

STUDY ON THE TECHNOLOGICAL NEEDS FOR THE WORKERS OF
SMALL AND MEDIUM SCALE METAL WORKING WORKSHOPS IN THE
FIELD OF PRODUCTION OF AGRI SUPPORTING IMPLEMENTS IN
BANGLADESH

A PROJECT THESIS

BY

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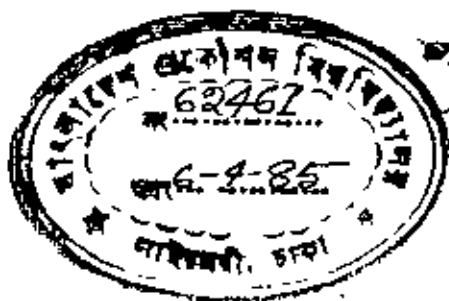
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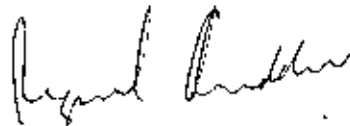
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(A.S.M. Rezaul Quddus)

ABSTRACT

Agricultural crop production is one of the most vital sector of our economy. Increased production of agricultural crops can be attained through efficient management of agricultural production system with constant and regular inputs in various forms. Agricultural implements are one of the factors that are absolutely necessary and are contributing to the crop production. Introduction of better implements will contribute to increased productivity and will require introduction of upto date production facilities together with know-how of the workers.

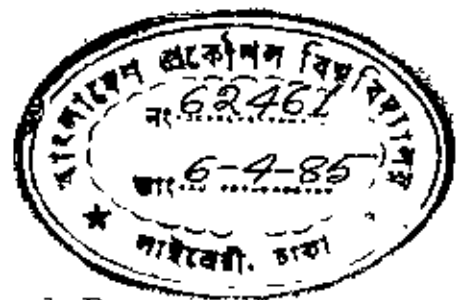
In this study different agricultural implements for crop production and their production processes have been listed. The present state of technique know-how together with the necessary technological needs of the workers have been identified.

LIST OF ABBREVIATIONS

ADP	Annual Development Programme
AUDP	Annual Upazilla Development Programme
BAU	Bangladesh Agricultural University
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BSCIC	Bangladesh Small & Cottage Industries Corporation
BSEC	Bangladesh Steel & Engineering Corporation
BITAC	Bangladesh Industrial & Technical Assistance Centre
BMTF	Bangladesh Machine Tools Factory
BWDB	Bangladesh Water Development Board
BUET	Bangladesh University of Engineering & Technology
CKD	Completely Knocked Down
DTW	Deep Tube Well
FFYP	First Five Year Plan
GDP	Gross Domestic Product
GEC	General Electric Company
IRRI	International Rice Research Institute
JICA	Japan International Cooperation Agency
IPE	Industrial & Production Engineering
LLP	Low Lift Pump
SFYP	Second Five Year Plan
SKD	Semi Knocked Down
STW	Shallow Tube Well

CHAPTER - 1

INTRODUCTION



1.1 Impact of Agriculture on National Economy:

The importance of agriculture can hardly be over emphasised in the economy of Bangladesh. During the financial year 1982-83, about 45.7% of the total GDP was from this sector and the value added from agriculture during the above year stood to the tune of 13553 crore taka. Agricultural product processing contributed to about 40% of the gross value of total industrial production(1).

Agriculture utilized 13.7 million people i.e. 83.3% of the total economically active population in 1982-83 and was the most important sector of our economy, constituting 46% of the GDP in 1981-82 when jute represented 51.1% of the nations total export for the year. The total export value for tea, jute and fishery was to the tune of Tk.1017.7 crore representing 82.15% of the total export for the same financial year. The import of food grain required Tk.1055.3 crore representing 85.15% and 29.68% of the total export and import value respectively for the year 1981-82. The annual growth in Agricultural sector in 1982-83 was 5.3% and that for crops was 5.5% for the same period.

Tk.3489 crore as A.D.P. expenditure for the year 1983 was allocated. 13.4% of the said amount had been allocated for agriculture. And another 13.5% of the amount had been allocated for flood control and water resources development purpose. The amount of money spent and allocated for agricultural flood control and

water development purpose in the first and second Five Year Plan (FFYP, SFYP) are given in the following tables (1)

	FFYP (Crore Tk)	Percentage	SFYP (Crore Tk)	Percentage
Agriculture	1086.91	27.63%	2149.00	13.38%
Flood Control & Water Resource	<u>1022.07</u>	<u>25.98%</u>	<u>2202.00</u>	<u>13.71</u>
Total Budget	3932.66		16060.00	

Development expenditures of the Govt. in agricultural sector for the year 83-84 was 13.49% and that for flood control and water resource development purpose was 13.50% of the total Tk.3488.9 crore.

As regard to the human resources, 133 lacs people are at present engaged in agricultural works. By the year 2000, it has been forecasted that the total available working force would be around 439.21 lacs, a majority of which will be employed in the agricultural sector.

In the case of land utilization about 60.07% of the total area 3,53,08,000 acres representing 74.24% of the total cultivable land were cultivated in the year 81-82. The average intensity of cultivation for the same year was 1.54 (Intensity of cultivation is the total sum of area of land cultivated throughout year divided by the net area).

493 Upazillas are now emerging as the basic unit of local level planning in the country. A sum of 425 crores taka has been allocated for infrastructure development at the Upazillas during the remaining years of SFYP after the creation of the Upazillas. During 82-83 a sum of 130 crores taka was spent on infrastructure works. For the year 83-84, an allocation of 172 crore taka more have been made for the same purpose. In addition another 167 crore taka will be spent for productive programmes like expansion and development of Irrigation facilities small drainage and flood control projects. Food for Work projects will contribute another 202 crore taka in Annual Upazilla Development Programme (AUDP) during 1983-84.

The Upazilla Parishad will prepare the AUDP patterned after the ADP at national level. Agriculture, Irrigation and Industry will receive major share of 30 to 40 percent of the total allocation. The parishads will undertake projects that are quick yielding and immediately productive in nature and completable within 2 years of commencement. As regards total cost of single project, financial ceiling have been fixed at Tk. 25 lacs. for construction projects with allowable adjustments for inflation and price changes.

We have already seen that 85% of our total export earning were spent for import of Food Grains in 81-82. It is felt and the Govt. has accordingly attached prime importance for increased production in this vitally important sector. The increase in the activities for increased agricultural production will generate

further employment. There remains bright prospect for increased production by the use of modern scientific method of cultivation tools, implements technology and other desired inputs in time.

1.2 Relevance of the Study in the Context of Need of Industry

The agricultural products have four distinct phases, namely production, processing, & preservation and consumption. The production of agricultural products namely crops require land preparation, plantation, irrigation, crop protection and harvesting. The processing and preservation of crops beginning with the transportation from the fields and subsequently stored in small quantities in every household of the villages. Later on some of the crops are processed locally for local consumption and the rest are transported to bigger industries through some marketing networks for further processing & storage in a mass scale. And from the above industries, some of processed products, like, rice oils, pulses and others are transported & distributed through different channels to the consumers.

After the liberation war the different Governments had attached prime importance for increased production in the agricultural sector. The economy of production, processing, and consumption of agricultural crops depend on efficient and effective management of the respective sectors and this in turn requires continuous Research & Development activities to introduce increased production and management methods. Researches for increased production are being carried out in different fields like, Genetics, Fertilizer, Irrigation, crop protection, farming by mechanical means and modern methods etc. by different institutions

like Bangladesh Agriculture Research Councils (BARC) and others.

Various inputs like numerous irrigation pumps, large irrigation projects, high yielding varieties of seeds, pesticides, fertilizers, modern production technology for increased production and so many others are regularly being introduced through different organizations, institutions and their network of branches to the root levels through out the country, involving a huge sum of money.

Tools, equipments, accessories etc. are required at different stages of production of agricultural crops. (Agricultural products include varieties of products like food grains pulses, oilseeds, vegetables, fruits, fishery, livestock, dairy, tobacco, tea, sugarcane, jute, cotton. (For this study we will restrict ourselves to the study related to the production of those crops, that are seasonally planted and harvested and are produced in large scale throughout the country and we will here after call them as agricultural crops for the purpose of our study).

Different type tools, equipments and mechanical means are required at different stages of production of crops like, land preparation, plantation, irrigation, crop protection harvesting, transportation. The variety of tools, equipments also sometimes vary depending on the types of crops being produced.

The traditional system of farming is at present in a very primitive stage in our country using manual and animal labour as the main source of power and with the very primitive, low yield tools as the main working tools. Till today the centuries old tools and methods are mostly used throughout the country. Mechanization of farming systems, use of better hand tools, and other simple mechanical equipments for production and initial processing of the crops, appropriate mechanical transports, storing & preservation systems have a great many things to do in the field of development of Agroecconomy of our country.

At present the availability of animal power is gradually reducing and it has become costlier. As regards to the manual power, the cost factor is being seriously counted ^{for} by the farmers. Also with the increase of total production volume and more acreage in production farmers are looking forward for high productive tools, equipments & methods. Considering high productive rate and other economic factors it is observed that our farmers are now ready to change over to the modern technologies leaving behind the centuries old practices.

In order to provide simple and high productive, durable, cheaper tools and equipments small & medium scale metal working workshops can play a very vital role. Agricultural tools as used at present, extensively throughout the country are made by cottage industries. With the increase in demand for agriculture

tools, equipments, accessories etc. demand for technological support in the form of technical know-how, workshop facilities, machinery and equipments, at the village level or at the Upazilla level is also increasing. These new workshops and those already working in the field, will in the near future, play every important role by providing a total technological support and a base for future development in the fields production of simple agro based & Agro supporting tools and equipments in the country. If properly planned, equipped and manned these workshops will introduce better equipments, tools and production process by adopting appropriate technologies in the agricultural sector by way of innovation and creativity.

Amongst many of the inputs for these small and medium scale metal working workshops manpower deserves for special consideration. For efficient running of these workshops, innovation and creativity, a stream of well trained, skilled, and educated manpower who have mastered their trade will be necessary. Keeping this view in mind this study on the Technological Inputs for human resources in this particular sector of agricultural production have been undertaken.

1.3 Literature Survey:

Studies on different aspects of metalworking industries in Bangladesh are very limited. Different organizations and institutions carried out some studies mainly on production

facilities and problems faced by these workshops. None of them quantified the technological needs of the workers of the metal working industries, specially for production of agricultural implements.

Hug, Rafique and K. I. Askar (2) surveyed 56 number of metal working workshops around Dhaka, of which 2 shops for electroplating, 3 for Die making and the rest for mechanical manufacturing and repair works. The findings of their study showed the income distribution, educational background, age and experience of the workers.

A sample study by Azim (3) on 81 Wayside mechanical, electrical, refrigeration and electronic engineering workshops of Dhaka revealed the educational background and experience of the workers as well as the capital investments. It was concluded that the wayside engineering workshops, in respect of man power training contributed more, than the big industrial organisations. It was also revealed that the income of workers increase with experience and know-how of the workers.

Hossain, et al, (4) studied the state of spare parts manufacturing by the Metal Working Workshops. They identified the spare parts being manufactured in different workshops and the various production constraints.

Technonet Asia, JICA and others(5) surveyed 346 small and medium scale metal working workshops in Dhaka, Comilla and Chittagong zones with a preset questionnaire. The study team obtained information and data regarding structural characteristics of products, productions, and the problems faced by these workshops. Various aspects of the industry like personnel, sales and marketing, manufacturing, technical, purchasing, financial etc. were discussed in considerable details. The survey findings revealed that low specialization ratio (carrying of multiple processes and product lines) and insufficient subcontracting exchanges were two major obstacles for economic production and quality products. The study ended up with specific recommendations to solve personnel, infrastructural, industrial engineering, marketing and other problems. A number of new project proposals in brief for promotion of specialization and subcontracting in metal working industries, recycling of scrap materials, modernization scheme for industries, training for entrepreneurship and industrial extension officers, plan for establishment of common facilities, workshops and management/skills development training centers have been drawn up.

JICA(6) in a separate study on small scale industries, surveyed some metal working workshops, taken as samples, of the four sub-divisions - Chandpur, Joydevpur, Kushtia and Bogra. The study with the different aspects and potentials of small scale metal working workshop development in the subsectors of

Agrobased and Agro supporting industries metal working and light engineering work shops. The study draw attention to poor quality and low specialization in respect of the different processes of the workshops. The study identified the problems in financial, raw materials, marketing, technological aspects of the industry and made specific recommendations to overcome these problems. In respect of technology the study emphasized to extend intensive activities and efforts to consolidate "Production Technology Development" by either/both strengthening the existing facilities and establishing new organization (Production Technology Development Center, PTDC) solely devoted to this purpose. The proposed PTDC will be engaged in (i) Production Demonstration (ii) Technical Training (iii) Technical Consultation and Extension (iv) Research and Development (v) Supply of special parts.

In order to ascertain the manufacturing capability within the country in the private sector for production of simple agricultural tools and implements Appropriate Technology Cell of BARC(4) conducted a survey in 1980. Altogether 97 workshops were surveyed throughout the country. The products - both agricultural implements and industrial tools, equipments of the firms, available physical facilities of machinery and equipments, problems of the manpower etc. were listed. A consolidated list of machinery and equipments were provided as a reference for a standard workshop manufacturing agricultural implements. A number of workshops throughout the country were recommended as capable of manu-
facturing

ring agricultural implements, provided they fulfil certain prerequisites.

