this industry.

(4) Short List of Priority Industries

Table 3.3.6 shows the list of industries which have been selected through the screening processes described above. It is to be noted that the list is a tentative one at this stage, although their economic viability has been examined by making a rough estimation of investment requirements, production costs and the marketability of the products. It is also to be noted that the industries listed in the table are classified by product to be produced and the actual small scale industry units to be established will not necessarily be classified in this way.

Table 3.3.6 Selected Industries for Priority Production

For immediate production	Possible future production
- Spade, hoe, plough etc.	- Screw driver, wrench and file
- Sickle	- Saw and plane (for carpentry)
- Hand-pushed weeder, pedal thresher and grain dryer	- Cane cutter/shredder
- Hand pump and centrifugal pump	- Blades for wood working machinery
- Handcart and wheelbarrow	- Insecticide sprayer
- Pipe fittings	- Oil mill equipment (pre-heater, cooker, tank etc.)
- Spare parts of jute and textile machinery	- Rice mill equipment
- Bicycle components	

Source : JICA Team

Some industries in the list have the prospects for starting the production immediately while others need a process of product and/or market development.

3.3.2 Demand and Supply for Selected Products

In an attempt to study the present demand and supply conditions of and to make a projection of future demands for agricultural tools and machines, nearly a dozen products are specifically selected. These products are, then, divided into three groups, each group with similar characteristics. The first group consists of the centrifugal pump and the hand pump, which are usually used for agricultural irrigation. The second group consists of the weeder, the thresher, the seed drill, the winnower and the hand hoe, which are the products needed chiefly for paddy cultivation and harvesting. The third group consists of various carts such as the bullock cart, the rickshaw, whose main use is for the short distance transportation of agricultural products.

The first two groups are directly related to the agricultural activities and, therefore, may be called agricultural machines or tools. The third group of products slightly differs from the above two, but they are taken up here as they constitute an integral part of rural agricultural life.

(1) Demand Projection for the First Group Products

The number of the centrifugal pumps actually in use is presented based on the actual operation record of BADC over the last several years in Table 3.3.7. Needless to mention, the figures are solely from the BADC operation and do not include privately installed pumps. If the privately owned pumps are taken into account, the total figures will increase easily by 10 percent. Then, the estimated grand total of centrifugal pumps actually in use is shown at the bottom line of Table 3.3.7.

Table 3.3.7 BADC Operation Record, BKB Sales Record and Estimates

	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81
1. Low lift pump (2 c/sec capacity)*	35,516	36,382	28,361	36,730			
2. Deep tubewell (2 c/sec capacity)*	2,699	3,828	4,461	7,453			
3. Shallow tubewell (1/2-3/4 c/sec* capacity)	1,026	2,162	3,045	6,447			
Sub-Total	39,241	42,372	35,867	50,630			
Shallow tubewell	n.a.	3,000	3,000	3,000	3,000	3,000	6,000
Total	39,241	45,372	38,867	53,630			
Other privately Owned LLP, DTW and STW (Estimated)	3,000	3,300	3,600	3,900	4,200	4,500	4,900
Grand Total	43,241	48,372	42,867	57,630			

Source : BADC, BKB

* : cubic feet per second

The BADC operation started with the large number of imported pumps and has already quite a long history and, therefore, the pumps themselves have long been in use. At the present, it is said that the substantial portion of the pumps of BADC is to be replaced. Not only because of this fact, but also the facts that the Government prohibited importation of the centrifugal pump in early 1980, and the Government declared to put the particular emphasis on the agro-industrial develo-ment and the agricultural irrigation development for the Second Five Year Develop-ment Plan, the domestic manufacturers in the sub-sector of metal working and light engineering industry enlarged their production capacity and made themselves ready to satisfy the future demand. Thus, it is wishfully said today that the total annual production capacity of the centrifugal pump in Bangladesh is 24,000 units.

As for the hand pump, the number presently in use is estimated at 450,000 units by the UNICEF study. The figure is far bigger than that of the centrifugal pump. This is mainly because the hand pump is cheap enough for the farmer to purchase (the hand pump costs between Tk 300 and Tk 350, while the centrifugal pump costs between Tk 2,000 - Tk 4,500) and partly because it can be used for both drinking water and irrigation water, and the Government subsidized the purchase of the hand pump.

This crucial need was strongly felt by two aiding organizations, UNICEF and USAID, who plan to supply 500,000 hand pump units collaboratingly up to the end of 1985. More precisely, UNICEF commenced a programme to supply the hand pumps with the local population in the manner that the target of 1 unit per 75 persons be attained by the end of the year 2,000. USAID, on the other hand, plans to provide the rural farmers with 240,000 units by the end of fiscal year 1981/82. The UNICEF programme is primarily meant for drinking water, while the USAID programme is directed for rural irrigation water.

Whichever the usage may be, it is clearly indicated that there is a huge demand for the hand pump for the coming decade or more. In order to meet the demand in the future, it should be urged to expand the production capacity of the existing foundry and light engineering workshops, as the present production (supply) capacity is estimated at 20,000 units per year.

a) Future Demand for the Centrifugal Pump

In Table 3.3.7, the operation record of the pumps is shown. In estimating the future demand, however, it is not appropriate to regard the annual increment in Grand Total as the demand and to project the future demand accordingly. Some elaborated examination as well as assumptions are required for the reasonable estimation of the future demand.

The annual demand can be divided into the replacement demand and the new demand. LLPs, DTWs, and STWs of BADC are operated under subsidized rental scheme and therefore, BADC possesses these units and maintains them regularly at its main and rural workshops. BADC's present rental capacity

is estimated from its annual report as below:

Table 3.3.8 BADC's Rental Capacity in 1979/80

LLP:	42,000 units
DTW:	10,000 units
STW:*	10,000 units
Total	62,000 units

For the successful future operation of this rental scheme, BADC needs not only new additional pumps but also replacement pumps.

On the part of BKB operation, the estimated demand for STWs for the whole Plan period is 30,000. When this figure is equally distributed over the Plan period, the yearly demand for STW becomes 6,000.

Other privately owned LLPs, DTWs and STWs may also require the replacement as well as the new establishment. However, as the estimated figures themselves are not so well-confirmed, it should be advised that some conservative consideration is given to the future demand projection.

In addition to these above, in the Second Five Year Plan it is projected that the new demand for STW is 100,000 units and that of LLP is 20,000 for the whole plan period, while the annual replacement demand for STW is estimated at 5,000 and that for LLP at 5,000 for five years. When all these figures are averaged equally over 5 years, the annual pump demand easily exceed 30,000 units.

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* For the shallow tubewell, BADC changed its policy recently from rental operation to soft loan sales operation with the assistance of BKB.

Keeping all these in mind, the demand projection for the centrifugal pumps for the Plan period is carried out upon the following assumptions:

- BADC doubles its holdings of pumps from the present 62,000 units to 124,000 units over the Plan period.
- BKB handles 30,000 STWs over the new Plan period.
- Individual farmers install 2,000 units of LLPs or DTWs or STWs over the Plan period.
- The replacement demand is realized at a rate of 5 percent. This assumption is extremely conservative in view that the life span of the centrifugal pump is usually set to be 8 years.

The projected demand in Table 3.3.9 is fairly conservative if the target of the Second Five Year Plan is compared with. To be more precise, the average

Table 3.3.9 Demand Projection for the Centrifugal Pump

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
New Demand						
BADC	(62,000)	12,400	12,400	12,400	12,400	12,400
BKB	(15,000)	3,000	3,000	3,000	3,000	3,000
Other Privately Owned	(4,500)	400	400	400	400	400
Sub-Total	(81,500)	15,800	15,800	15,800	15,800	15,800
Replacement Demand	-	4,075	4,865	5,655	6,445	7,235
Total	(81,500)	19,875	20,665	21,455	22,245	23,035
		(97,300)	(113,100)	(128,900)	(144,700)	(160,500)

Source : JICA Team

annual demand in the Plan exceeds the projected annual demand by a little more than 10,000 units. Our conservative projection, however, can easily be justified

by the fact that over the last several years the annual domestic production of the centrifugal pumps recorded only a few thousands and it is only this fiscal year when the demand (mostly public procurement) for the centrifugal pumps exceeds 10,000 units. Thus, the actual production record implies that the present production capacity is far below what will be required from the next year on. The total annual domestic production capacity at present must be at least 50% lower than the self-proclaimed 24,000 units.

b) Future Demand for the Hand Pump

Unlike the case of the centrifugal pump, the demand projection for the hand pump is fairly simple. This is because there already exist two particular programmes sponsored by UNICEF and USAID, which specifically promise to supply 500,000 hand pumps possibly during the Plan period. In other words, the realizable demand of 500,000 is already secured at this point of time.

Basing on this given precondition, a couple of assumptions are given and the demand projection is performed hereunder.

- The 500,000 hand pumps are equally divided and allocated for each year over the Plan period.
- The replacement demand is realized at a rate of 10 percent over the five year period. This assumption is very conservative in view that the life span of the hand pump is usually 5 years.

In spite of the fact that the projection shown in Table 3.3.10 is carried out in quite a conservative manner, it reveals clearly that the production capacity

Table 3.3.10 Demand Projection for the Hand Pump

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
New Demand	(450,000)	100,000	100,000	100,000	100,000	100,000
Replacement Demand	-	45,000	55,000	65,000	75,000	85,000
Total	(450,000)	145,000 (550,000)	155,000 (650,000)	165,000 (750,000)	175,000 (850,000)	185,000 (950,000)

Source : JICA Team

falls far short of the demand. According to the BKB estimation, the total domestic production capacity can only cater for 20,000 hand pumps annually. It is not known how the demand/supply gap of more than 100,000 units can be met successfully.

(2) Demand Projection for the Second Group Products

Although nation-wide statistics of the past production of the weeder, the thresher, the seed drill, the winnower, the hand hoe and the paddy dryer do not exist in its aggregate form, there are some clues which can lead to the justifiable future demand forecast.

One of the clues is the production-sales record kept by the Comilla Cooporative Karkhana Ltd. The record of the Karkhana Ltd. over the last few years, as shown in Table 3.3.11 reveals that even the nearby area around Comilla sub-

Table 3.3.11 Production Record of Comilla Cooperative Karkhana

	1976/77	1977/78	1978/79	1979/80	
Weeder	2,550	3,600	2,142	3,000	(3,000)
Thresher	1,800	1,750	1,886	2,000	(3,000)
Seed Drill	105	4,500	3,011	n.a.	(3,000)
Winnower	12	20	15	n.a.	(3,000)
Hand Hoe	20	2,200	4,800	n.a.	(3,000)

Source : The Comilla Cooperative Karkhana Ltd., Ranirbazar, Comilla, Bangladesh.

Note: Figures in the parentheses are the public procurement by the Ministry of Youth.

division has substantial demand for a limited kinds of agricultural implements and machines. Obviously, the figures shown in Table 3.3.11 are only those manufactured at the Karkhana Ltd. If we take into account the fact that there exist more than a dozen of Karkhana-spin-out small manufacturing units within the Comilla

township alone which produce these agricultural implements and machines, their past production-sales record, particularly the weeder and the thresher, must have reached the double of the Karkhana's figures easily. In addition, it should be noted that the figures of these two items are realized solely in the private market, while the sudden high production records of the seed drill and the hand hoe in 1977/78 and 1978/79 are attributed to the public procurement of the Director of Agriculture (Jute Production).

In addition to the above, there is recently a strong movement, within the Ministries concerned, to subsidize agricultural activities towards modernization of farming. The Ministry of Youth, particularly, in an attempt to increase crop production and to ease the problem of disguised unemployment in the rural areas through mobilization of the jobless rural youth, has started a compaign to teach them methods of modernized agricultural farming by providing simple agricultural implements and machines on the subsidized basis. The public procurement of six kinds of implements and machines; namely, (a) the weeder, (b) the thresher, (c) the seed drill, (d) the winnower, (e) the hand hoe and (f) the seed treater, each at 3,000 units, was under way by the Ministry of Youth, and their production was nearing to its final stage at one of the Dacca manufacturing units at the time of the Team's survey. This can be regarded as another clue in compiling past production statistics.

The above observations can, then, lay foundations for establishing some plausible assumptions in estimating the potential future demand for these agricultural implements and machines.

a) Future Demand for the Weeder

In order to carry out the future demand projection of individual agricultural implements and machines, various sets of assumptions have to be introduced. It should be noted here, then, that for the sake of easier and practical implementation these assumptions are to be set rather conservative than ambitious.

The demand projection for the weeder, the thresher, the seed drill the winnower, the hand hoe and the paddy dryer are duly carried out item by item

hereunder. The last item, the paddy dryer, is newly included here as the team's technical expert envisaged that quicker paddy drying will lessen paddy loss during the rainy season.

The following assumptions are, then, introduced for the weeder:

- The present (1979/80) weeder-user farmers are 25,584 in number out of the total land owner farmers of 4,915,785.
- During the first year of the Plan period, one percent of the total non-user/land-owner farmers purchases the weeder newly, and the new demand thereafter grows at an annual growth rate of 10 percent up to the end of the Plan period.
- 10 percent of the weeders in use is replaced by the new weeder every year. In other words, it is assumed that the wooder can be used for 10 years.

By these simple assumptions, the yearly demand for the weeder for the coming Plan period is projected as in Table 3.3.12.

The projected figures look quite conservative in view of the number of existing farmers with more than 1 acre of land. However, in comparison with another projection by BKB*, the present projection is fairly moderate. This is due to the fact that the above projection is conducted on recognition that the agricultural modernization is such a long process as the traditional agricultural farming method can not be easily altered within a decade or two.

In spite of this gradually increasing future demand, the production capacity does not seem to cope with it, especially towards the end of the Plan period, as the present production capacity may be estimated at a little over 10,000 per year.

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* According to the BKB's projection, the future demand for the weeder is estimated at 500,000 units.

Table 3.3.12 Future Demand for the Weeder

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Farmers with more than 1 acre		4,915,785	4,915,785	4,915,785	4,915,785	4,915,785
No. of weeders in use	25,284	74,486	128,278	187,449	252,538	324,135
New demand		48,902	53,792	59,171	65,089	71,597
Replacement demand		2,558	7,449	12,828	18,745	25,254
Total demand		51,460	61,241	71,999	83,834	96,751

Source : JICA Team

b) Future Demand for the Thresher

The pedal thresher is also fairly popularly prevailing among the Comilla farmers and its future demand is expected to grow at a substantial rate.

The demand proejction is, then, carried out upon the following assumptions:

- The present (1979/80) thresher-user farmers are 13,872 in number of out of the total land owner farmers of 4,915,785.
- The new introduction of the thresher is taken place at a rate of 0.33 percent of the total non-user/land owner farmers in the first year, and the new demand thereafter grows at an annual growth rate of 10 percent up to the end of the Plan period. This assumption is laid down upon consideration that one thresher would possibly the purchased jointly by two to three farmers on an average over a substantial period of popularization of this item among farmers.
- The replacement is taken place at a rate of 10 percent out of the total threshers in use.

On these assumptions, the future demand for the thresher is estimated for the Plan period in Table 3.3.13. The total demand for the Plan period amounts to 124,751 units. This figure closely corresponds to that of BKB projection. However, as similarly in the case of the weeder, the domestic production capacity does not seem to exceed 10,000 at the most.

Table 3.3.13 Future Demand for the Thresher

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Farmers with more than 1 acre		4,915,785	4,915,785	4,915,785	4,915,785	4,915,785
No. of threshers in use	13,872	30,212	48,186	67,957	89,706	113,629
New demand		16,340	17,974	19,771	21,749	23,923
Replacement demand		1,340	3,021	4,819	6,796	8,971
Total demand		17,727	20,995	24,590	28,545	32,894

Source : JICA Team

c) Future Demand for the Winnower

The past production of the winnower at the Karkhana Ltd. is very small and almost negligible. Thus, the use of the winnower is rarely known among the village farmers. For this type of product, therefore, it should be necessary to undergo a few years of educational-cum-demonstrational period. Then, the increasing demand at a higher pace can be expected.

Keeping this in mind, the following assumptions are employed:

- The concerned Government agencies demonstrate the winnower at every single rural market of the Country, whose existing number is said to be a little over 6,000 in total, for the first three years of the Plan period.
- During the fourth year of the Plan period, the new demand shares 0.3 percent of the total non-user/land-owner farmers and, then, the demand

grows at a rate of 10% per annum.

- The replacement demand is created at a rate of 10% out of the total winnowers in use.

Table 3.3.14 shows the demand projection of the winnower. The total demand for the whole Plan period amounts to a little over 40,000.

Table 3.3.14 Future Demand for the Winnower

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Farmers with more than 1 acre		4,915,785	4,915,785	4,915,785	4,915,785	4,915,785
No. of winnowers in use	3,200	4,200	6,200	9,200	23,929	40,131
New demand		1,000	2,000	3,000	14,729	16,202
Replacement demand		320	420	620	920	2,393
Total demand		1,320	2,420	3,620	15,649	18,595

Source : JICA Team

This figure is quite below the number of existing villages, 63,000. However, it is our expectation that the moderate projection will lead to a successful implementation by both the public sector and the private sector. The domestic production capacity is presently very low, but the demand figures shown above may be regarded as attainable by the existing manufacturing capacities.

d) Future Demand for the Seed Drill

Owing to the large order form the Director of Agriculture (Jute Production) in 1977/78 and 1978/79, 7,000 seed drills were manufactured at the Karkhana Ltd. In 1979/80, 3,000 units were manufactured by Chittagong Steel Works Ltd. of Dacca for the Ministry of Youth. These seed drills were obviously used for sowing jute seeds in rows. Thus, the seed drill can find its markets to mainly the jute growing farmers as well as crop growers other than paddy.

Keeping the above in mind, the following assumptions are laid down for the demand projection:

- There are approximately 1,000,000 jute growing farmers in the country.
- The number of the seed drills presently in use is estimated at 10,000.
- The new demand shares 0.5 percent of the total non-user farmers during the first year and grows at a rate of 10 percent per annum.
- The replacement demand is realized at a 10% of the total seed drills in use.

The final outcome of the projection is shown in Table 3.3.15. The aggregate total demand for the whole Plan period is 40,681, which is far below the BKB projection of 5 lakh. However, it is believed that, in view of the past production record, the figures in the total demand are reasonable. In addition, they are within reach of even the production capacity of the Karkhana Ltd.

Table 3.3.15 Future Demand for the Seed Drill

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Jute growing farmer		1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
No. of seed drills in use	10,000	14,950	20,395	26,385	32,973	40,220
New demand		4,950	5,445	5,990	6,588	7,247
Replacement demand		1,000	1,495	2,040	2,639	3,297
Total demand		5,950	6,930	8,030	9,227	10,544

Source : JICA Team

e) Future Demand for the Hand Hoe

Similarly as in the case of the seed drill, the Karkhana Ltd. received a total order of 7,000 hand hoes from the Director of Agriculture (Jute Production)

in 1977/78 and 1978/79. Then, in 1978/80 the Ministry of Youth procured 3,000 units from Chittagong Steel Works Ltd. As the hand hoe is used for removing weeds from the crop field of dry soil, it can be applied for both jute cultivation and crop cultivation other than paddy.

Then, the following assumptions are given for the demand projection of the hand hoe:

- There are approximately 1,500,000 potential farmers who can use the hand hoe.
- The number of the hand hoes presently in use is estimated at 10,000.
- During the first year of the Plan period, the new demand is created at 0.5 percent of the total non-user farmers and grows at a rate of 10 percent per annum.
- The replacement demand is taken place at a 10% of the total hand hoes in use.

In Table 3.3.16, the future demand is projected upon the above assumptions. The total demand figures are very conservative when compared with the BKB projection. The BKB forecasts the national requirement of 5 lakh units during the coming Plan period, while the present projection totals only 59,078.

Table 3.3.16 Future Demand for the Hand Hoe

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Potential farmers		1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
No. of hand hoes in use	10,000	17,500	25,750	34,825	44,808	55,789
New demand		7,500	8,250	9,075	9,983	10,981
Replacement demand		1,000	1,750	2,575	3,483	4,481
Total demand		8,500	10,000	11,650	13,466	15,462

Source : JICA Team

In spite of this large discrepancy, it is the Team's belief that the projected figures are quite reasonable from the viewpoints of the small domestic production capacity as well as the traditional conservative attitude of rural farmers to the newly introduced agricultural implement.

f) Future Demand for the Paddy Dryer

In the history of paddy cultivation of Bangladesh, the paddy dryer has never been introduced properly to the farmers. In 1976, BADC obtained 8 paddy dryers from West Germany, but they could not lay foundations for popularizing the use of the paddy dryer among farmers.

In view of better preservation of paddy during the rainy season, the Team's experts strongly recommended to consider seriously the possibility of introducing the paddy drying to the country. It is also pointed out that the multi-purpose use of the paddy dryer is also possible for tobacco leaves drying and other crops drying.

In order to project the future demand for the paddy dryer, the following assumptions are set forth:

- There are no paddy dryers presently in use.
- The new introduction of the paddy dryer is taken place at a rate of 0.05 percent of the total non-user/landowner farmers in the first year.
- The new demand grows at a rate of 10% per annum.
- The replacement demand is realized at a 10% level of the total paddy dryers in use.