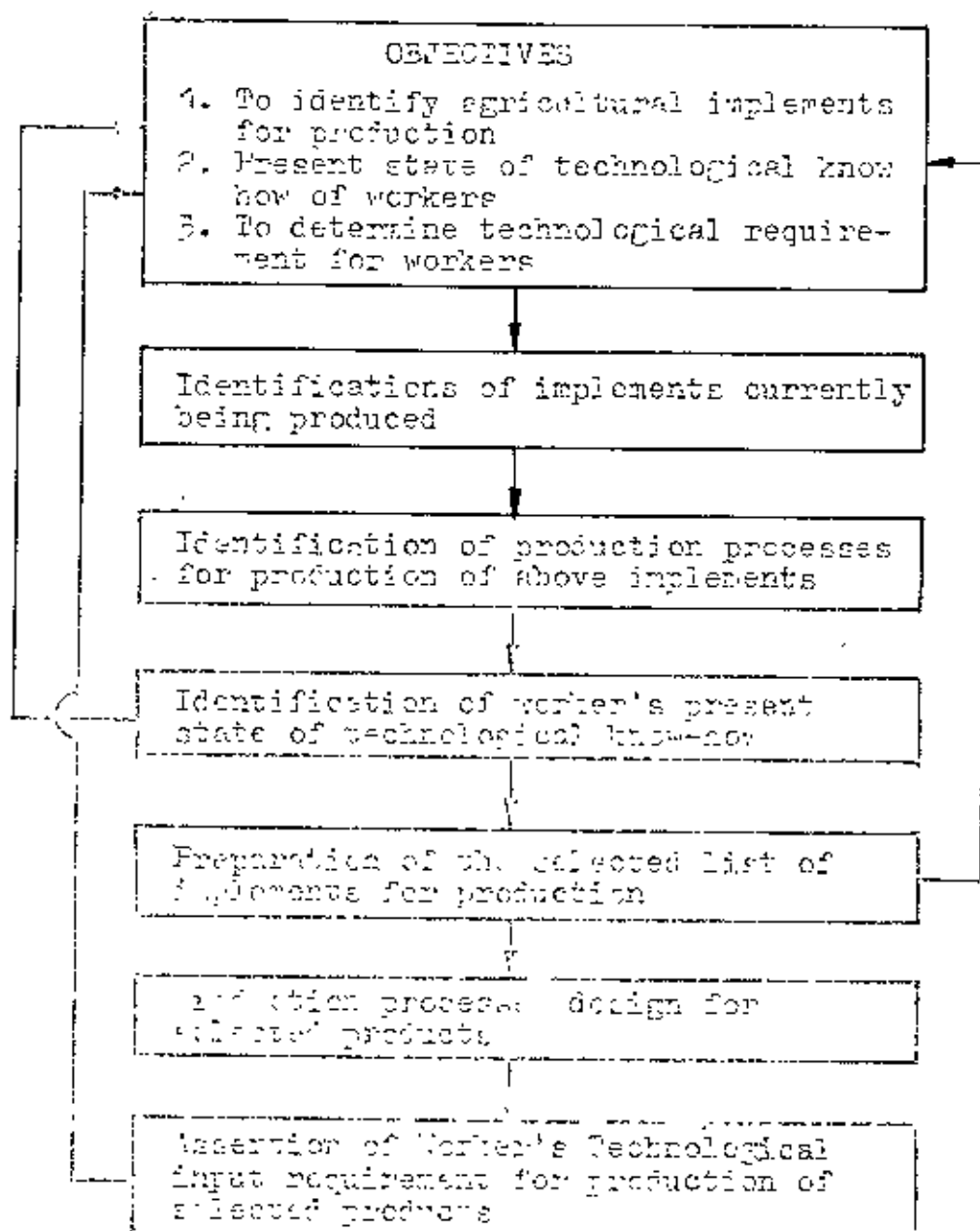
1.4 Objectives of the Study

In a developing country like ours, the contribution of small and medium scale metal working workshops in job creation, capital mobilization income distribution, in general the economic developing process is substantial. "It is recognized that human resources are the major instruments of all development. A number of empirical studies have also proved that a country's economic progress has been due, more to the knowledge and skill of the people than to the abundance of resources from nature". In view of the above observations the role of skilled, educated and trained workers in the metal working industries are of utmost importance. None of the several studies in the metal working sector carried in the past have focussed in depth to the development of human resources in this sector of metal working for production of Agricultural implements. Considering the importance and necessity of such studies the present work was undertaken with the aims -

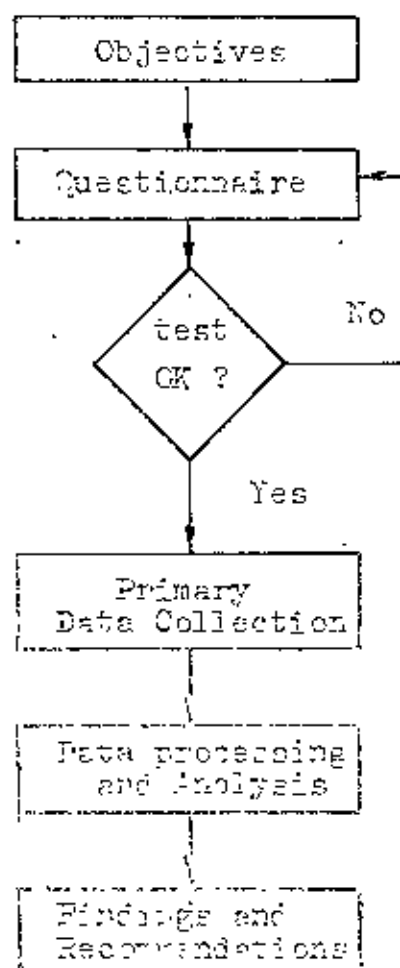
1. To identify the Agricultural Implements that are being manufactured in selected workshops in Bangladesh and the related manufacturing processes
2. To identify the present state of technological know-how of the workers engaged in these industries
3. To determine technological input requirements for the workers of this industry.

1.5 Research Methodology

The prime objective of this study is to find out the requirements of technological inputs for the worker of metal working industry, that will produce selected agricultural implements for local consumptions. In order to attain that objective the following steps and procedures were followed.



In order to identify the present agricultural implements and other metallic products being manufactured by these industries, the related manufacturing processes being followed and to identify the present state of technological know-how of the workers, survey techniques in generating the primary data from a sample of industries/workshops have been used.



The questionnaire (Annexure-1) was designed, keeping in view of the objectives. In order to get a clear picture of the metal working industry, a number of questions on problems relat-

ting technical and managerial aspects were included. The survey was limited to 33 workshops of Dhaka, Khulna, Bogra & Tongi Industrial Area. The selection of these workshops were randomly made. Regarding the choice of zones, discussions have been made in chapter 5, article 5.2 . The questionnaires were filled in after discussions with the workers, supervisors and managers of the workshops. The facilities of the workshops were in most cases physically inspected.

The information and data collected during survey were manually processed, analyzed and conclusion were drawn.

CHAPTER - 2

AGRICULTURAL IMPLEMENTS

2.1 Identification of Agricultural Implements that are Presently in Use in Bangladesh

Various kinds of agricultural tools, equipments and implements are currently in use in our country for land preparation, planting, transplanting, harvesting, irrigation, crop protection and for other related works. The names of different tools and equipments in use in different parts of the country for agricultural crop production are listed below.⁽⁹⁾ The name of the same equipment, tool varies from zone to zone with different local names

<u>Job</u>	<u>Method & implements</u>
Land Preparation	Plough (Nangal), Yoke (Joal), Alon Hoe (Kodal), Rail (Moi), Mallet, Basket, Tractor, Power Tiller etc.
Planting & Transplantation	By hand, Seed Drill
Weeding	Nirani, Hand Hoe (Anchra), Hand Pushed Weeder, Rake
Crop Protection:	From Pests- Knapsack sprayer
Flood -	By embankments and drainage system
Drought -	By different irrigation methods. Irrigation tools etc. and methods are - Swing Basket, Dose, Hand pump, Deep Tube well, Shallow Tube Well, engine/motor driver centrifugal pump, Large scale irrigation schemes etc.
Harvesting	Sickle, (Kaste), Curved Knife (Haisha),
Threshing	Hand Beating, Treading with cattle (Molan), Pedal Thresher

<u>Job</u>	<u>Method & implements</u>
Winnowing	Kula, Mechanical winnower
Drying	Sun drying, Dryers using kerosene as fuel
Par Boiling	Iron Pan, Deckchi
Husking	Dheki, Rice mill
Storage	Dole, Earthen Jar, Berr (Gola)
Transportation	Manually, Bullock cart, Push cart, Wheelabrow

Brief description and use of some of the above implements are given below.

PLUGH

Land preparation implement

Local name: Mangal

Power requirement: Two draft animals and a man

Usage: For ploughing and furrowing

Average working life: Half to one year

Output: 0.28 to 0.30 acre/day for single ploughing
(6 to 7 working hours)

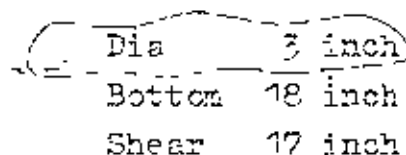
Season of use: Round the year

Depth of ploughing: 4 inch to 5 inch

Material: Wood and Mild Steel

Weight: 20 to 25 pounds

Dimension: Standard length - 30 inch



Shear width $7\frac{1}{2}$ inch

Manufacture: Local Blacksmiths

SPADE

Land preparation implements

Local name: Kodol

Power requirement: One man

Usage: For cutting earth, digging pits for sugarcane and potatoes, making drains, for removing weeds and grasses boundary preparation etc.

Average working life: 2 to 3 years

Materials: Mild Steel

Weight: 3.5 to 5 pounds

Dimension: Blade length-9" width-10" Handle-40"
Handle diameter 1.5"

YOKE

Land preparation implement used with plough

Local name: Joal

Power requirement: Two draft animals and one man

Usage: Used with the plough

Materials: Wood

LADDER

Land preparation and threshing works

Local name: Moi

Power requirement: Two draft animals and one man

Materials: Bamboo

Life: Half to one year

MALLET

Local name "Kurish"

Power requirement: One man

Usage: For crushing the soil clods

Materials: Wood

Output: 0.15 to 0.20 acre/day

Weight: 1 to 1.5 pounds

HAND HOE

Local name: Anchra

Power: One man

Usage: Intercultural operation tool
for weeding

Output: 0.15 to 0.26 acres/day

Material: Bamboo. Spikes - M.S.

SICKLE

Local name: Kanchi

Power requirement: One man

Usage: For harvesting paddy, wheat, jute etc.

Life: 2 to 3 years

Output: 0.06 to 0.08 acres/day

Materials: Blade M.S. handle - wood

Dimension: Length - 13", width - 1½ inch

Weight: 0.33 pounds

RAKE

Intercultural operation implement

Local name: Nangal/Bida

Power requirement: Two draft animals and a man

Life: 6 to 7 years

Material: Wood and M.S.

Usage: For weeding, mulching, and thinning of jute and Aus crop in early stage

CURVE KNIFE

Local name: Haisha

Power requirement: One man

Usage: For cutting sugarcane, grass, jute

Output: 0.15 to 0.20 acres/day

Life: 4 to 5 years

Material: M.S. and wood

Dimension: Length - 20", width - 2.5"

DHEYJ

Usage: Husking equipment

Power: 2 to 3 woman/man

Life: 30 years

Output: 140 to 160 pounds/day

PEDAL THRESHER

Mechanical Threshing equipment

Engineering Arrangement: Drawing no. 2.1

Output: Paddy more than 120 kg/hour

Wheat more than 75 kg/hour

Power: One or two men

Materials: Wood, Steel angle, Steel bar, Steel sheet, steel wire, ball bearing, cast iron etc.

WEEDER

Engineering arrangement: Drawing no. 2.2

Usage: Weeding grasses and other unwanted plants

Weight: 5 kg.

Output: 0.5 to 0.75 acre/day

Power: One man

Materials: Wood, steel plate, steel strip, bar, cast iron etc.

GRAIN DRYER

Engineering arrangement: Drawing no. 2.3

Usage: For drying food grains

Weight: 650 kg.

Fuel requirement: 4 litres of Kerosine per hour

Materials: Steel plate, wood, fan and kerosine burner set, paint etc.

2.2 Demand and Supply Position of Agricultural Implements

Most of the agricultural tools and implements at present in use are locally manufactured. For land preparation tractors and power tillers are rarely used. Tractors and power tillers were first introduced in our country for farming purpose in and around 1957. Tractor ploughing is five times faster and 30% cheaper than the traditional method of ploughing by local "Nangol" and bullocks. Besides a tractor can be used for many other purposes. Tractors can be rented and in off season it can

be used as a transporter. (a study by BARC)

Tractors are much in use in India. In 1966, about 20 lacs HP and in 1971 about 480 lacs HP of Tractor power were available for agricultural purpose. The ratio of man, animal labour to tractor power was about 50:50. In Phillipines power tillers are extensively used. Before and just after liberation war tractors and power tillers were imported from Soviet Russia and America. But for the problems of small holding, high fuel cost, lack in repair facilities, shortage and irregular supply of spare parts and other after sales services, high initial cost etc. the ^{use} of tractors and tillers for agricultural purpose did not become significant and now a days the import of the items have been discontinued.