Table 3.3.17 shows the projected demand for the paddy dryer. The total demand figures are even more conservative than any other cases of agricultural implements and machines. This is simply because the Plan period is regarded as an experimental and introduction period of the paddy dryer.

Table 3.3.17 Future Demand for the Paddy Dryer

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Farmers with more than 1 acre		4,915,785	4,915,785	4,915,785	4,915,785	4,915,785
No. of paddy dryer in use	Nil	2,458	5,162	8,136	11,417	15,016
New demand		2,458	2,704	2,974	3,271	3,599
Replacement demand		Nil	246	516	814	1,142
Total demand		2,458	2,950	3,480	4,085	4,741

Source : JICA Team

(3) Demand Projection for the Third Group Products

The third group products consist of the rickshaw, the push cart (hand cart), the horse cart, the bullock cart and the bicycle. These items are all short distance transportation means and are usually called, "Un-organized Road Transport".

Among these, the rickshaw and the horse cart transport primarily passengers, and secondarily goods. Therefore, in most cases they are used for goods transport without reforming the cart itself purposely. However, in some cases especially in rural areas, the rickshaw and the horse cart are found to be manufactured particularly for goods transport. In addition, the bicycle is another means of human transport and is rarely used for goods transport. Thus, the remaining two kinds of carts, the push cart and the bullock cart, are specifically meant for goods transport, which mainly draw our present attention.

The needs to up-grade the conditions of short distance transportation in rural areas of Bangladesh have long been recognized. Agricultural products such as crops, vegetables and fruits are said to be often wasted at the farmer's place due to non-availability of short distance transportation means. The average number of the bullock carts per village is revealed to be 1.4 from the statistics shown in Table 3.3.18. This figure is evidently too small to satisfy the needs of goods

transportation in a rural village. Besides, the difficulties and heaviness in handling the bullock cart seem to limit its usage to a certain extent.

Table 3.3.18 Statistics of Un-organized Road Transport

	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79*	1979/80**
Rickshaw	90,772	95,290	100,796	117,083	118,249	124,634	131,364
Push cart	4,593	4,593	4,655	4,758	4,869	4,979	5,091
Horse cart	991	1,062	1,096	1,283	1,470	1,630	1,808
Bullock cart	86,600	87,200	88,500	89,200	89,800	90,474	91,155
Bicycle							(80,000)***
Total	182,956	188,140	195,047	212,324	214,388	221,717	229,415

Source : Bangladesh Bureau of Statistics, Statistical Yearbook of Bangladesh, 1979.

Note : *, ** All the figures in these two years are estimated by the Team.

*** The figure in the parenthesis is the estimated annual demand for the bicycle.

To compensate this drawback, the push cart (hand cart) is in service. However, as the statistics show, the number of existing push carts is unexpectedly small, 5,091 carts in 1979/80. The figure seems to imply that the statistics included only one type of push cart defined rigidly by the statistical authority. However, the Team observed at least 5 types of push carts at work during the field survey, and a couple of them were in fact the pull carts. If these carts are included in the category of "Push Cart", the number of carts presently in use will easily be doubled or tripled.

Keeping these discussions above in mind, the following assumptions are provided for the demand projection for the bullock cart and the push cart:

- The number of bullock carts increases by the same trend as in the past.
- A 1 percent of the total bullock carts in use is replaced by new ones.

- The number of push carts presently in use in 15,273.
- The total new demand for the Plan period is 63,000, the same figure as that of existing villages in Bangladesh.
- The replacement demand is created at a 10% of the total push carts in use.

In Table 3.3.19, the future demand for the bullock cart is projected. The total demand increases at a natural low level in terms of both volume and growth rate. The domestic production capacity by the rural carpentry workshops and the small rural MW/LE workshops will not face any difficulty to satisfy the future demand.

Table 3.3.19 Future Demand for the Bullock Cart

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
No. of existing Bullock Cart	91,152	91,836	92,524	93,218	93,918	94,622
New demand		684	688	694	700	704
Replacement demand		912	918	925	932	939
Total demand		1,496	1,606	1,619	1,632	1,643

Source : JICA Team

In Table 3.3.20, the future demand for the push cart is projected. Although the new demand is equally distributed over the Plan period, the demand itself appears quite ambitious. However, in this case, the demand is considered to include new types of push carts, the wheelbarrow and what they call the "rear car" which can be drawn at the rear of the ordinary bicycle. In this latter case, therefore, the future bicycle demand which exceeds easily 80,000 per annum is unconsciously taken into consideration.

Table 3.3.20 Future Demand for the Push Cart

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
No. of existing push cart	15,273	27,873	40,473	53,073	65,673	78,273
New demand		12,600	12,600	12,600	12,600	12,600
Replacement demand		1,527	2,787	4,043	5,307	6,567
Total demand		14,127	15,387	16,643	17,907	19,167

Source : JICA Team

As for the production capacity, the existing rural MW/LE industries should be able to cope with the projected demand as the present technological level of these industries is judged adequate by the Team's field study.

3.4 DEVELOPMENT GUIDELINE

No particular characteristic difference was noted between the four Sub-Division under study. Also, a field survey conducted by the Study Team resulted in finding little difference between these areas, save for Kushtia, as far as the development of metal working/light engineering industry--the most important of both agro-supporting and agro-based industries--was concerned.

Generally, following factors are considered in determining the location of industrial sites:

a) Raw materials supply

b) Market availability

c) Manpower and technology availability

d) Infrastructure availability

e) Capital availability

f) Policy considerations

The four Sub-Divisions are more or less in similar condition as the site of small scale metal working/light engineering industry when considering in terms of these factors, except for factor f).

Policy considerations for the establishment of a development guideline of small scale metal working and light engineering industries include:

- To create nuclei of modern industry in the particular rural area.
- To establish linkages between agriculture and industrial sectors.
- To foster private enterprises.

In view of the above, factors to be considered in the determination of development guidelines will be as presented in Table 3.4.1.

Table 3.4.1 Factors of Development Guideline Formulation

Elements of Guideline	Factors to be Considered
1. Establishment of industrial units to meet market demands	. Demand for products . Demand for repairing . Geographical distribution of the demands
2. Setting-up supporting mechanisms	. Raw materials and specific parts and components supply . Technology backup and skilled man-power supply . Sales and marketing network
3. Selective promotion	. Priority allocation of capital funds for metal working/light engineering in designated areas . Infrastractural concession
4. Utilization of the existing facilities	. Existing supply capacity . Existing distribution channels . Existing supporting mechanisms

Source : JICA Team

Therefore, guideline for the development of small scale metal working/light engineering industry can be summarized as follows (see Figure 3.4.1.):

a) A few metal working/light engineering production bases and several repairing-cum-production bases are to be established in each of the Sub-Division. The desirable distribution of the base is at least one in each Thana.

b) Any existing facilities of relevant government organizations and private enterprises should be fully utilized, and inadequate capacity should be expanded by additional investments.

c) A part of the small scale industrial development fund should be allocated to investment in new production/repair bases and to the modernization/ expansion of existing facilities.

d) In establishing each new production base, infrastructural and other developmental efforts should be added so as to allow for the future expansion and diversification.

e) A central organization should be established for technical back-up services to include technical training, technical consultation, new products development, and products standardization.

f) A central cooperative organization should be established for the supply of raw materials and specific parts.

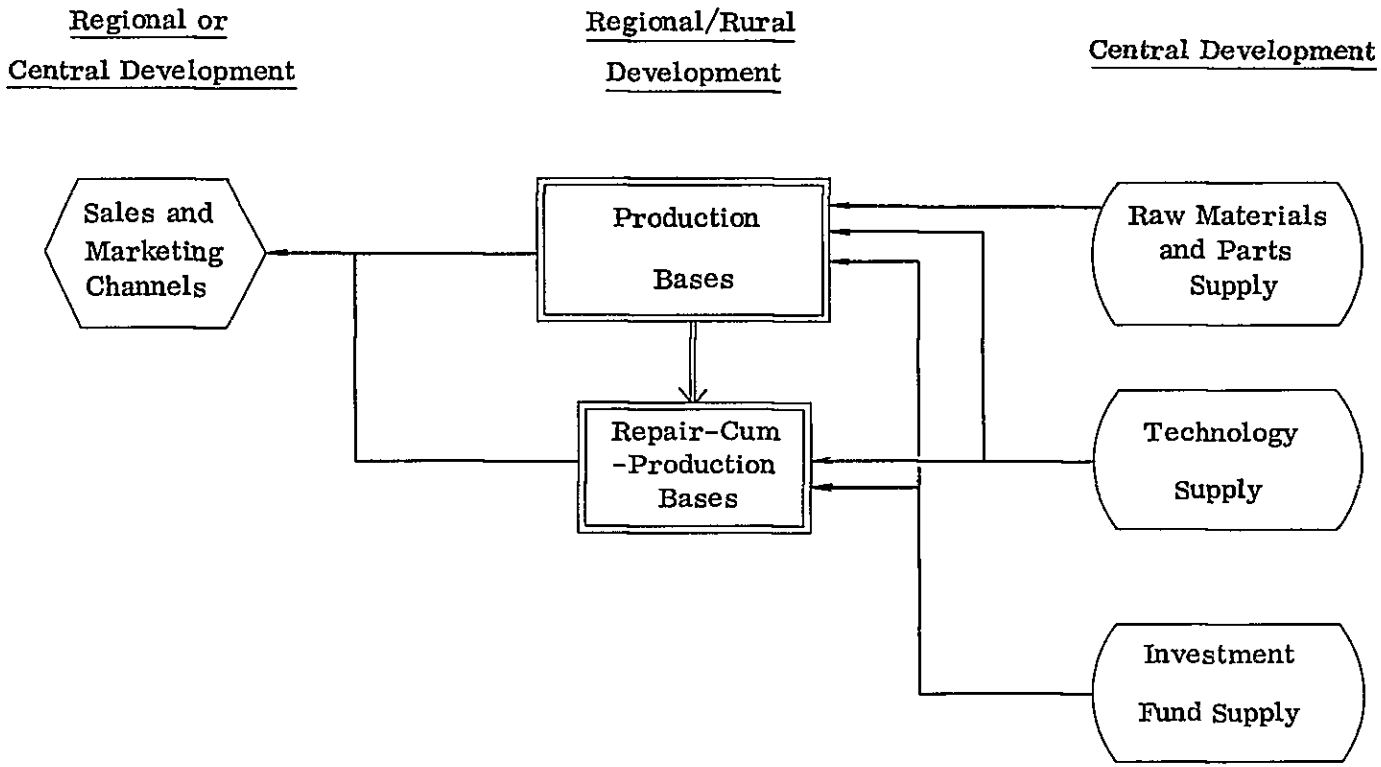
g) Products should be marketed in cooperation with, for instance, agricultural sector; appropriate distribution channels and marketing measures should be established.

Inasmuch as the major market of small scale metal working/light engineering industry is agricultural sector, the following policy is recommend for interface between the two:

- That the agricultural sector carry out R&D on basic needs for various agricultural tools, implements and machinery and perhaps prototype development and testing.
- That the industrial sector accomplish large scale production of those products.
- That sales and marketing be accomplished either by the agricultural sector or by both the agricultural and industrial sectors in cooperation preferably through a joint distribution channel.
- That repair and maintenance be accomplished by the agricultural sector (to be replaced by the industrial sector in the future) in rural areas, and by the industrial sector in suburban areas.

Details of the development plan will appear in CHAPTER 5.

Figure 3.4.1 Schematic Development Guideline



Source : JICA Team

CHAPTER 4 THE PRESENT STATUS AND PROBLEMS OF SMALL SCALE METAL WORKING AND LIGHT ENGINEERING INDUSTRIES

CHAPTER 4 THE PRESENT STATUS AND PROBLEMS OF SMALL SCALE METAL WORKING AND LIGHT ENGINEERING INDUSTRIES

4.1 TECHNOLOGY AND QUALITY OF PRODUCTS

4.1.1 Technology

(1) General Remarks

One who has had an opportunity to glance at a factory of small-scale metal working and light engineering (MW/LE) industries in Bangladesh would be amazed by the ingenuity of those who are engaged in the business. It is indeed astonishing to see a number of very small metal working and light engineering industries jointly manufacture such relatively sophisticated industrial products as lathes and centrifugal pumps with limited range of production facilities and raw materials. Individually, the smallest of them can be a machine shop which has only one lathe and few ancillary equipment and is manned by the proprietor himself with one or two assistants, a foundry equipped with a small crucible furnace, etc.

Their products and components thereof may appear almost indentical to those produced in more industrially developed countries. A closer look at them would, however, detects fatal shortcomings. The level of the quality of these products will be dealt with later in 4.1.2.

Such shortcomings are widely observed, even in less sophisticated products and even in those manufactured by larger industries. They should not be attributed only to poor production facilities and the difficulties in obtaining proper raw materials. There is a room for rectifying some of the shortcomings by slightly modifying the production facilities and shop floor practices. Problems of specific technologies are dealt with in the sections which follows. In this section problems of general nature will be discussed.

Firstly, the importance of engineering design should be emphasized. Many products of the existing metal working and light engineering industries are dead-copies from similar products of foreign origins and are engineered without

conforming to proper technical specifications. In fact, the use of technical drawings is very rare among the metal working and light engineering industries (not only small-scale metal working and light engineering units). When drawings are used they do not specify the tolerance of the measurements, the surface roughness and other important elements.

The practice to use drawings (and the ability to read them) is essential to ensuring the uniformity of products and it is a prerequisite to the promotion of sub-contracting and other forms of linkages between industrial units. It is to be emphasized here that technical drawings and specifications should be adequately prepared so as to ensure that the product is manufactured to serve its purpose within a reasonable range of performance and durability at the minimum possible production cost.

Secondly, much more attention should be given to the importance of production technology. The quality of products and the efficiency of production operations cannot be achieved by a mere combination of adequate production facilities, proper raw materials, the skill of workers, and good technical drawings.

There are many other important elements which are broadly refered to as production technology or know-how. Dynamic balancing of impellers of centrifugal pumps is an example. The need for it may be taught by a text book but the text book does not tell when, how and to what degree it should be done. This comprises an important element of production know-how in manufacturing centrifugal pumps. Any industrial product has such vital points in the production process which, if not managed properly, will result in the poor quality of the product and the low efficiency of production operations.

Many literatures are available which tell about elements of production technologies but their treatment of the subjects is usually too general to put into action at the floor level. For the production of a specific product a literature is not readily available. Foreign collabolation either in the form of direct investment or technical cooperation arrangement is often a quick answer, since such technologies are usually embodied in individual firms. But such an arrangement is difficult to envisage in cases of small-scale industries. Certain involvement at the govern-

mental level is called for.

Thirdly, there is a need for promoting quality consciousness on the side of the parties who purchase the products of small scale MW/LE industries. To refer to an extreme case, the Team have witnessed an instance that agricultural implements such as hand-pushed weeders and pedal threshers are manufactured by a medium-sized factory in Dacca according to an order from a public agency. The quality of the products is such that they would serve the purpose, at best, for a very short period. The products are purchased by the agency to distribute them to farmers with an aim to promote agricultural production by introducing improved farming technology. Whether the products are given to the users as an outright grant or at a subsidised price they would only discourage the users from adoption of intended improvements.

Forthly, a need for promotion of industrial specialization deserves attention. At present as in many other developing countries, there is a tendency that manufacturing units tend to be self-contained, that is, they tend to undertake all the production processes to produce a final product without resorting to farming out some jobs to outside. As acknowledged, and emphasized elsewhere this tendency would be hampering the upgrading production techniques of small-scale industries and hindering efficient utilization of capital equipment from the standpoint of the individual firm concerned as well as from that of the national economy.

(2) Machining

There exist machine shops of varying sizes in the Country, from very small ones equipped with a lathe together with a bench drilling machine and a bench grinder and employing only few workers to considerably larger ones which employ some hundred workers. If several exceptional cases such as BMTF and BITAC are excluded, these machine shops are not essentially different from each other in terms of sophistication of machinery installed and the nature of products they produce. Larger establishments have more lathes but not many of them have milling machines and other more sophisticated machinery.

There are cases where even very small machine shops operated by proprietors

by themselves with a few assistants are manufacturing lathes (by letting out some jobs to other machine shops equipped with a milling machine etc.). Most of small ones, however, are typically undertaking jobbing works to supply others with relatively simple spare parts needed for repairing machines such as rice and other grain mills, oil mills, bicycles, rickshaws etc. Larger establishments tend to have, beside a machine shop, a carpentry shop, a foundry, a sheet metal work shop etc. and produce finished products such as centrifugal pumps of 0.5 - 1.5 cubic feet per second capacity, hand-pushed weeders, pedal threshers and other simple agricultural tools, or spare parts for various machinery such as those for jute and textile mills.

Technical problems of these machine shops, whether they are large or small in size, arise from lack of quality consciousness and lack of fundamental knowledge of machine shop operation rather than from inadequacy of machinery they have. Fundamental knowledge of machine shop operation mentioned above are as follows, all of which are neglected by most of machine shops:

- use of blue prints as the basis of shop operations and the ability to read them
- use of measuring instruments such as vernier calipers (many machine shops do not have any)
- use of jigs and fixtures to ensure operation of machinery at the required accuracy
- proper choice of tools and materials (although this is often difficult to achieve under prevailing market conditions)
- use of cutting fluid
- installing machine tools on right foundation (many machines are installed on the floor without any ground making)
- lubricating, cleaning and other indispensable works to maintain the accuracy of the machinery and equipment.

A prominent shortcoming of most machine shops is that components of products are not made accurate so as to ensure the interchangeability. That is, components are not machined within a required range of tolerance and surface roughness. Failure in any aspect of machine shop practice pointed above would cause such a shortcoming and very often all these aspects are almost completely neglected. By acquiring such fundamental knowledge and taking adequate care, products of more acceptable quality and durability could be produced with minimum additional investment.

(3) Casting

The number of foundries existing in the Country is estimated to be around 400. Almost all of grey iron casting foundries fall in either or two categories described below. Rare exceptions are such as those of BITAC and BMTF where up-to-date foundry technology is utilized.

- Foundries equipped with cupolas of 1-3 ton per hour capacity and employing 20-100 persons.
- Very small foundries using 100-200 lb crucibles and employing ten persons at most.

Typical products of these foundries are components of centrifugal pumps of 0.5 - 1.5 cubic feet per second capacity, grain milling machines, vegetable oil milling machines, weighing scales as well as cooking pans, weights for fishing nets, manhole covers, sanitary cisterns and fittings etc. Properties of the products are not substantially different between the two categories of foundries. There are a number of non-ferrous metal casting foundries also, producing small machine components such as roller bearing holders of bicycles as well as many kinds of ornamental goods.

This section deals mainly with grey iron casting foundries of the two categories mentioned above with limited reference to the other types of foundries. Salient features of technologies utilized by these foundries are described below with regard to major stages of casting operation.

a) Moulding Sand and Sand Preparation

In Dacca, foundry grade sand is available from two sources of supply in the suburbs of the city. The sand is not classified by the merchants as such but experienced moulders can identify sand good enough for casting. Sand from a place called Kaliakair has grain size of 100 mesh and sand from Gaffargaon 60 mesh. In the two kinds of sand mentioned above, the grain size is fairly uniform and grain shape is sub-angular. Both are river bed sand but are naturally clay-covered such that additional binding clay is not required for the first two or three burnings. The SiO_2 content is in the range of 85 - 90% and its refractoriness is fairly satisfactory for use as core sand as well as facing sand.

In most of the other parts of the country, sand of similar quality can be found although it may not be readily available from the markets. Thus the quality of locally available sand should not cause any major trouble in most of iron casting operations. Moulding practice in most of foundries, however, does not match the quality of the sand and slight modifications in moulding practice could significantly improve the quality of castings.

Many foundries add coal dust not only in the facing sand mixture but also in the backing sand. Interviews with managers and foremen of the foundries gave an impression that the coal dust content in the moulding sand mixture is not controlled properly. It was observed in a number of foundries that the moisture of the sand was excessively high due to adding too much water. In almost all the foundries many castings were being mended at the cast surface by filling blow holes and short runs by welding, perhaps suggesting that improper sand mixture causes such troubles.

To old sand local clay is also added. Coal dust and binding clay are usually ground by 'dhekki', a traditional foot operated rice husking device. Mechanical kneading is rarely practiced.

b) Moulding

Moulding method is a typical bedding-in method using one moulding box. Patterns made of cast aluminium are extensively used. Moulding bed is usually not insulated from the ground. Under the climatic conditions in Bangladesh where the relative atmospheric humidity is usually above 80% in the May to October period, such a moulding bed structure makes it impossible to control the moisture of moulding sand within the acceptable level.

In addition, moulding bed of most foundries is not properly protected from the rain. Often the buildings in which the moulding bed is located do not have proper walls and roof is made of corrugated iron sheets without adequate rain shielding. Thus, it is not surprising to hear a remark of a resident foundry engineer that the reject rate of castings can be almost 100% in the rainy season (casting operation is continued even under such conditions of the rainy season extensively resorting to mending by welding).