At present the cost of labour and animal power has gone up considerably. At the same time the acreage under cultivation have exceeded by far any past record. With easy supply system of irrigation equipment the IRRI cultivation is now every common feature in the villages. Besides during 1969-70, cultivation of wheat was not as common as it is now a days. Thus the increase in the net cropped area and the intensity of cropping (Total cropped area divided by the net area sown throughout the year) has created demand for faster land preparation works. This trend in the increase of total cropped area and intensity of cropping is expected to continue for the years to come. Consequently the

Tractors and tillers with high capacity are expected to be in use or will have demand in the years to come. On the other

hand supply of electrical power to the rural areas has provided one of the major infrastructural support for establishment of small and medium scale workshops in the rural areas, which can provide technological backup supports for mechanized cultivation with tractors and power tillers.

Irrigation Pumps:

Deep tube wells, low lift pumps are now a days widely used in the villages. Small villages where as much as 6 numbers of shallow pumps driven by diesel engines or by electric motor are not rare in these days. Until now different types of pumps of different capacities are procured by different organizations like BADC, BKB, through local and foreign sources and distributed the same to farmers on soft terms and conditions. Till 1982-1983, different type and quantity of pumps operating under BADC and BKB are given below⁽¹¹⁾ -

	BADC (Nos.)	BKB (Nos.)
DTW	15,300	Not available
STW	78,700	More than 28000
LLP	39,000	Not available

Besides power pumps, hand sprayers for spraying pesticides are sometimes imported. The same type of sprayers are also used for spraying chemicals for killing mosquito larvae in anti malarial and anti mosquito drives in Municipal areas.

Agricultural tools etc. are at present manufactured according to the market demand throughout the country, mostly by cottage industries. The demand and supply position of many of the commonly used agricultural implements are shown in the following tables. (10)

Present Annual Demand for various Agricultural Implements

Item	Present demand	Present capacity	Present production
1. Weeder	50,000 pcs.	10,750 pcs.	14,286 pcs.
2. Paddy Thresher	50,000 pcs.	1,600 pcs.	3,902 pcs.
3. Seed Drill	180,000 pcs.	21,600 pcs.	34,464 pcs.
4. Hand Hoe	10,000 pcs.	Not available	Not available
5. Hand sprayer	50,000 pcs.	31,193 pcs.	27,580 pcs.
6. Kodali	75,000 doz.	13,490 doz.	17,675 doz.
7. Shovel	35,000 doz.	32,890 doz.	15,554 doz.
8. Belcha	5,000 doz.	Not available	Not available

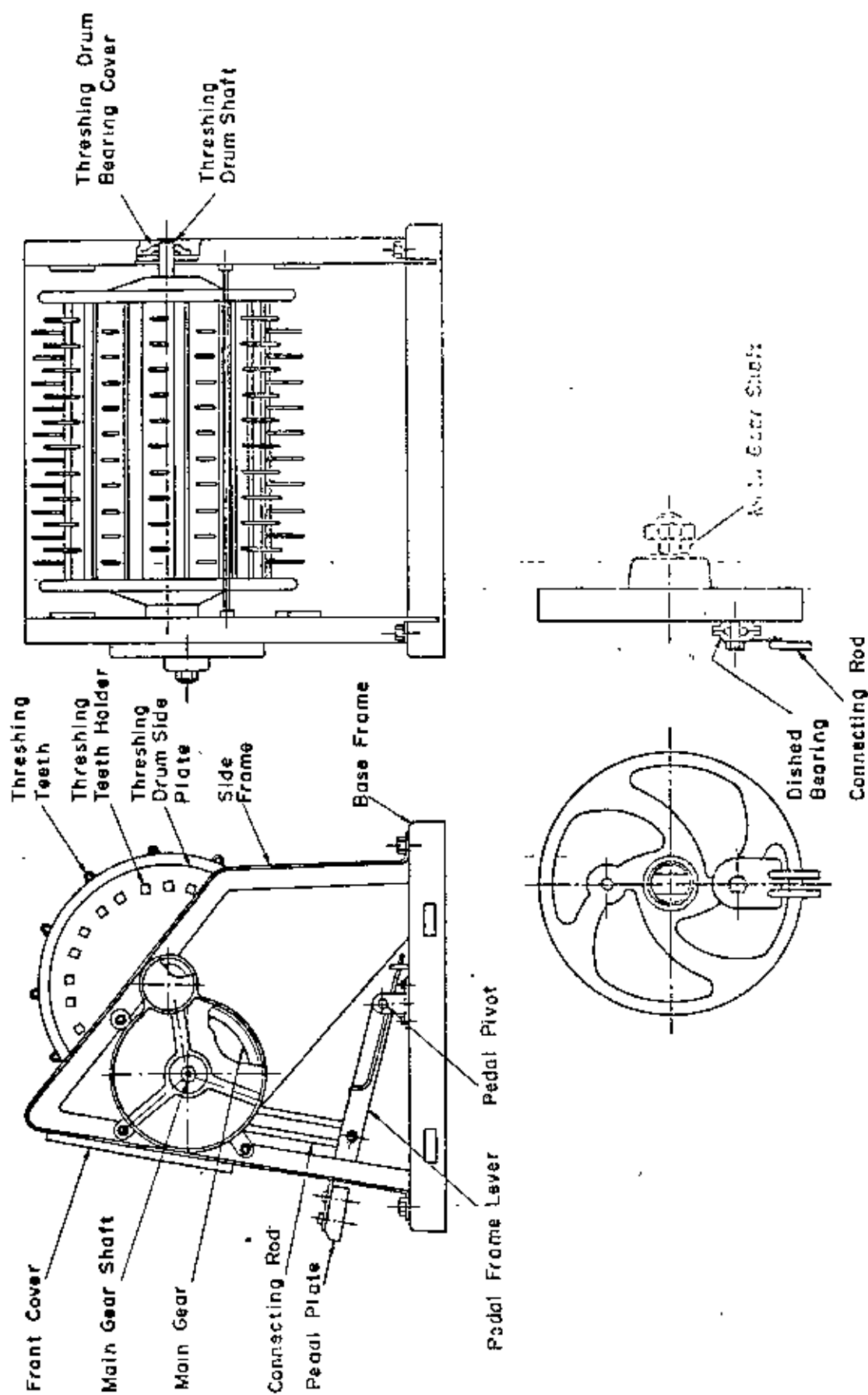


Fig. 2.1

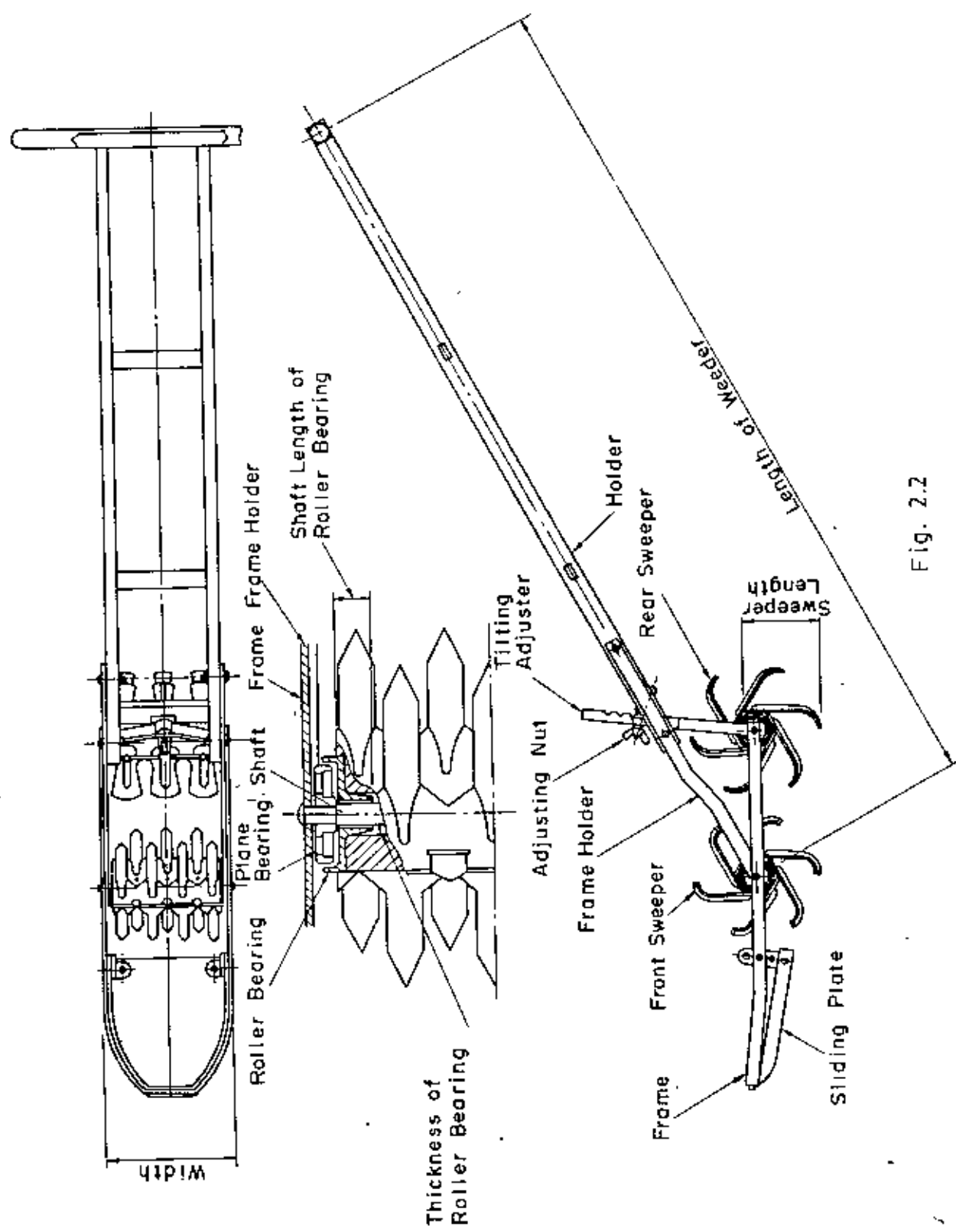


Fig. 2.2

Static Type Grain Dryer

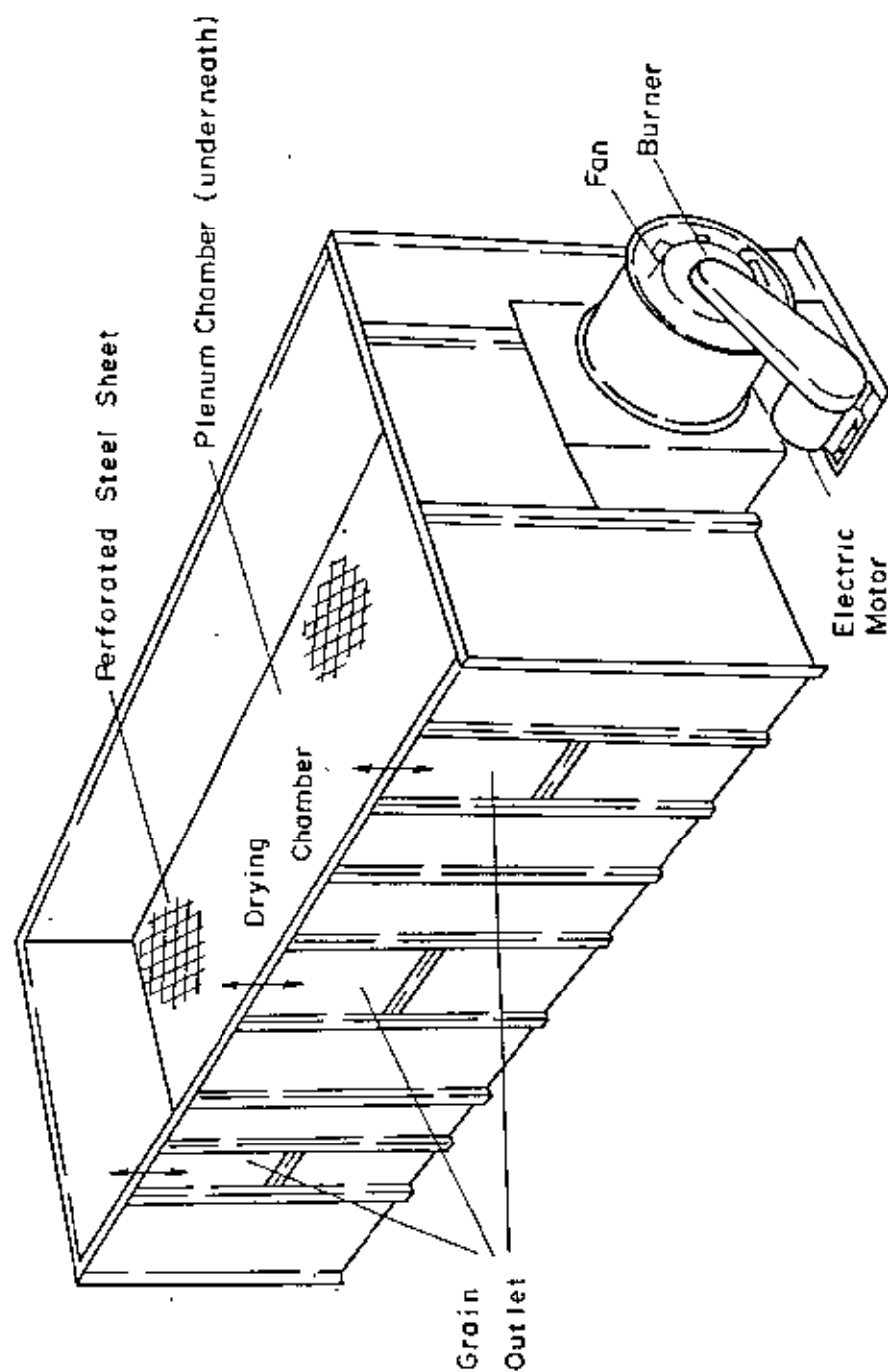


Fig. 2.3

Centrifugal Pump (6)