In designing moulds, it is pointed out that more adequate considerations should be paid to such aspects as direction of solidification and venting air and moisture in order to ensure better cast surface.

In preparing core sands addition of molasses is extensively used. Some foundries of larger size have core drying ovens of brick structure which are fired by either fire wood or natural gas.

In the sand mixture for non-ferrous metal casting molasses is believed to be the best binder, volumetric ratio of molasses being 15 - 20% of the mixture. For small non-ferrous metal casings which require extra smooth surface, a sand mixture using engine oil as a binder has been developed by BITAC (the technology is known as the Mobil Oil Sand System in Bangladesh). Finishing of castings by this method is almost comparable to die-casting.

c) Melting

As mentioned earlier, existing foundries are equipped with either cupola or crucible furnaces. Other melting furnaces such as electric induction melting system have not yet been installed in the industry. In some foundries a cupola

is so constructed that pipeline natural gas can be burnt together with coke in the cupola in order to minimize the cost of fuel.

Design and installation methods of cupolas in most of existing foundries are not satisfactory. The height of the furnace relative to its inner diameter could be increased so as to improve the heat efficiency. The number of tuyeres would better be increased and the size of the wind box could be made larger in order to ensure more uniform flow of air blown into the cupola. It is strongly recommended that in designing cupolas standard specifications already established in industrialized countries be followed. For reference, the standard specifications layed down in Japan are given in Table 4.1.1.

Most of existing cupolas are of local made. Fire bricks are produced in the Country including the Mirpur factory although their properties are inferior to those made in more industrialized countries. Fire bricks in singly lined cupolas can hold heat only for about five hours and those in doubly lined cupolas for about 15 hours.

In small foundries crucible furnaces are used even for iron melting (suggesting perhaps the difficulties for small machine shops to obtain castings from larger foundries). Crucible furnaces are fired with either coke or furnace oil.

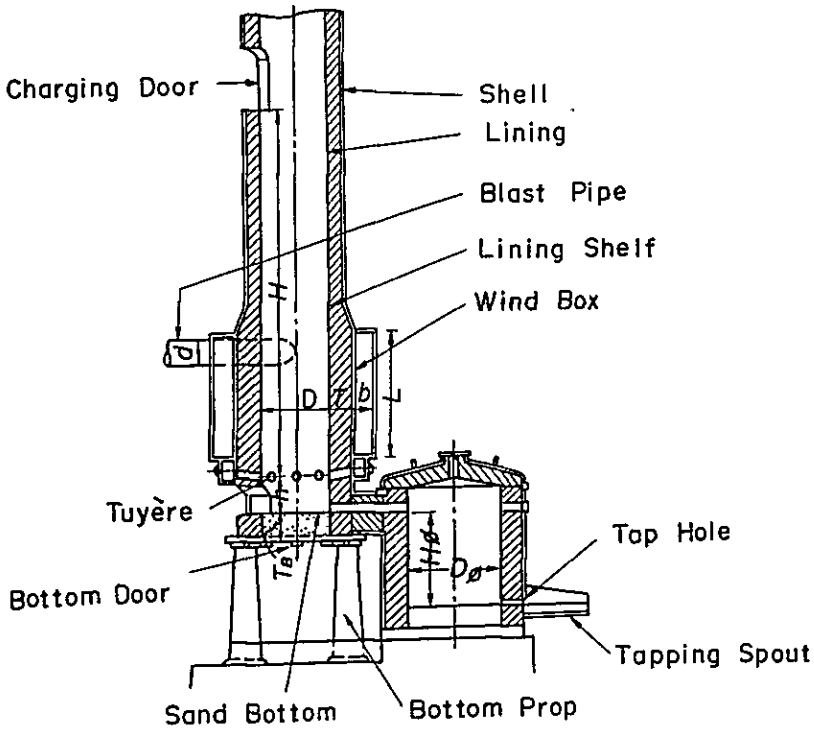
Cake is imported from abroad, very often from India and the Eastern Europe. Import of coke is centrally controlled by the Coal Comptroller. Complaints are head that the Coal Comptroller does not pay the attention to the quality of coke it imports. It is reported that coke for other use, which had very high sulphur and ash content, was imported in the past and used at causing serious troubles in casting operation.

Table 4.1.1 Standard Specifications of Japanese Cupola Furnaces*

Type of cupola	D (mm)	A (m^2)	A/S	H (mm)	H/D	h (mm) Without fore-furnace	h (mm) With fore-furnace	d (mm)	b (mm)	L (mm)	H_F=D_F (mm)	T (mm)	T_B (mm)	'Velocity of dissolution (V/A-121-140) (t/hr.)
1	300	0.071	4 - 9	1,500	5.0	350	-	120	120	480	-	80	80	0.3
2	350	0.096	4 - 9	1,750	5.0	400	-	130	130	520	-	100	90	0.4
3	400	0.126	4 - 9	2,000	5.0	450	-	140	140	560	-	120	100	0.6
4	450	0.159	4 - 9	2,250	5.0	500	350	150	150	600	580	120	130	0.8
5	500	0.196	4 - 9	2,500	5.0	550	350	160	160	640	630	120	160	1.1
6	550	0.238	4 - 9	2,750	5.0	600	350	180	180	720	680	190	180	1.4
7	600	0.283	4 - 9	3,000	5.0	630	375	200	200	800	730	190	200	1.8
8	650	0.332	5 - 10	3,250	5.0	660	375	215	215	860	780	190	200	2.2
9	700	0.385	5 - 10	3,500	5.0	680	375	230	230	920	830	240	220	2.7
10	750	0.442	5 - 10	3,750	5.0	700	400	250	250	1,000	880	240	220	3.2

* : For details of size designation see Figure 4.1.1.

Figure 4.4.1 Specifications of Cupola in Japan



d) Metal Materials

Pig iron is imported from a number of countries. Import is monopolised by TCB with exceptions of import by UNICEF and few others which have special import license. It is reported that the quality of pig iron is satisfactory for the time being with its composition roughly as follows:

- Carbon 4.2%
- Silicon 4%
- Manganese 0.5%
- Sulphur ..... below 0.1%
- Phosphorus ..... 0.1 - 0.15%

(Pig iron imported by UNICEF contains slightly more phosphorus, 0.15 - 0.2%, so as to ensure freer flow of molten iron in castings of thin walls of hand pumps.)

Complaints are heard among foundry engineers that pig iron classified according to different compositions is not made available in the markets. It is also reported that foundries have bitter experience in the past when pig iron of very bad quality was imported and foundry managers are not assured that such cases will not be repeated in the future.

Scrap cast iron is available from markets, classified into two categories, sanitary ware scrap and machinery scrap. It is possible to buy scrap of required composition selectively if a buyer has experties to identify it. Ratio of pig iron and scrap in the charge is usually adjusted, in most cases, on a trial and error basis by machining test pieces. Technique of using scrap steel to adjust the composition of silicon is not practiced. It is reported that many foundries use only pig iron (without adding any iron scrap) when pig iron is cheaper than iron scrap.

Lack of metallurgical knowledge, coupled with undesirable practices in various stages of casting operations as described throughout this section, results in sub-standard castings. Additives such as ferro-silicon and ferro-manganese are not used (in fact they are not available in the market but this is rather not the cause but the result of foundries not demanding such materials).

e) Pouring

Pouring operation is undertaken solely by hand carried ladles, even at larger foundries having cupolas of larger capacity, say 3 ton per hour. Since they do not resort to machine molding (reasonable choice under prevailing price of labour), their moulding bed tends to be very large. In extreme cases molten metal is hand carried to moulds about 100 yards away from the cupola. Decrease of temperature during such transportation can cause defective casting.

Not much safety precausions are taken in the foundries. Workers wearing goggles are never sighted. Ladles containing molten metal are carried by bare-footed workers.

f) Post-casting Operations

Castings after being knocked out of the sand are cleaned, at best, by a wire brush to a minimum extent. Surface appearance of castings seems to be of little concern to most of foundries and their customers. Use of surface cleaning technique such as shot blasting are very rare.

Annealing to relief casting stress is not undertaken. As a matter of fact, most of products of the existing foundries may not require annealing. Some products do need it, for an example lathe beds, and they are seasoned instead in some foundries. One foundry under construction has installed an annealing furnace aiming at producing malleable iron castings such as pipe fittings.

(4) Forging

Forging operations are predominantly performed by blacksmiths. Although some factories have forging facilities beside turning and other metal working facilities, most of them employ hand forging only. According to the TECHNONET/ JICA survey which covered 315 firms, 22 employ forging process and the number of firms which employ forging as their main production process is only one. Of the 22 firms employing the forging technology only 6 equipped with powered press/ hammer. Among these 6 firms only one had the facility with the maximum capacity above 2 tons.

It is envisaged that the demand for products which require power forging operations will increase as the economy progresses. In Japan and U.S.A., some of blacksmiths have developed themselves to modern engineering industries based on their traditional technology. Some of blacksmiths in Bangladesh have high level technology as will be described below and are worthy of attention as modern forging industries in embryo.

According to an estimate there are about 8,000 blacksmithy units in Bangladesh. Almost all of the blacksmiths are members of Karmakar and Boshtomi, hindi castes. Their main products are sickles, spades and other agricultural tools; 'boti' (a traditional kitchen cutlery) and other household utenciles; hammers and other carpentry tools; nails, hinges and other building hardwares; etc.

The entire production process is performed manually. Materials are cut to a size with a hammer and a chisel, and heated and hammered repeatedly until the final shape is obtained. Air blow to the hearth is operated by hand. Water quenching is exclusively used. For finishing only a file is used. Most of the tools and equipment they use are made by themselves.

Materials are mostly scrap iron or steel of various origins such as rail, machine parts and concrete reinforcement bar. Fuel for the forging hearth is either charcoal (often burnt fire wood collected from kitchens) or coal (burnt or rejected coal from locomotives and brick factories). Some blacksmiths use a mixture of both.

Among a number of blacksmiths visited the Team came across with very skillful blacksmiths in Bogra. They are Mr. Shamal Chandra Mohonta and Mr. Babul Chandra Mohonta. The two are brothers and each of them has a workshop of his own. Although they produce a variety of products, they are specially good at making sickles. One of them whose workshop is located in Malati-nagar Bakshihatkhola is 26 years old and has been practicing this trade for 12 years. He employes a young boy as his assistant. The production process of a sickle made from a combination of mild steel and medium-carbon steel is described below (he also makes sickles solely from medium carbon steel).

The production technique using two pieces of steel of different metallurgical properties is known as forgeweld. Mild steel forms the structural part of a sickle and high-carbon steel forms the blade. The beauty of the technique lies in that the mild steel being less brittle stands the impact given to the sickle when it cuts while the hard steel blade gives extra sharpness in cutting operations.

First, a piece of concrete reinforcement bar is heated and flattened. A slit is cut on it and a small thin piece of medium-carbon steel is inserted therein. The resulting workpiece is heated and hammered repeatedly until the final shape of the sickle is obtained. Small saw teeth are cut along the edge of the blade of the sickle with the aid of a file. The sickle covered with finely ground salt is heated and them quenched into water. The hardness of the blade is tested by filing it. If satisfactory, tempering operation follows.

The whole process described above takes about one hour. Mr. Mohonta says that if sickles are produced on a batch basis he can make about 30 sickles a day. Due perhaps to the low level of demand for their sickles coupled with a shortage of working capital, he makes sickles according to individual orders of farmers. Thus the production efficiency is much lower than that could be achieved if sickles are produced by the batch system.

Metal materials are obtained at market in the town. Reinforcement bar costs Tk. 8 per seer (one seer is about 0.93 Kg) and pieces of broken stopper blade of a rice milling machine (medium carbon steel) Tk. 10 per seer. Coke and charcoal are brought by his unemployed neighbors and Mr. Mohonta pays Tk. 12 for a half gallon tin of coke and Tk. 3 per tin for charcoal. The piece of his sickle is Tk. 6 per piece without a handle, which he buys from a nearby carpenter one Taka a piece, if so requested by the customer.

The quality of his sickles has been revealed to be very high by a metallurgical test as shown in Table 4.1.2, but the amount of orders he receives is small. Many farmers of the nearby villages buy cheaper but inferior sickles available in the market. Such sickles cost only Tk. 3 or Tk. 4 but wear out quickly.

Table 4.1.2 Metallurgical Properties of Sickles Made by Blacksmiths

Test Piece No.	Manufacturer	Carbon Content of Steel	Hardness of the Blade
1	Mr. Mohonta of Bogra	0.6% in blade 0.27% in other part 1/	Hv780-800
2	Mr. Mohonta of Bogra	0.46%	Hv544-560
3	Blacksmith of Joydebpur	0.2 - 0.25%	Hv188-196

Source : JICA Team

Note : 1/ --- The forgeweld technique was employed.

(5) Sheet Metal Work/Welding

Quite many firms employ sheet metal work/welding technology. The TECHNONET/JICA survey shows that 129 out of 315 firms surveyed employ this technology, of which 42 firms as their main production process. Products fabricated primarily by this technology include components of bicycles and rickshaws, truck frames for irrigation pump sets, hand-pushed weeders, seed drills, seed treaters, steel furnitures and cabinets, grilles for gates and windows, hinges etc., to name those observed by the Team.

Production facilities commonly utilized by these firms are simple employing manually operated presses, shearing, blanking and bending machines. Power-operated machines are not very common. For welding, only manually-operated electric arc welders are widely used. Welders of other types such as oxy-accetylene welders and spot welders are rare.

Exceptional cases are found in some medium/large-scale firms. These include wire drawing with multipul-stage dies, production of bicycle mud guard with a roll forming machine, automatic production of welded tubes from steel strip, rebuilding of automobile crank shafts with a sub-merged arc welder, etc.

(6) Press Work

The production precesses which employ power presses in more industrialized countries are still predominantly undertaken by manual operations in Bangladesh. According to the TECHNONET/JICA survey, there are 9 firms which have screw press, 20 firms which have crank press and 5 firms which have penumatic/hydraulic press among 315 firms surveyed. The maximum capacity of these power presses is mostly below 100 tons. Blanking dies used are mostly simple ones and the use of compound dies and progressive dies is rare. The Team observed many of dies are not designed and manufactured properly.

Although resorting to manual operations in place of power press work is logical choice under the economic and social conditions of Bangladesh, the demand for products which require the use of power press work is expected to increase. For the sound development of this technology, however, the problem in obtaining

appropriate materials should be solved and the die making technology should be introduced.

(7) Heat Treatment and Surface Treatment

Heat treatment of iron and steel is not widely performed except by blacksmiths, although the quality of some products could be improved by quenching and some others by stress relief annealing. The situation seems to be due to the lack of the quality consciousness of the manufacturers as well as of the consumers, coupled with the difficulty in obtaining proper materials which have good heat treatment characteristics.

4.1.2 Quality of Products

(1) Hand and Animal-drawn Agricultural Tools and Implements

Products classified under this heading are hand hoe, spade, plough, sickle etc.. The important function of these products is cutting capability similar to that of cutlery. As sickles are used for cutting herbaceous plants, hand hoe, and spade plough are used for 'cutting' clods of earth. The products currently used in the Country are, however, not designed and produced properly for these purposes.

Prerequisites for a good cutlery are;

i) it cuts clean,

ii) the sharpness of the blade lasts long,

iii) it is designed for use under certain given conditions (the nature of farming operation to be used for, the nature of soil to work with, etc.) and

iv) it has long service life.

The prerequisites iii) and iv) in the above are the questions of designing more appropriate tools and implements and the agricultural research institutions are expected to develop improved design (see 3.3.1). The prerequisites i) and ii) are the questions of production technology and the quality of the products produced in the Country is evaluated inferior from these standpoints.

To cut clean, the blade should be sharpened. But hardly no whetting operation is performed by the manufacturers of these products, whether by blacksmiths or by machine equipped factories. In fact, most of them do not have whetstones. If blades of these products are sharpened by a whetstone, they will cut much more cleaner. Whether such cutting quality lasts long is another question, the prerequisite ii) in the above.

One way of knowing the quality in the light of the prerequisite ii) is to examine the metallurgical property of the blade. The Team asked a metallurgical testing laboratory in Japan to conduct a test on sickles made in Bangladesh. The results of the tests are shown in Table 4.1.2. One sickle made by a blacksmith in Bogra, the test piece No.1, is concluded to be of the highest quality which can possibly be attained with the material usually available to local blacksmiths. Another sickle made by a blacksmith in Joydebpur, the test piece No.3, is much inferior and cannot be regarded as cutlery.

Although the number of test pieces is very small the test seems to have identified sickles of the highest and the lowest quality available in the Country. Perhaps the quality of sickles made by other blacksmiths falls between these two extremes although the production process may be seemingly similar to that of the test piece No.1.

The quality of spades made by modern factories will not be comparable to sickles of higher quality described above since the material is steel of low carbon content and heat treatment is not performed.

Technological conditions to be met in order to manufacture blades of good cutlery are as follows;

- the use of right materials (the use of materials of uncertain origins should be avoided),
- employing appropriate forging process according to the specifications of the product and the quality of the material,
- applying proper heat treatment according to the quality of the material and the purpose of final use of the product, and

- sharpening the edge of the blade to the right angle and dimensions.

The difficulty in obtaining desired materials is one of the most serious problems industries in Bangladesh are faced with and will be discussed later in 4.2. The forgeweld technique described in 4.4.1 is worthy of attention in this respect since it can economize the use of high quality steel as well as it ensures the extra robustness of the product.

(2) Simple Agricultural Machinery

The following paragraphs deal with the quality of hand-pushed weeders and pedal threshers. Although the Team observed these products of very unsatisfactory quality produced by a factory in Dacca, there are a number of other factories whose products are of better quality. But there is much room for improvement in those products in order to ensure reasonable performance and durability.

Sliding plates of the weeders can be modified in size and shape so that they can be more easily operated in the paddy field in Bangladesh. It has been observed that the sliding plate tends to go too deep in the mud to such an extent that two persons are needed to operate a weeder, one pushing and the other pulling with a rope. Adjustment mechanism of the sliding plate should also be modified.

In order to stand the excessive force imposed on the cultivator sweep due to such tough use, the cultivator sweeps are made of extra thick steel plate and do not fit closely to the hexagonal bar. They are joined to the shaft by welding but since the hexagonal bar is made of cast iron, a material of low weldability, they come off quite easily. Rivetting of the sweeps are not properly made and cannot stand the force imposed on them. Wood for the handle is not dried sufficiently causing deformation of the handle.

Shortcomings of the pedal threshers are as follows:

- Threshing teeth are drived into the tooth holder by hand loosely. Thus they come off easily.
- The threshing tooth holders and the threshing drum side plate are assembled loosely. Again the durability cannot be guaranteed.

- The threshing drum is not balanced and vibrates excessively when it rotates.
- The shaft of the threshing drum and ball bearings are not fit properly. Thus the smooth rotation and durability cannot be guaranteed.
- Surface of gears is rough and causes unstable rotation.
- Since a return spring is not installed to the foot pedal, kicking action of the foot pedal could hurt the operator.
- As the threshing drum is not covered by outer shield, grains scatter away.

(3) Hand Pumps and Centrifugal Pumps

Major components of hand pumps and centrifugal pumps are made of cast iron. Due to the inferior casting technology described earlier in 4.1.1, these components are of the sub-standard quality. Besides, following shortcomings are pointed out.

Water discharge of hand pumps is not in proportion to long and heavy strokes of the handle. This indicates that the mechanical efficiency of the pump is low. The efficiency could be substantially raised by making appropriate improvements in the quality of cast iron, surface roughness and tolerance of the piston and cylinder, design of mechanical links, prevention of leakage and assembly operations.

With regard to the quality of centrifugal pumps following are major shortcomings:

- The surface of components are very rough due to improper casting operations and little finishing work. Thus the efficiency and discharge capacity of the pump would be much lower than those engineered properly.
- No care is taken at all to ensure that the impeller is dynamically balanced. Thus the durability of the pump can not be guaranteed.
- Each unit of the pump is assembled by making some adjustments to components individually. Thus the inter-changeability of components is lost making the repair and maintenance difficult, if not impossible.

(4) Bicycle, Rickshaw and Carts

From the standpoint of the safety of passengers, the design and specifications of various components of bicycle and rickshaws need modifications. Particular care should be taken in the design and specifications of hub-body, hub-spindle, rim and spoke for rear wheel. At present, these components are made according to same specifications whether the bicycle is used for carrying light or heavy loads. And the strength and the rigidity of the body frame and wheel are not high enough to guarantee the safety of traffic when used for rickshaws which sometimes carry more than 200 Kg.

The quality of many components should be improved so as to compete with imported bicycles. Production system is also to be streamlined in order to decrease the price. Specialization of firms in certain line of components is to be encouraged for this purpose.

A variety of hand- and animal-drawn carts is found in Bangladesh. While there is a keen interest in developing new transport equipment to replace these and other conventional means of transportation, there is an ample room for improvement in the carts of conventional model. Those made of wood tend to be built robustly at the expence of excessive dead weight. They could be made lighter in weight (thus saving material used and power needed for moving) by reinforcing certain important parts, such as use of metal wheel and rubber tire, use of metal bearing on the shaft, use of metal reinforcements on joints of various components, etc.