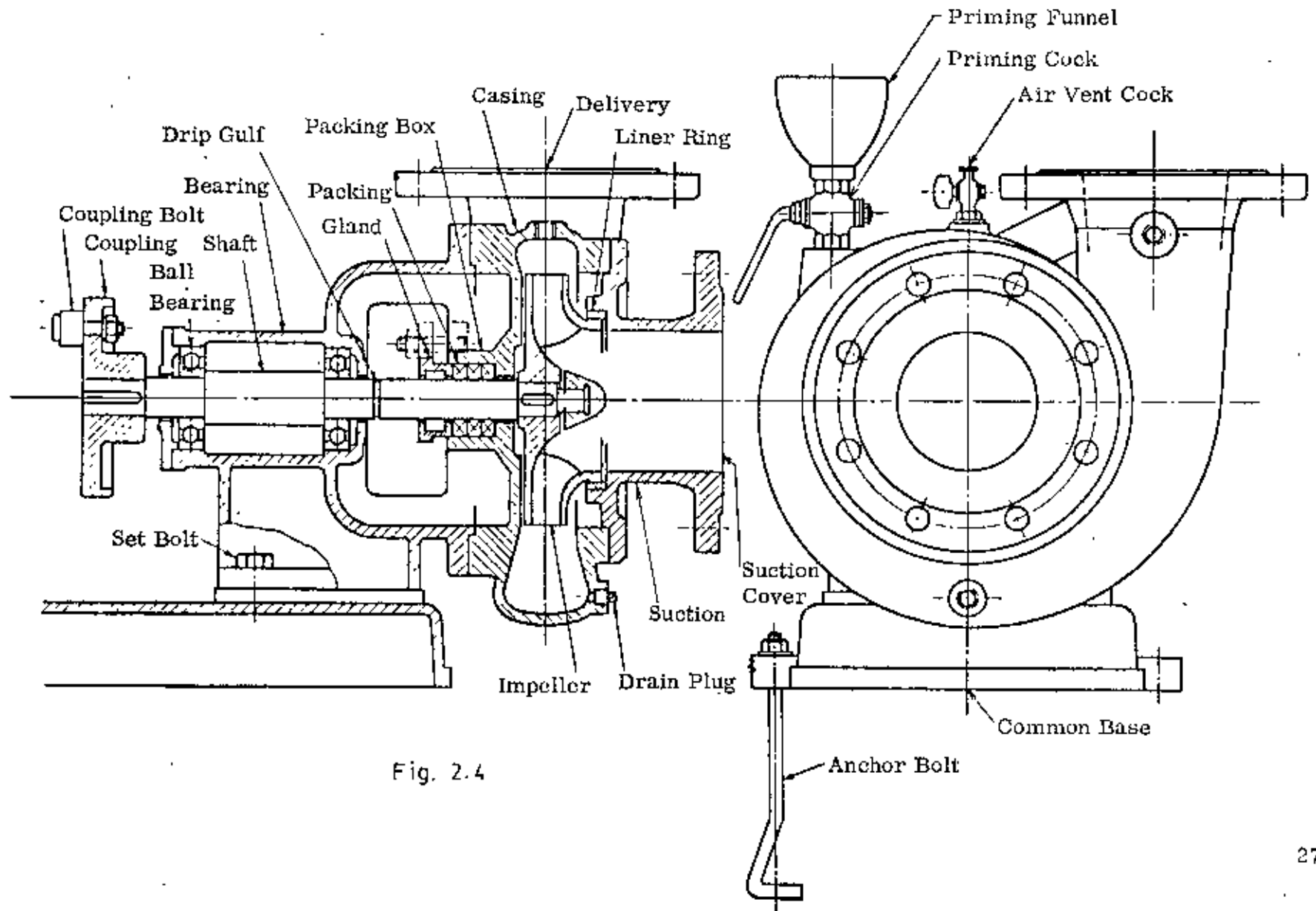


Fig. 2.4

MANUFACTURE OF AGRICULTURAL IMPLEMENTS

3.1 Import of Agricultural Implements:

Different tools, implements, animal and manual power are required at different stages of production of agricultural crops. The different stages are land preparations, plantation, crop protection, irrigation, harvesting and processing. In some cases the major inputs like fertilizers, pesticides are either imported or produced locally in some industrial concerns and are applied either through manual or some mechanical means or device. Implements are required for application of the above material inputs. The study on production of above inputs is beyond the scope of this study. The tools, implements or any other mechanical device, their accessories which are or may be employed for production of crops are within the scope of this study. This includes equipments for land preparation, plantation, weeding, irrigation harvesting, transports, food grain processing and for other agricultural works. As the same industries producing agricultural implements, are capable of manufacturing simple machinery and their components for small and medium scale agro processing industries like rice mill, oil mills, flour mills etc. study for manufacturing of the same may be carried out in the scope of future works in this regard.

Many of the agricultural implements centrifugal pumps, power tillers, sprayers, tractors etc. were in the past and at

present are being imported. Presently centrifugal pumps for irrigation purpose are no longer imported. But the pump driving units diesel engines of lower horse power or electrical motors are still required to be imported. Bangladesh Diesel plant and BMTF at Joydevpur are manufacturing and assembling diesel engines for centrifugal pumps with imported SKD and CKD parts. As regards to the electrical motors GEC is manufacturing the same to some extent. But nevertheless the production capacities and present production quantity are very small in comparison to the existing demand in the market.

Tractors and power tillers are occasionally imported in assembled and in CKD conditions. Spade is also on the import list of the Govt. and is regularly imported to meet the demand in the market. As for other agricultural implements which are labour saving are yet to be popularized and accepted by the farmers.

The spares and components of various agroprocessing machinery and equipments are mostly imported, though most of the same could be locally manufactured with the existing facilities.

3.2 Local Manufacture of Implements:

Besides tractors all of the agricultural implements are manufactured to some great extent by the local manufacturers. BMTF and few other private manufacturing units can manufacture power tillers. Turbine pumps are manufactured by BMTF, Sonar

Bangla pumps, Milners Ltd. Centrifugal and hand pumps are being manufactured by a large number of industries both in the public and private sector.

Other agricultural implements like pedal thresher, weeder, etc. are manufactured locally and does not require any imported technologies. But the initial cost, lack of proper advertisements, after sales service etc. are the main reasons for their poor acceptance by the farmers. Farmers of our country are accustomed to century old methods and are usually reluctant to welcome better modern technologies and implements. Most of the farmers are ignorant of the facts that these simple implements can give them more benefits at a much less cost in the long run.

For ease of marketing and better after sales service the agricultural implements need to be manufactured nearest to the area of use with proper after sales service facilities. If small scale metal working workshops with proper technological inputs are set up at or around Upazilla or nearby important places, they can effectively manufacture the implements and provide the necessary after sales/^{service} at minimum cost. Electricity with other infrastructural facilities are being extended to the rural areas and this in turn will expedite the growth of small scale metal working workshops along with other development works.

3.3 Selection of agricultural implements for this study for production in the small and medium scale metal working workshops

Considering the production capacities, and facilities required, present state of technological know-how and demands of implements etc. the following products may be listed for production at the first stage by the metal working workshops under study. Some of the production facilities may be required to undergo some modernization work and new technology is to be introduced and this in turn will require assessment of technological know-how and requirement of new inputs for the same for the workers' of the industry.

Selected Agricultural Implements for Production By Metal Working Workshop

- | | |
|----------------------|---------------------|
| - Plough | - Hand pumps |
| - Sickle | - Centrifugal pumps |
| - Pedal Thresher | - Winnowers |
| - Hand Pushed Weeder | - Spade |
| - Dryers | |

Demand for Agricultural Implements Estimated by JICA⁽⁶⁾

Name of Implements	1979 - 1980		1980 - 1981		1981 - 1982	
	Use	Demand	Use	Demand	Use	Demand
	(Nos.)	(Nos.)	(Nos.)	(Nos.)	(Nos.)	(Nos.)
Weeders	25284	-	74486	51460	128278	61241
Thresher	13872	-	30212	17727	48186	20995
Winnowers	3200	-	4200	1320	6200	2420
Seed drills	10000	-	14950	5950	20395	6930
Hand hoes	10000	-	17500	8500	25750	10000
Paddy dryers	-	-	2458	2458	5162	2950
Centrifugal pump	-	21500	19875	97300	20665	113100
Hand pumps	-	-	550000	145000	650000	155000

Demand for Agricultural Implements Estimated by JICA (Contd)

Name of Implements	1982 - 1983		1983 - 1984		1984 - 1985	
	Use	Demand	Use	Demand	Use	Demand
	(Nos)	(Nos.)	(Nos)	(Nos.)	(Nos.)	(Nos.)
Weeders	187449	71999	252338	83834	324135	96751
Thresher	67957	24590	89706	28545	113629	32894
Winnowers	9200	3620	23929	15649	40131	18595
Seed drills	26385	8030	32973	9227	40220	10544
Hand hoes	34825	11650	44085	13466	55789	15462
Paddy dryers	8136	3480	11417	4085	15016	4741
Centrifugal pump	21455	128900	22245	144700	23035	160500
Hand pumps	750000	165000	850000	175000	950000	185000

Above figures have been estimated and forecasted by JICA depending on past record with some preconditions.

CHAPTER - 4

KNOW HOW FOR LOCAL PRODUCTION OF IMPLEMENTS

4.1 Metal Working Industries - Past and Present:

From centuries back agricultural products and cottage industries dominated the economic scene of our country. Each village was self reliant ⁱⁿ respect of their agricultural and other consumer goods. The cottage industries, mainly in the textile, and metal working and pottery fields provided the products required for the livelihood of the villagers. With the improvement of communication network and establishment of mass producing big industrial concerns, the cottage oriented industries are gradually on the way of abolishment.

The blacksmiths of the villages provided the entire quantity and variety of the metallic products required by the villagers. The metal working people were the goldsmiths who made the ornaments with gold and silvers, Bronze and products like, drinking glasses, plates, dongs, etc. were also manufactured in the village cottage industries. Aluminium and other metallic products were rather uncommon to the villagers in those days. Still now a days almost every villages of the country has got a blacksmith shop, run by a blacksmith family, who are traditionally blacksmiths, from their great grand fathers. The blacksmiths generally manufacture their products by hand forging of steels and by casting of ferrous and non ferrous metals and their alloys. Whatever skill and technical know-how they have, they gathered through long experience and practice.

Now a days the metal working industries are no more confined to the cottage industries in the villages. Most of the metallic products that are produced in the country are at present manufactured in the urban areas by the mechanized industries. The industry today is composed of cottage, small and large scale industries. In our country a cottage industrial firm represents the nonmechanized units performing the metal working processes basically by hand or the use/^{of} simple hand tools. Small scale industries on the other hand are characterized by the use of low level technologies, electrical power inputs and a capital investment of Tk. 25 lacs (Defined by BSCIC). Large scale industries are characterized by employing larger working size, consuming electrical power and a fixed investment in capital items above Tk. 25 lacs level.⁽⁵⁾

In 1974 there were 2000 number registered small industries in the country as per Department of Industry of the Govt. It has been estimated that about 3000 metal working workshops were in operation throughout the country in the year. As per informations as given by BBS out of total registered 3214 number small industries, 346 numbers were in operation in the Basic metallic industries in 1982-83. Majority of the small scale metal working workshops are located in and around Dhaka, Chittagong and Khulna areas, obviously due infrastructure facilities. In a study by JICA⁽⁵⁾ in 1979-80 it has been found that about 91% of the total small scale metal working workshops are located in the urban areas. According to a survey in 1966, there existed about 24000

numbers of cottage industries, employing about 50000 people engaged in the manufacture of agricultural tools, implements like plough, sickles, Dao, Boti etc.

The large industries are mostly in the public sectors and during the last few years due to Govt. Policy some large industries in the metal working sector have been established.

4.2 Present State of Technology in the Cottage Industry:

The existence of cottage industries in the rural areas in the metal working sectors is now a days in question. Still then, in every villages of the country there exists a blacksmith family. Most of the male members of the family are now going for jobs, other than that of blacksmiths due to poor income in this job. Also sufficient quantity of job are not available in the villages. Just one or two men of the family are engaged in this profession to supply the local demands of agricultural implements and other ferrous items for household use. Their living standard have also been lowered in respect to the other villagers in different professions.

The tools etc. of a blacksmith shop in the villages usually consists of hammers, bellows, anvils, tongs, a coal fired fire - place - all located in a typical village cottage, adjacent to the house of the blacksmith. The blacksmith has got good practical knowledge of different heat treatment procedures like annealing, quenching, tempering, hardening of mild steel but has got practi-

cally no knowledge in the theories of the same. Hand forging is the most common process employed by the blacksmiths. Ferrous and non ferrous casting is not so common in the blacksmithshops.

Ploughs, sickles, rakes, hoes, axes, dao, boti, knives etc. are the common items manufactured in the blacksmiths.

4.3 Present State of Metal Working Technology in the Small and Medium Scale Metal Working Workshops:

Small scale metal working industries are mostly (91%) located in the urban areas with electrical power supply, easy road or river communication. Processes like casting, forging, sheet work, welding, plating, machining, assembly press work etc. are employed by them for the manufacture of different metallic products. As regards machining and equipments, lathes, drills, shapers, casting furnace, welding sets etc. are common in majority cases. The products of the workshops are usually different industrial machinery, and parts, automobile parts, agricultural machinery, pipe works, etc. Their products may also be grouped as consumer and capital goods. The technical know-how of the employees of the workshops depend on the type of processes employed by the industry. Generally the workers are self trained and become skilled with the increase of working years. Usually they lack in formal technical education or vocational training of any kinds.

Technology Levels in Small and Medium Scale Metal Working Industries

CASTING

Practically all casting in all iron foundries are of gray cast iron by sand casting method. Natural sand is used as moulding material. The volume of non ferrous casting is much smaller in comparison to that of ferrous casting. Scrap cast iron is mixed with imported pig iron and melting is done in cupola furnace or in crucible furnace. Cupolas are all locally manufactured and no standard is found in the construction of cupolas of different industries. In some foundries natural gas is also burnt alongwith imported coke. Casting quality depends on the quality of pig iron used. Moulding bed of the foundries are usually large and as a result molten metal has to lose temperature during transportation to the moulds after tapping, result in bad casting. Post casting operation like, cleaning by shot blasting, annealing to relief casting stress, is also absent.

Typical product of different iron foundries are components of centrifugal pumps, hand tube wells, grain and oil milling machines, cooking pans, weights for fishing nets, measuring weights, manhole covers, sanitary fittings, workshop machinery like lathe, shapers etc.

Forging:

Forging operations are predominantly performed by the blacksmiths by hand forging method. The entire production process

is performed manually without any use of any kind of mechanical press. Materials are cut to pieces with a hammer and a chisel and heated in a small coal fired hearth. Heating and hammering is done repeatedly until the final shape is obtained. No measuring instrument is used and the shape is usually checked with eye observation or compared with the sample of the job. Blowing of air to the hearth is carried out by operating the air bellow with hand or a leg linked through a chain. Water quenching is extensively used. For finishing works only a file is used. Materials for forging are usually scrap mild steel rods, plates, rails etc. The product is usually smaller in size so that it can be heated and handled easily without any difficulty. Fuel for the forging operation is either charcoal left after cooking or rejected coal from the locomotives or a mixture of both. Many agricultural tools, like sickles ploughs, rakes, etc. are ^{made} by the blacksmiths with hand forging method.

Heat treatment after forging operation are usually carried out by the blacksmiths to improve the quality of their products. The quality of the product can be improved much if the blacksmiths use proper raw material and follow the required heat treatment techniques.

Sheet Metal Work & Welding:

Products fabricated by this technology are the components of centrifugal pumps, sets, hand pushed weeders, seed drills, seed treaters, pedal threshers, still furnitures, cabinets, grills etc. Production facilities that are commonly utilized in

these processes are welding sets, simple manually operated sheet bending machines, shearing machine, bench drills etc.

Machining:

Machine shops commonly known as road side engineering workshops of varying sizes exist throughout the country. The smallest may be with a lathe machine and a drill with two or three people working. The bigger ones may be as large ^{as} to employ more than 30 people with much more machinery and equipments. These larger shops are often supported by their own foundries. Many of these machine shops produce sophisticated machinery like lathes, shapers by themselves. Centrifugal pumps, deep tubewell turbines pumps, spare parts for jute and textile mill machinery, spares for printing press and many other machinery and their components are manufactured by these road side engineering workshops. The workers of these shops whether big or small are not accustomed to the use of blue prints, better measuring tools, jigs and fixtures, etc. and thereby are not so quality conscious.

4.4 Human Resources in the Small and Medium Scale Metal Working Workshops:

It has been observed that technical problems of the metal working workshops whether large or small in size arise from lack of fundamental knowledge of the process and quality consciousness rather than from any inadequacy of machinery or equipments they have. For better quality and durable products the

man behind the machines must be properly trained and educated. The metal working workshops employ a large number of workers throughout the country. Most of the workers employed by them are without any knowledge of the processes of the workshops and with a little educational background at the time of their appointment. Out of a total number of 4,93,919 workers of the industrial sector of the country 48,711 people worked in the small and medium scale metal working workshops in 1981.⁽¹⁾ Agricultural tools, implements etc. are to be manufactured by these workshops. The workers of these workshop are accordingly to be brought up in order to produce better quality, durable and economic products. For this purpose technological inputs in the form technical education, vocational and on the job training, etc. for the workers are to be arranged in time prior to taking up of a scheme of manufacturing the agricultural tools implements etc. in these workshops in a mass scale. In order to introduce the technology, we have, at first find out the products to be manufactured, their manufacturing process, machinery and equipments required, raw materials, production volumes and many other technical details. List of products that are to manufactured by these workshops.

Small and medium scale metal working workshops, established in the rural areas or in the Upazillas, producing only agricultural implements etc. may not be economical due to under use of their facilities. Many other products that are within the manufacturing capacities of these workshops will be

needed to be manufactured. A metal working industry can produce a variety of metallic products with simple adjustments. These industries develop extensive linkage with other industries.

4.5 Processes Required for Production of Selected Agricultural Implements

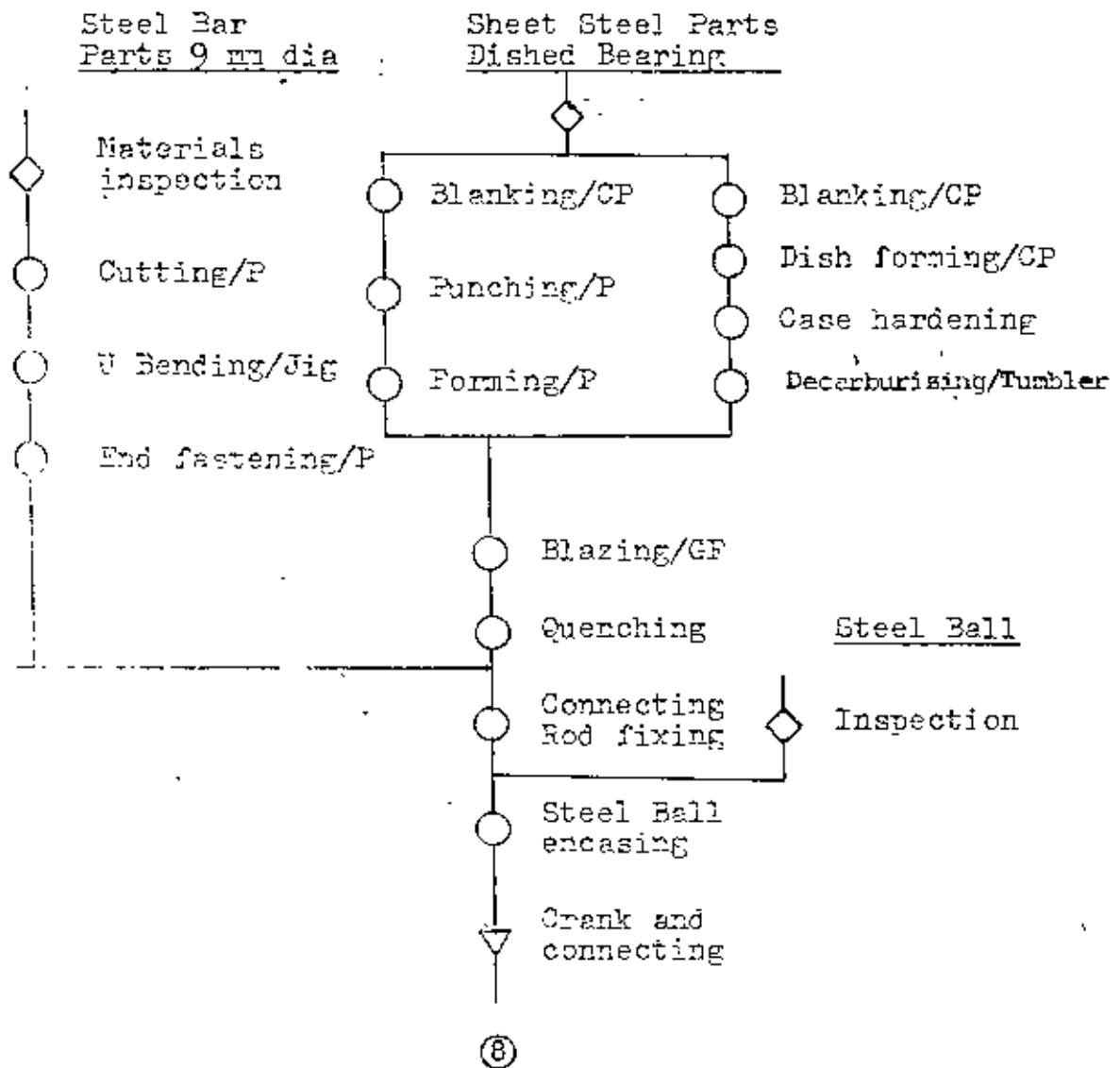
Machinery & Equipments Requirement for Production of Selected Items:

In order to manufacture the items as listed earlier, various machinery and equipments and other production facilities will be required. It is not necessary that all the machinery and equipments as listed below will be required and have to be installed in a single workshop depending on the product, and quantity of production machinery and equipments will vary from shop to shop both in type and quantity. A list showing the requirement of different machinery and equipments is given below.

Machinery & equipments, and their abbreviations for production of agricultural implements etc.

<u>Name of the machine, equipment</u>	<u>Code</u>
Lathe 4'6'	LA/16
Shaper	SFR
Portable drill	PD
Bench drill	BD
Horizontal Milling machine	HM
Cylindrical grinder	CG

Thresher Parts Manufacturing Process - 3

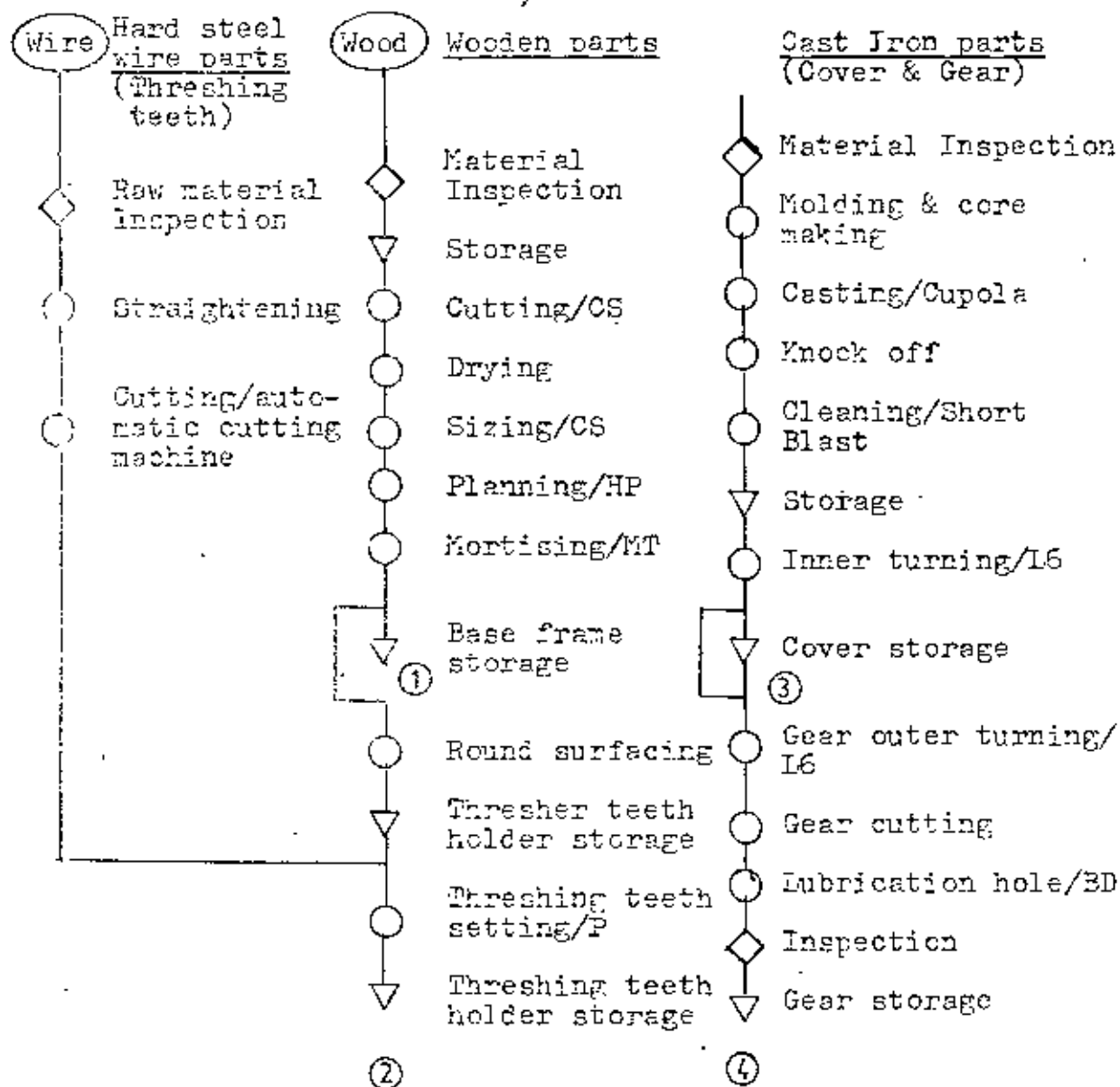


Portable grinder	PG
Universal Tool Grinder	UTG
Square Shear	SS
Vibrating Shear	VS
Power Press/Crank press	P/CP
Double Crane Press	DCP
3 Rolls Bender	HR
Sheet Bending Machine	SB
Bend Saw for wood	BS
Hacksaw Machine	HS
Radial Drilling machine	RD
Wood circular saw machine	WCS
Hand wood planner	HP
Wood lathe	WL
Mortising machine	MT
Spring hammer 30 kg/15kg	SH-30/SH-15
Anvil	AN
Blacksmith furnace	BF
Gas fired/ Oil fired furnace	GF/OF
Oil Bath	CB
Arc Welding set	AW
Gas Flame cutting set	GC
Spot welding set	SW
Pipe Bender	PB
Vice	VC