4.2 MARKETING AND DISTRIBUTION CHANNELS

The terms "Marketing" is defined in its broad sense as the economic process which encompasses all those activities and institutions responsible for the exchange of goods and services. Therefore, the producer has to establish the marketing strategies from two angles; that is, (a) selection of specific consumer groups, and (b) the actual marketing techniques such as product planning, pricing, branding, channels of distribution, individual sales, advertising, promotions, packaging, display, servicing and physical handling.

In the small scale industrial sector of Bangladesh, however, the marketing is the most neglected areas in the industrial activities. This is particulary true for the locally manufactured products.

The industrial manufacturers usually pay attention only to raw materials procurement and product manufacturing itself, paying seldom attention to product sales. This is due to the fact that the seller's market has been prevailing in the economy for a long time. Industrial products can, almost regardless of their quality and price, find their customers quite easily. Consequently, the manufacturers do not have any intention or motivation to confirm the customers' expectations and needs.

The above is the general tendency and problematic fact in the field of marketing in Bangladesh. This can be more true in the sub-sector of the small scale industry where the industrial unit is relatively immature in the production operation, than in the medium and large scale industrial sub-sectors.

4.2.1 Assessment of Purchasing Power

In order to fulfil one of the top priority objectives of the Second Five Year Plan; namely, the rural development, a series of inter-related activities have to be strengthened. To be more precise, the agricultural production has to be increased through rural industrialization. Then, for the successful implementation of the rural industrialization, the demand for agro-related industrial products has to be secured through raising the purchasing power of rural population. Assessment of the purchasing power would perhaps facilitate to visualize the present potential scope of

the agro-industrialization, in the short run, and accordingly of the rural development.

Since there do not exist any statistics on recent household expenditure in Bangladesh, it is almost an impossible task to calculate the individual disposable income on agro-industrial products. However, it is possible to estimate how much of cash a village farmer can afford to spend on agricultural implements and tools by (1) investigating presently owned agricultural implements and machines and their values (or prices), (2) identifying annual cash income of an average rural farmer and (3) drawing reasonable conclusion on the purchasing power upon cross-checking (1) and (2).

(1) Agricultural Implements Presently Owned by a Farmer

There exist more than two dozen kinds of agricultural implements and machines presently in use and in potential use in Bangladesh. They are, centrifugal pumps, hand pumps, diaphram pumps, ploughs, weeders, winnowers, seed drills, hand hoes, doons, paddy dryers, rice hullers, oil expellers, sprayers, rakes, seed treaters, cane crushers, paddy threshers, power-tillers, tractors and so on. In the traditional farming, however, most of these implements and machines are not used. Rural farmers, instead, use a limited number of traditional and simple implements such as (1) the bullock-driven plough (Larghal with Fal, Tk. 250/-), (2) the clod crusher (Mai, Tk. 60/-), (3) the spade (Kodal, Tk. 40/-), (4) the sickle (Kachi, Tk. 3/-), (5) the knife (Dha, Tk. 15/-), (6) the earth softener (Achra, Tk. 200/-), (7) the rake (Narani/Pachun, Tk. 5/-), (8) the iron bar (Shabol, Tk. 150/-), (9) the irrigation basket (Seni), and (10) the irrigation boat (Donga).

These agricultural implements are owned by every single landowner/farmer in Bangladesh without exception. And most of them are manually operated and some of them are bullock-driven. They usually last for several years, and most of repairing is done by the farmer himself, by a village blacksmith unit, by a rural carpentry shop or very rarely by a small MW/LE workshop in a nearby township.

The total value (or price) of 10 items listed above reaches to an amount of approximately Tk. 1,000/- on an average. There is, of course, slight over-

estimation in this figure since a large number of various types of pumps (more than 60,000 units of LLPs, STWs and DTWs and approximately 450,000 units of hand pumps) are either rented or owned by rural farmers. If these implements (except pumps and other agricultural machines) are assumed to be replaced after 5 years, a farmer's annual expenditure on agricultural farm implements will be Tk. 200/-. This amount will definately form a part of the farmer's annual cash income.

(2) Annual Cash Income of an Average Rural Farmer

Ideally, the annual cash income in terms of per farmer or aggregation should be calculated from the farmer's household expenditure survey. However, as the latest survey data are not available in Bangladesh, it can only be possible to obtain it through the interview survey and other published statistics.

During the Team's field study, the Team visited Debidwar, located some 30 km away to the north-west of Comilla, where some farmers as well as the manager of the Thana Workshop-cum-Training Center were interviewed on their agricultural activities. It was revealed that a farmer with 2 to 3 acres of land in the area of Debidwar can earn an annual cash income of Tk. 1,500/- to Tk. 2,000/-. In view that Debidwar is not necessarily a rich farming area, these figures may be regarded quite conservative and moderate. Needless to state, the cash income is the farmer's disposable income as his family lives mostly a subsistence life. It may be argued that the per capita income, Tk. 1,649/- in 1978/79*, is a reliable indicator of the average people's purchasing power. Although this is partly true, it is almost impossible to trace a farmer's cash income. Nevertheless, let us estimate the per capita cash income for reference by laying the following simple assumptions. (* This is reported on the Bangladesh Observer on March 7, 1980.)

- A rural household consists of 6 people on an average.
- The subsistence sector shares 80% of the farmer's economic values produced.

Then, the farmer earns Tk. 9,894/- (Tk. 1,649 x 6) through their agricultural activities per annum in terms of money on an average. Out of this, the farmer can only earn the annual cash income of 20% of Tk. 9,894/-, namely Tk. 1,979/-.

Though this last figure is very rough and requires quite a number of qualifications, it roughly corresponds to the figures obtained from the interview survey.

Thus, the rural farmer seems to have been spending some 10% of his total annual cash income, ranging Tk. 150/- to Tk. 200/- in real terms. It can, then, be said that the purchasing power of the rural farmer is at the present very much limited. In manufacturing and marketing agricultural metal working and light engineering products, the above discussion has to be always kept in mind.

4.2.2 Marketing and Distribution of Metal Working and Light Engineering (MW/LE) Industrial Products

(1) Metal Working and Light Engineering

The Team's field study revealed that MW/LE industries produced two types of outputs. One is repairing services for various kinds of machines and equipment already in use such as cars, trucks, tractors, power tillers, diesel engines, rice and flour mills, sugar cane crushers, pumps and so on. The other is production of parts, semi-finished goods and finished goods.

For the purpose of marketing, it is usually the case to deal with the latter type of output, particularly, the finished goods. Finished products of MW/LE industries vary from one to another depending on the characteristics of the industiral unit. These products can, then, be divided into four groups for the purpose of clearer classification; (1) Agricultural Implements and Machinery, (2) Transport Equipment, (3) Construction & Building Products and (4) Other Products. The representative product list of each group is shown in Table 4.2.1.

Because of the similarity of marketing for most of the locally manufactured finished goods by MW/LE industries, the first two groups are characteristically investigated.

Table 4.2.1 Products by Group

Group	Products	
Group 1	1. Hand Pump	9. Hand Hoe
Agriculture MW/LE Products	2. Centrifugal Pump	10. Spade
	3. Plough	11. Sickle
	4. Weeder	12. Rake
	5. Winnower	13. Sugar Cane Crusher
	6. Seed Drill	14. Rice Mill
	7. Paddy Thresher	15. Flour Mill
	8. Paddy Dryer	16. Oil Expeller
Group 2	1. Bicycle	
Transport Products	2. Rickshaw	
	3. Metal Carts	
Group 3	1. Sanitary Pipes & Fittings	
Construction &	2. Manhole Cover	
Building Products	3. Valve	
	4. Gate	
	5. Window Grill	
	6. Furniture & Fixture	
Group 4	1. Bolt & Nut	
Other Products	2. Nail	
	3. Drilling Machine	
	4. Lathe	

Source : JICA Team

(2) Marketing and Distribution Practices

a) Agricultural Implements and Machinery

It has been made clear that rural farmers use only the traditional and simple agricultural implements for farming. This fact indicates that most of the farmers have never come across the relatively modern agricultural implements and machines, or even if they happened to know them, they could not convince themselves its usefulness and efficiency to introduce them to their farming.

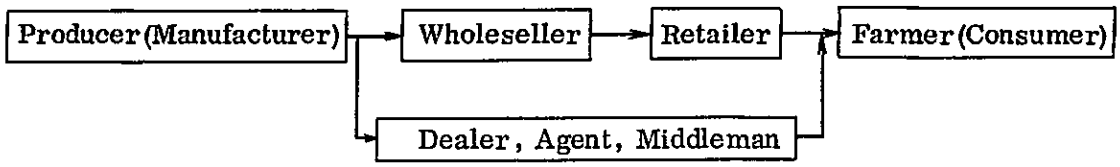
In a limited number of areas, however, a very simple agricultural mechanization is under way. The most representative area is Comilla, where the Comilla Cooperative Karkhana Ltd. and the Bangladesh Academy for Rural Development (BARD) jointly played an important role in agricultural farming mechanization and modernization. One of the typical examples is the paddy weeder. The Karkhana Cooperative Ltd. has been producing the weeders for a decade or so, whose promotion and extension was well facilitated by the agricultural extension workers of BARD. At the present, the weeders turned out to be one of the readily-owned agricultural implements among Comilla farmers. Although the Karkhana Cooperative Ltd. is the main supplier of the weeders in Comilla, there already exist almost a dozen of Karkhana spin-out small manufacturers in the town. The production of the weeders is, then, estimated at more than 5,000 per annum in 1979-80 from the production record of the Karkhana Cooperative Ltd. For other simple agricultural implements and machines such as the pedal threshers, the seed drills, the winnowers and the hand hoes, the similar phenomena, though to a lesser extent, are prevailing in this area.

b) Pumps

The Team undertook a field study to rural townships of Comilla, Chandpur, Kushtia, Bogra and Joydepur (in addition to Dacca city and the city of Chittagong), and found that in the rural township there are quite a limited number of hardware stores where some of the agricultural implements and machines are sold.

The typical items are like hand pumps and their fittings, and spades. The other relatively modern and sophisticated agricultural implements and machines are hardly found in these stores. The implication of this phenomenon is that most of these items do not have enough demand and, therefore, not manufactured readily and are not used in rural farming. Thus, there is no market distribution channels which are often shown in a very simple formula as follows:

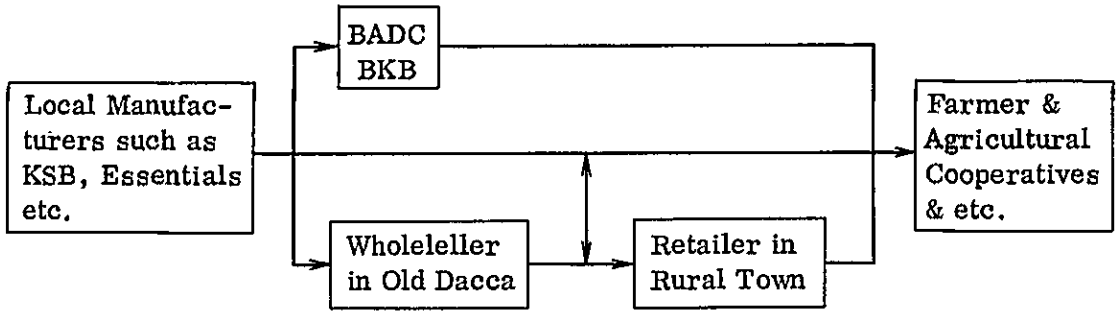
Figure 4.2.1 Typical Distribution Routes of Agricultural Hardwares



Source : JICA Team

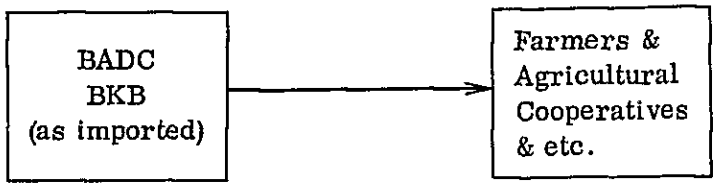
Thus, so far as most of the agricultural implements and machines are concerned, they are usually sold directly from manufacturers to farmers. However, there are some exceptions in this usual and ordinary practice. The centrifugal pumps, both imported and locally manufactured, are marketed usually on a distribution channels as follows:

Figure 4.2.2 Locally Manufactured Pump



Source : JICA Team

Figure 4.2.3 Imported Pump



Source : JICA Team

These two figures are obviously representative cases. And when the pumps are sold, they have to mostly be accompanied by diesel engines, the tubes and strainers and other fittings as the tubewell sets unless they are the replacement of the pumps themselves.

The locally manufactured pumps are mainly supplied to the public corporations and the particular Ministries which require pumps for some specific projects, and partly marketed through a private channels. Wholesalers of the pumps are usually located at old Dacca and retailers who labour to travel to Dacca to purchase a very small quantity (say, several) of the pumps have their shops in rural towns. Another distribution channel is formed as a direct channel between purchasers and rural pump manufacturing industrial units. It is observed, during Team's field survey, that there always exist one or two industrial units with a foundry workshop and a light engineering workshop, where the pumps are manufactured to satisfy a part of the rural pump demand.

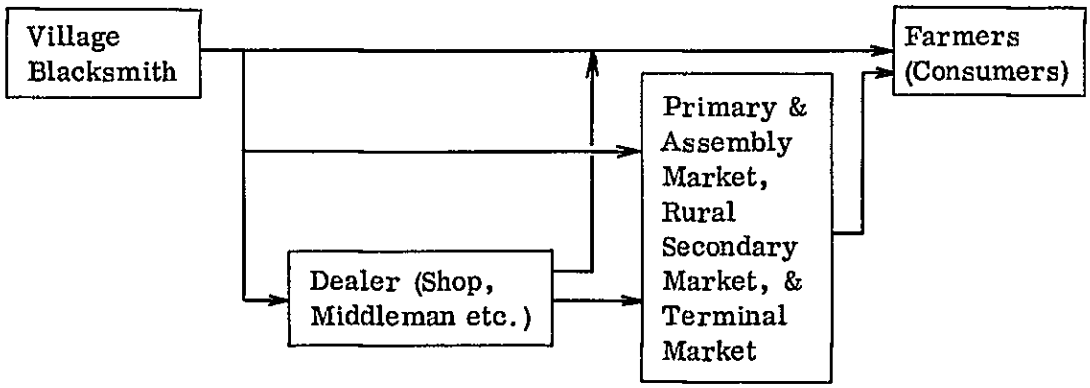
The distribution channel of the imported pump is usually very simple as shown above. This is because the pump importation is usually done for public procurement. As in the main case of the locally manufactured pumps the pumps for public procurement are distributed to farmers and agricultural cooperatives with some subsidy and special financial arrangements. In fact, BADC has a relatively long history of rental scheme of the tubewell set and BKB has recently started to intensify to give a relaxed loan to an individual farmer. These positive arrangements of the Governmental institutions are expected to give substantial influence on modernization of the traditional farming and on agricultural productivity.

Marketing and distribution for some other items such as power tillers, tractors and hand pumps is also almost the same as the case of public procurement of the pumps mentioned above.

c) Blacksmith Products

Some consideration should be given to agricultural tools and implements provided by blacksmiths such as ploughs, spades, sickles, rakes and so on. In fact, the most of the traditional agricultural implements which are made of iron and steel are produced by village blacksmiths. This, in turn, implies that these products have a long established marketing channels, which are shown in the following figure:

Figure 4.2.4 Blacksmith Products Distribution



Source : JICA Team

The village blacksmiths sell his products to farmers in three ways: (a) directly to farmers at their workshops, (b) through open air markets by themselves and (c) through dealers.

The Figure shown before would explain the important position of the open air market for distribution of agriculture tools and implements manufactured by village blacksmiths. Thus, it is quite understandable that the rural farmer can have an easy access to these agricultural items whenever needed. The relatively modern agricultural implements and machines obviously do not appear in these

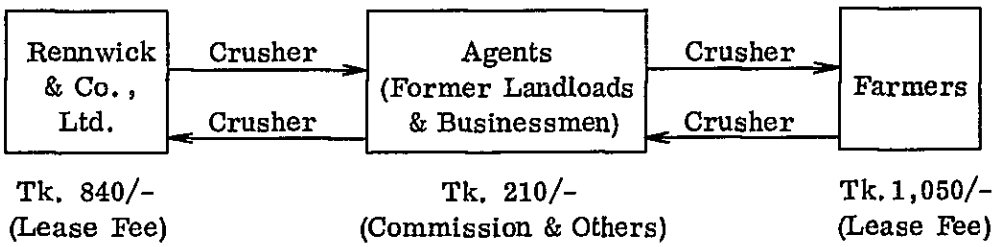
markets at any level except probably a very limited number of terminal markets where some permanent stalls are built.

b) Agro-Processing Machines

As a typical example of marketing agro-processing machines, the sugar cane crusher, which has long involved a very unique leasing system was selected. Although a large amount of sugar cane is processed at the large sugar mills operated under BSFIC, the rural farmers still engage widely in primitive sugar cane crushing (local crude sugar manufacturing) with the help of small crushing machine. To satisfy this local demand for the crushing machine, MW/LE industries in Kushtia are actively at work.

Rennwick & Co., Ltd. (BSFIC unit) has long been engaged in this product line and has an established leasing channel, which is shown in Figure 4.2.5 hereunder:

Figure 4.2.5 Leasing System of Cane Crusher



Source : JICA Team

Rennwick & Co., Ltd. leases out crushers to its 80 agents all over the Country and the agents hand over them to farmers obtaining 10% of the leasing fee as commission and the additional 10% as other incidental charges. As this leasing is undertaken seasonally, when the harvesting season is over, all the crushers are re-collected through the agents back to Rennwick & Co., Ltd. for repairing and re-conditioning.

Although Rennwick & Co., Ltd. has such a nation-wide operation leasing more than 9,000 units of crushers per year, most of the small MW/LE industries

in Kushtia does the same leasing business locally directly with farmers within their direct reach.

e) Transport Equipment

Transportation facilities in Bangladesh are not well developed by any standard. However, it is by no means so difficult to suffice a certain level of requirements for transportation facilities without changing their present conditions drastically, if various technical expertises are introduced and duly practiced.

There are a number of transportation modes in Bangladesh such (1) airplane, (2) train, (3) ship, (4) bus, (5) car, (6) truck, (7) jeep, (8) auto rickshaw, (9) ricksaw, (10) push cart, (11) horse cart, (12) bullock cart and (13) bicycle. The first eight are long distance transportation modes and the latter five are short distance transportation modes. The small scale MW/LE industries can take initiative in manufacturing and marketing the latter five transport equipment at present.

To view the important position of this unorganized road transport in the transportation sector, the related statistics are presented in Table 4.2.2. The figures in the Table may show how importantly these transport equipment are serving the people as an integral part of rural and urban lives by transporting passengers and cargo over a relatively short distance.

Table 4.2.2 Unorganized Road Transport

	1974/75	1975/76	1976/77	1977/78
Rickshaw	95,290	100,796	117,083	118,249
Push Cart	4,588	4,655	4,758	4,869
Horse Cart	1,096	1,283	1,470	1,131
Bullock Cart	87,200	88,500	89,200	89,800

Source : Bangladesh Bureau of Statistics, Statistical Year Book of Bangladesh 1979.

The manufacturers of these transport equipment vary substantially, depending on the characteristics of each kind of equipment. The rickshaw is usually manufactured by small rickshaw manufacturers which can be found one or two in any rural town of the country, in addition to a large number of rickshaw assemblers in old Dacca. The rickshaw industry is evidently very prosperous and, therefore, its production capacity is believed to be over 10,000 units per annum. Push carts, horse carts and bullock carts are manufactured by rural carpentry workshops and small scale MW/LE workshops. The rural carpentry workshops deal with most of their manufacturing work as the carts are mostly made of wood and bamboo, while the MW/LE workshops manufacture iron and steel parts of the carts such as the frame, the wheel, the wheel ring, the shaft and bearing, and so on.

The marketing practices of these transport items except bicycle, which are mostly mass-produced, are more or less the same. As there are no established markets which can consume a large number of these carts, no mass-production is taken place and, therefore, a manufacturing or an assembling unit usually produces them on an order basis. It is, thus, a common practice that a customer (or a user) places an order by approaching a manufacturer, and the manufacturer sells a transport cart directly to the customer at the factory when it is completed. There is, in fact, not much room for marketing efforts in its modern sense.

As for the bicycle, the situation is entirely different. The long established M/S Bangladesh Cycle Industries Ltd. assembles 25,000 bicycles per year with more than 90% of parts production supply by itself and conducts marketing through its sales agents throughout the Country. This company, before its nationalization, had a sole agent who paid the security deposit of Tk. 4,000/- and held exclusive rights to sell all the bicycles to the customer. After the company was nationalized, it opened a door to prominent wholesale and retail businessmen of the Country to become its sales agents with the security deposit of Tk. 2,000/-. Presently the company has 157 appointed sales agents all over Bangladesh. Although the sales network is already well-established, the number of sales agents is expected to increase up to 200 in a few years.