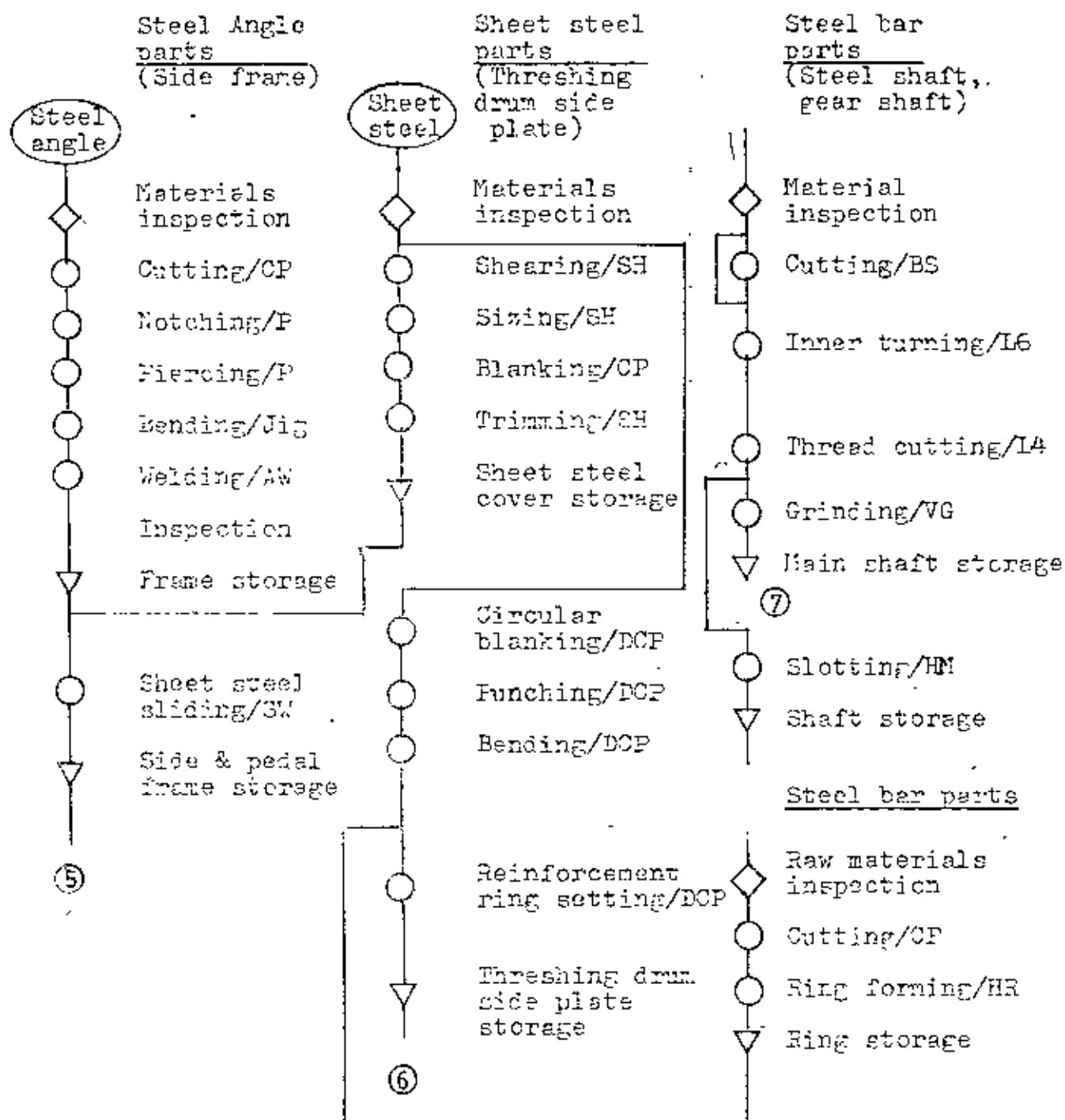
Manufacturing process of different agricultural implements (6)

PEDAL THRESHER

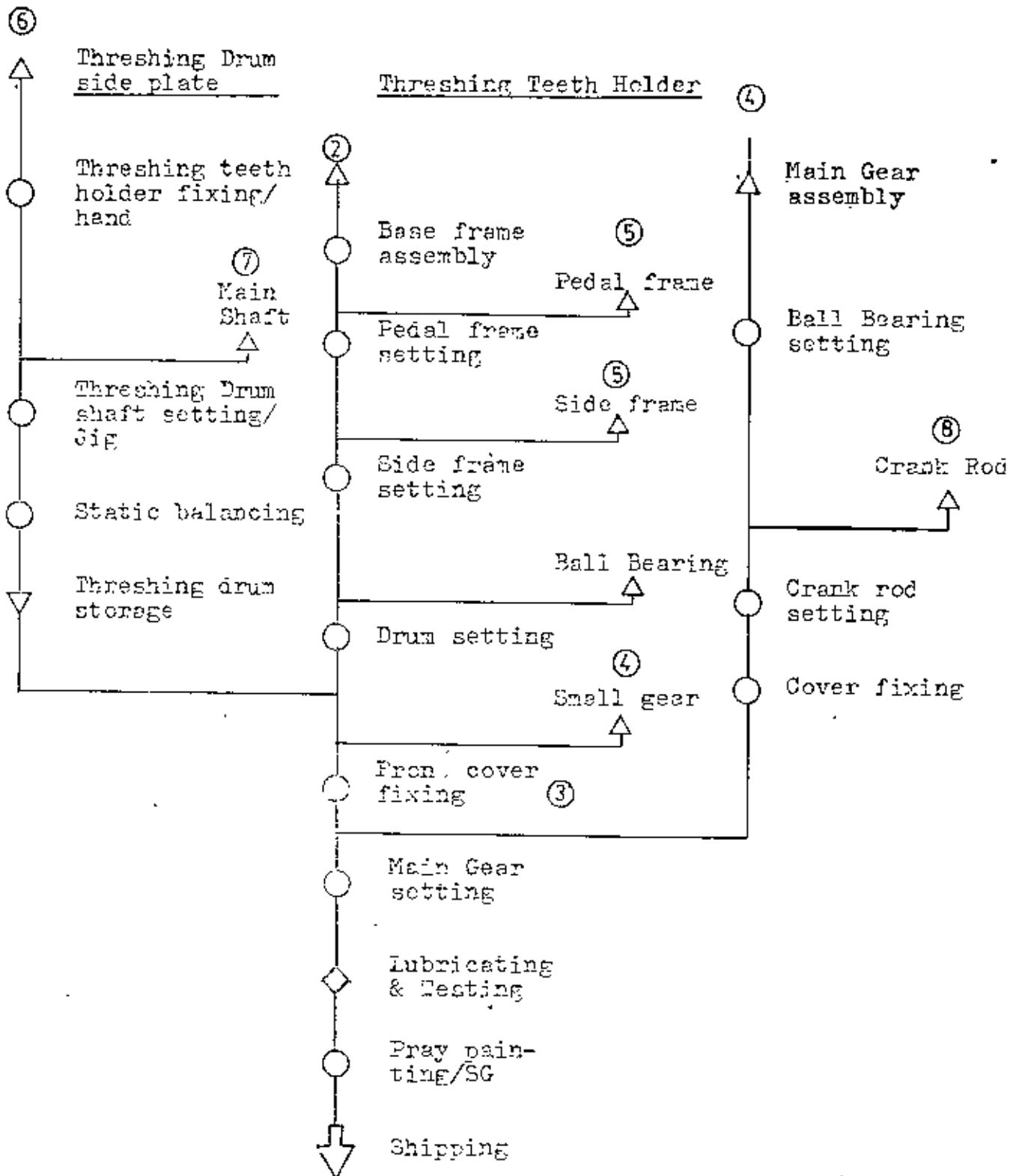
Thresher Parts Manufacturing Process - 1



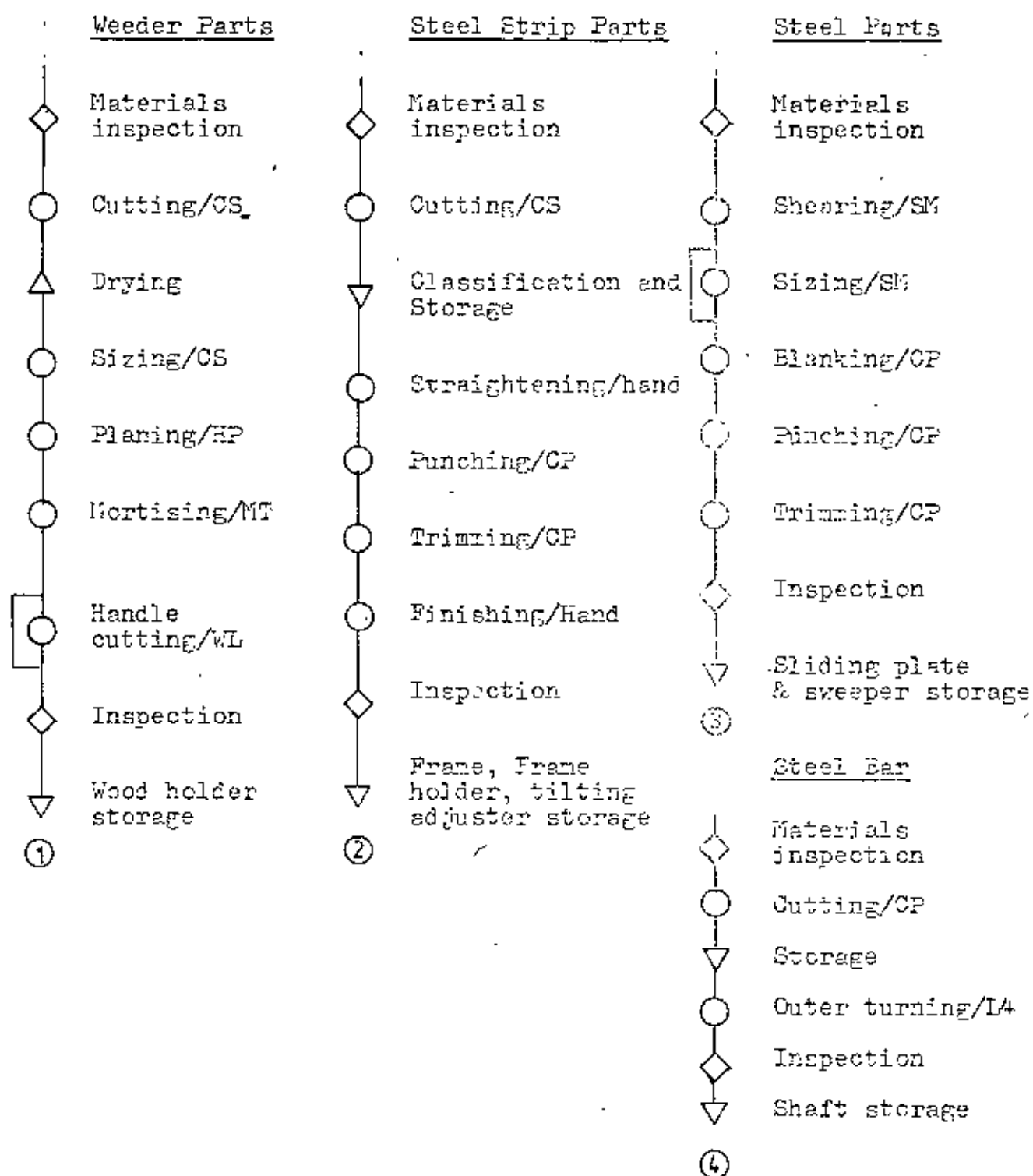
Thresher parts - manufacturing process-2



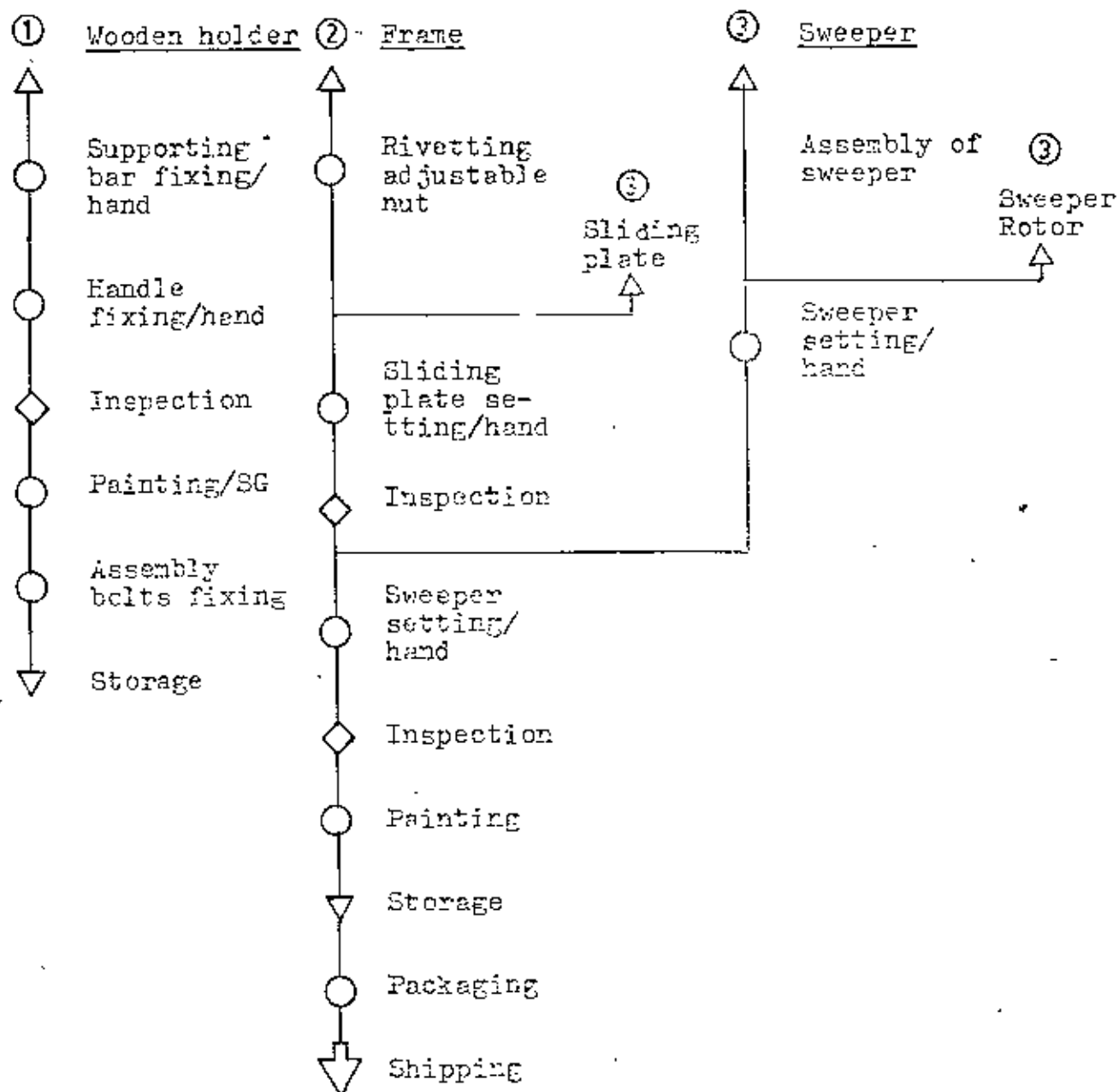
Thresher Assembly Process



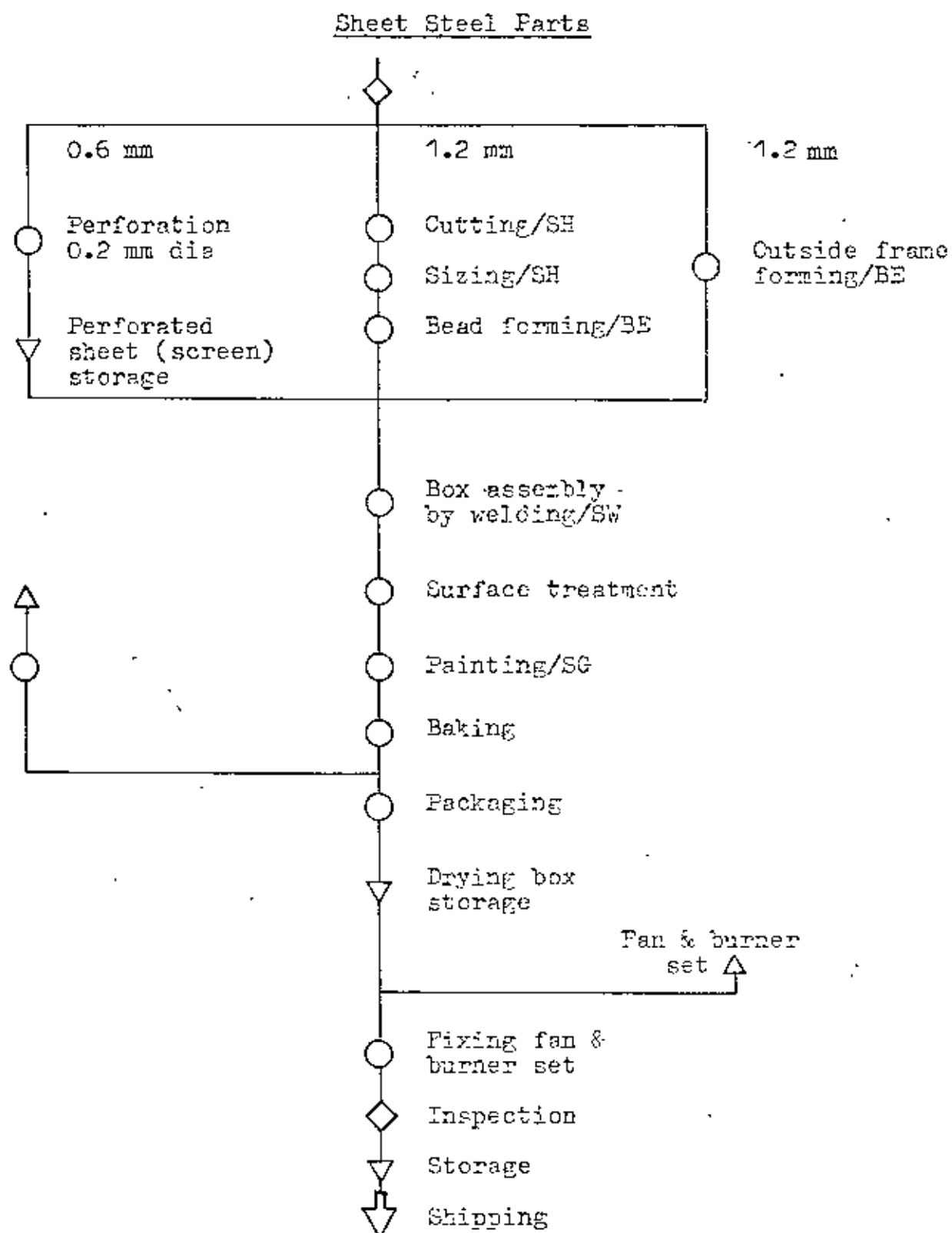
Paddy Weeder Parts Manufacturing Process(6)



Paddy Weeder Assembly Process



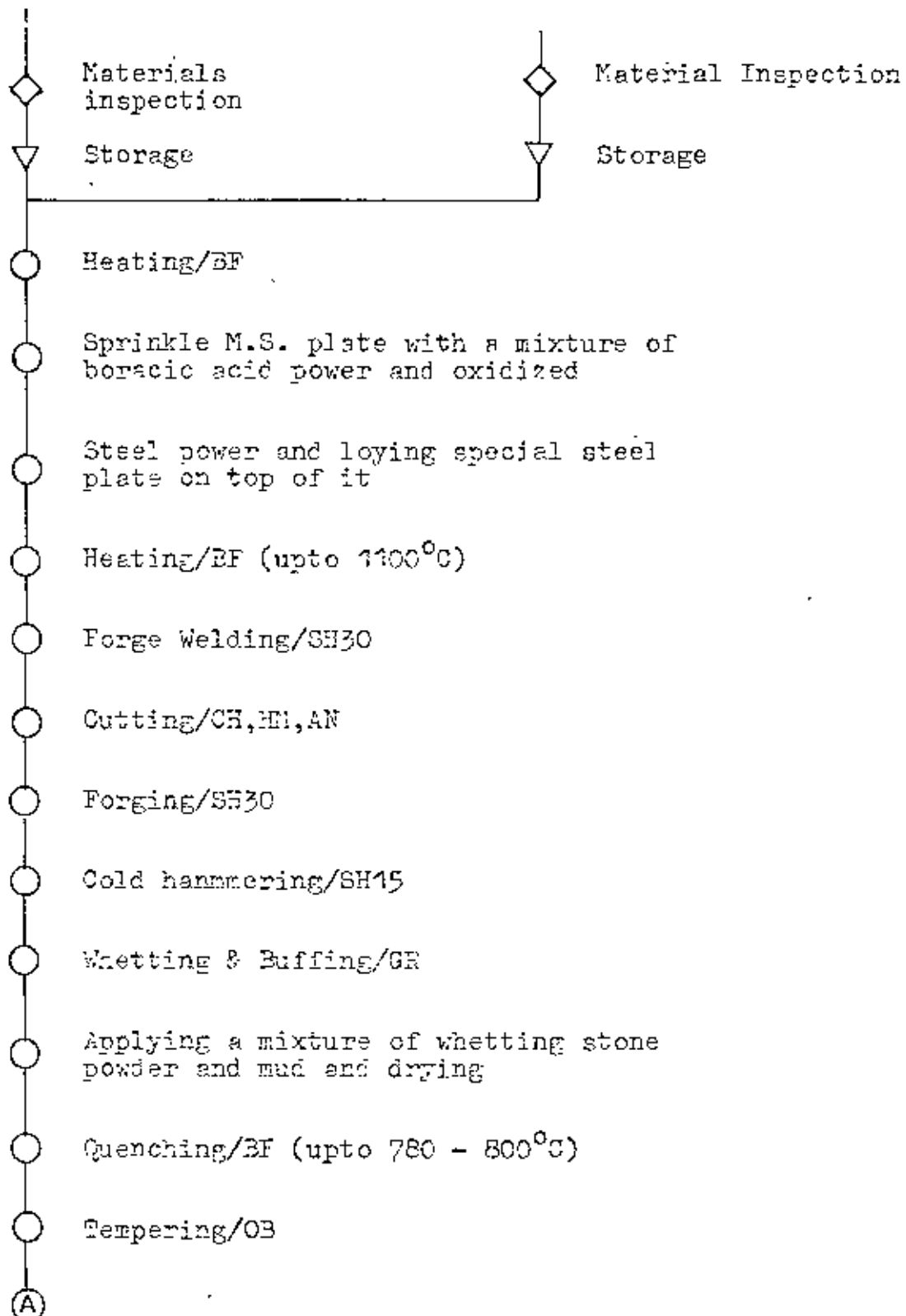
Static Type Paddy Drier Manufacturing Process(6)



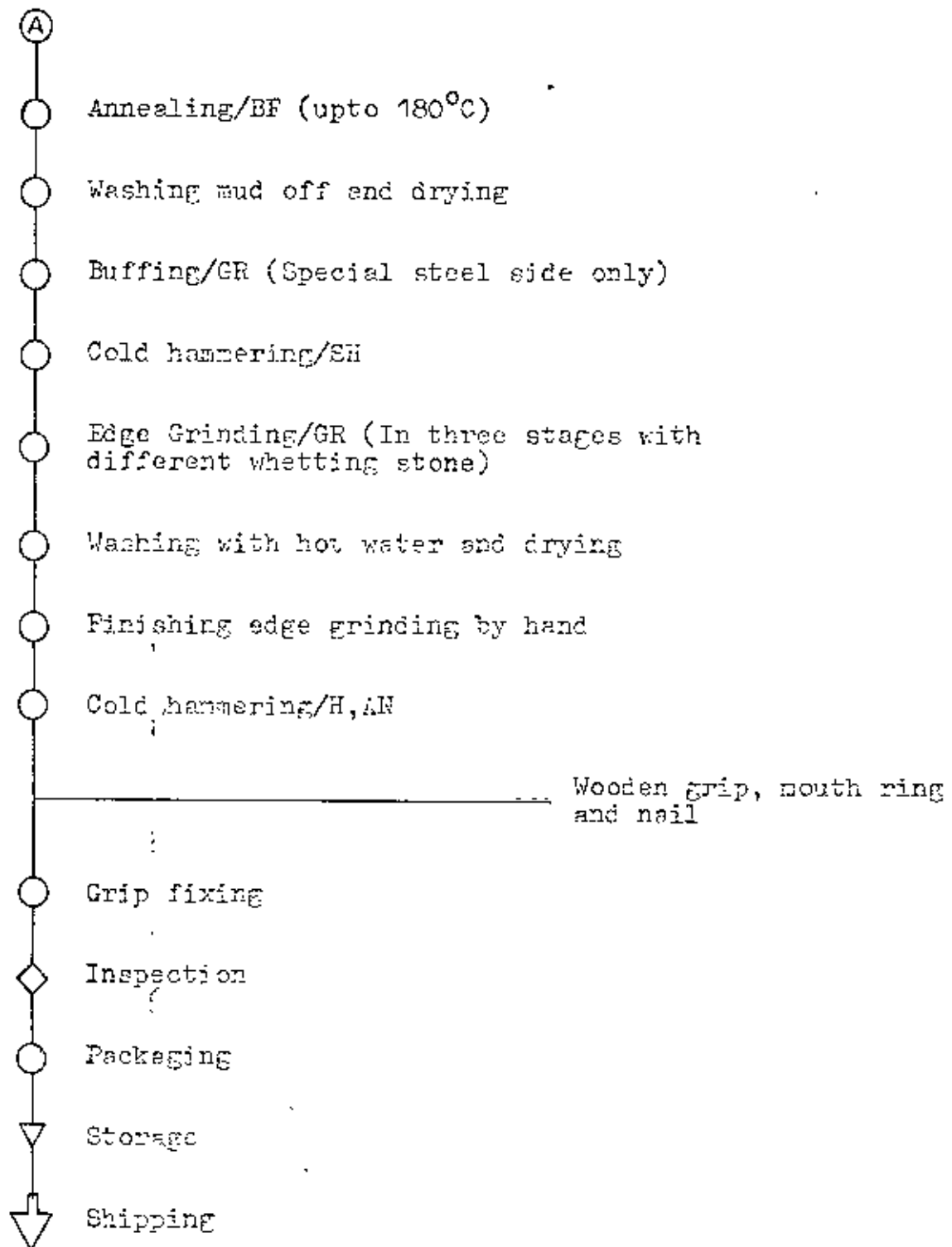
Sickle Manufacturing Process(6)

Mild Steel Plate

Special Steel Plate



Sickle Manufacturing Process(Contd.)



Centrifugal Pumps Manufacturing Process

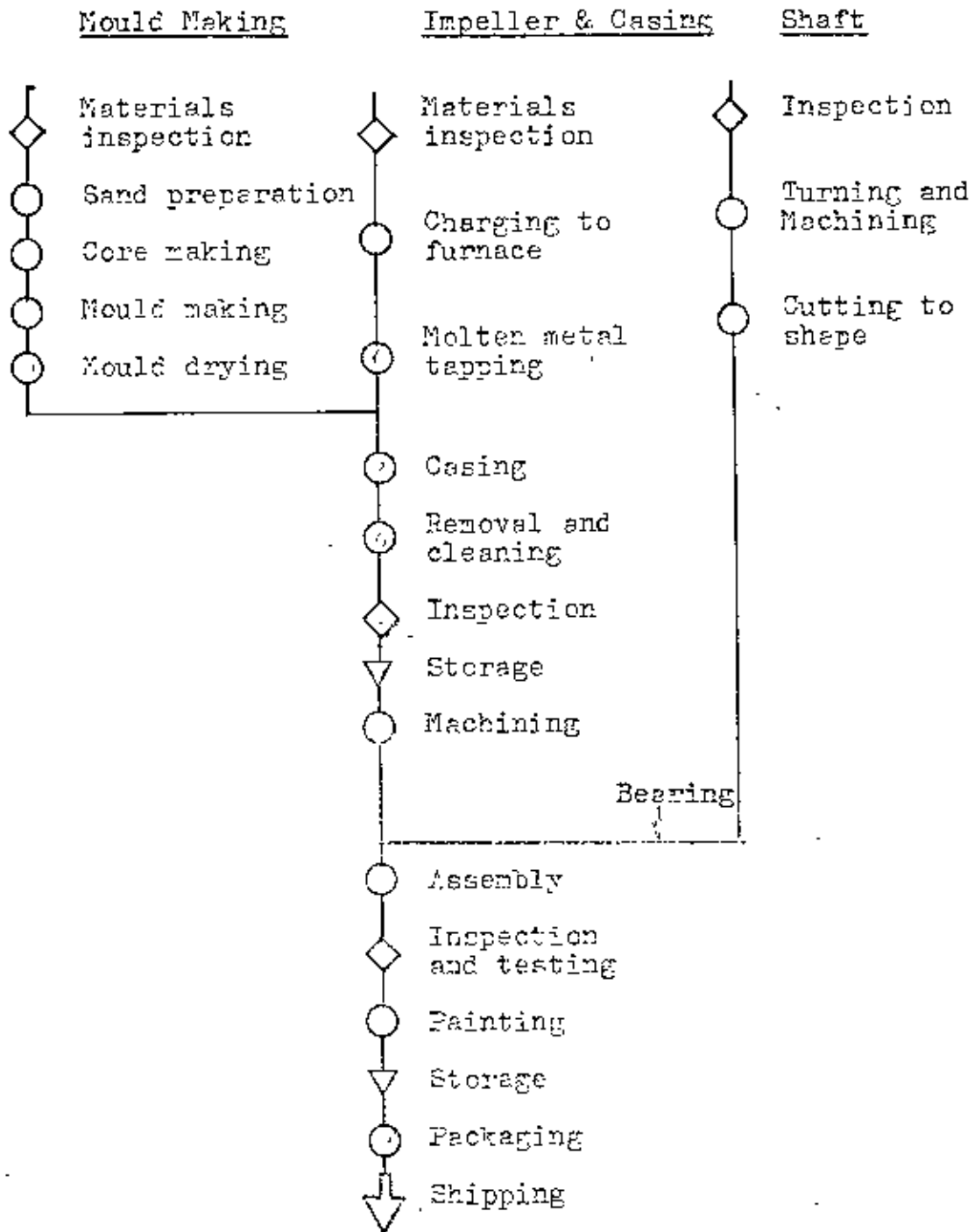
1. Product Specifications: As per fig. 2.4

Suction and Discharge dia (mm)	Capacity (M ³ /min)	Head (m)	Power (HP)	Weight (Kg)
50 x 50	0.5	15	2.1	35
75 x 75	0.4 - 1.4	15	4.8	55
100 x 100	0.8 - 2.0	15	6.5	85
150 x 150	1.5 - 3.6	15	11.0	110

2. Material Requirements:

<u>Components</u>	<u>Materials</u>
Impeller	Cast iron
Housing/Casing	Cast iron
Bearing	
Base frame	M.S. Plate
Bolts and nuts	M.S.
Packing	
Shaft	Steel Bar

3. Production Process:

Centrifugal Pump Production

Hand pump manufacturing:

<u>Components</u>	<u>Materials</u>	<u>Operations</u>
Body	Cast iron	Casting, machining
Handle	Cast iron	Casting, machining
Head	Cast iron	Casting, machining
Nut, Bolts	Mild steel	
Washers		

Winnowing manufacturing:

<u>Components</u>	<u>Materials</u>	<u>Operations</u>
Plate casing	M.S. sheets & plates	Cutting, welding
Inclined tray	M.S. sheets	Cutting and joining by tack welding
Air blower	Steel plate, shaft	Cutting, welding, machining
Gears	Cast iron/M.S	Casting, machining
		Assembly works
		Testing & Inspection

Table 4.1: Production Processes for Manufacturing Different Agricultural Implements

Product	Process	Casting	Forging	Welding	Machining assembly works	Press works	Heat treatment	Wood work	Surface treatment	Riveting	Plate & sheet metal works
Centrifugal pumps	x		x	x					x		x
Hand pump	x		x	x							
Pedal thresher	x		x	x			x	x			x
Weeder					x	x			x	x	x
Grain dryer			x	x					x		x
Sickle			x	x	x		x	x	x		x
Spade			x			x	x	x			x
Plough			x				x				

METAL WORKING WORKERS AND RELATED TECHNICAL KNOW-HOW

5.1 Technological Needs of the Workers:

Metal working workshops are found in all district and subdivisional towns of the country. With the availability of electrical power and creation of Upazillas, many small metal working workshops have started functioning in the rural areas. Repair of agricultural pumps, components of pump sets, rice and flour mill parts, automobile parts etc. repair and manufacture are the main business of these workshops. Excepts the districts of Dhaka, Chittagong, Khulna and Bogra, repair works are the main business of the metal working workshops in all other districts and places of the country. Manufacturing works together with alot of repair business have fiarly grown up in these four districts. Most of the shops are equipped with one or two lathes, drills machine, one-electric arc welding ste, vice etc. The larger or medium workshops are generally supported by foundries and are engaged in manufacturing jobs. These manufacturing industries in the Dhaka zone are mostly in the Tejgaon and Tongi Industrial areas. In all other places in the Dhaka zone as in Tipu Sultan Road, Sadarpath, Mug Bazar, Badde etc. repair workshops are the majority. The machinery and equipments used by these workshops are mainly lathes, drill machines, shapers, welding sets, grinders and in some workshops milling machine and planer. The larger shop differ with the small shops in respect of their business, type, business volume, number of machinery and equip-

ments and the number of workers.

In respect of production process, casting, forging, sheet metal working, welding, machining, assembly, press works etc. are employed by these industries and they produce varieties of metallic products like industrial and agricultural machinery tools, implements, components, spares, automobile spares, steel furnitures, cabinets, jute and textile machinery spares, spares for printing press machinery and so on.

As already have been stated that quite a good number of workers are employed in these workshops. The quality of products depend not only on the type of machinery used on quality of raw materials on any other technical aspects but also on the skill and technical know-how of the work force of the industry. For better planning and efficient running of this industry keeping in consideration for increased demand for all sorts of metallic products in the future, as have been stated in some other places, the present capabilities and potentials and the state of technical know-how of the main work force are needed to be assessed & explored to a great details. The technological needs of the workers for production of selected agricultural implements have been analysed and presented in Table 5.1.

TABLE - 5.1

Technological Needs for Worker for Different
Production Process for Manufacturing Agricultural
Implements

Knowledge Production process	General Technical Knowledge	Knowledge of various production variables
1. Casting	Drawing & dimension reading, measurement	Material(CI), casting process, cupola furnace and composition of char- ges, foundary, casting defects.
2. Forging	Drawing & dimension reading, measurement	Forging steel, forging temperature, Heat treat- ment, forging defects.
3. Welding	Drawing & dimension reading, measurement, symbol reading	Welding process variables e.g. voltage, current, electrode etc, materials & weldability, welding defects.
4. Plate & sheet metal wor- king	Drawing & dimension reading, measurement	Materials, cutting, fabri- cation and assembly works, blanking, punching, pier- cing, bending operations.
5. Machining- and assem- bly works	Drawing (part and assembly), dimension reading & measurement	Operation of machine tool e.g. lathe, milling-m/c, grinder, shaper, drill, Measuring instruments & technique, knowledge of fits & tolerance, jig & fixtures
6. Press work	Drawing & dimension reading, measurement	Cold & hot forming opera- tions, three dimensional forming, use of template.
7. Heat treat- ment		Heat treatment of metal, surface hardening techni- que
8. Surface treatment		Different type of paints, surface preparation, appli- cation method of painting.

5.2 Design of Questionnaire & Field Survey

In order to assess the present technological knowledge of the workers of the industry we have to study various aspects of the industry. Accordingly the type of products, their standard, quality, production process, type of production machinery and equipments, tools, production volume, aspects of production wastage, human factors in production etc. are required to be identified and analyzed in details.

The above factors of production of the industry can be properly identified by physical survey of the enterprises. As there are more than 3000 number workshops in the country, it is not practically feasible to take a physical survey of all of them. In this regard a statistical approach will better serve our purpose. A representative number of samples of the workshops will have to be surveyed and after analysis of the informations gathered a fair prediction on the state of total population can be made.

Questionnaire and Field Survey:

In order to attain the objective to gather knowledge of the present technical know-how of the workers of the industry a field survey, depending on a well designed questionnaire, meeting our requirements, was felt necessary. The questionnaire has to concentrate on the following points, so that we can have the desired informations.

1. Background of the workshop
2. Personnel aspects
3. Manufacturing aspects
4. Other technical aspects

Accordingly a questionnaire has been designed after giving due considerations to the above aspects. The questionnaire is provided at the annexure-II. Due to limitations in time and the survey work has been confined to the three places, Dhaka, Khulna and Bogra zones. These three areas have been selected because of concentrations of the metal working workshops and other industries. All these three zones have good infrastructural facilities.

In the previous studies by JICA the field survey was conducted in Dhaka, Chittagong, Comilla, Noakhali, Khulna, Jessore, — Kushtia, Pabna, Bogra, Rajshahi, Dinajpur, Chandpur and Joydevpur areas. Both the studies concentrated mainly on other financial and technical aspects rather than study ^{of} technology inputs in the human resources sector of the industry.

In Dhaka zone 17 nos. workshops in Dhaka city, Tejgaon, and Tongi industrial area were surveyed. In Khulna and Bogra 10 and 6 number industries were respectively surveyed. Amongst the total 33 numbers workshops visited many had foundries. During the field survey, workers as well as the managers of the workshop were interviewed and the facilities were physically inspected.

5.3 Analysis of the Data collected During Field Survey

Table 5.2: Processes used in Metal Working Workshops in Sample Space

Process Workshop	Cas-ting	For-ging	Wel-ding	Plating & sheet metal	Machi-ning & Assy.	Press work	Material treat-ment	Others
DHAKA	1.	x				x		
	2.	x	x			x		
	3.	x	x			x		
	4.	x		x		x		
	5.	x		x		x		
	6.	x	x			x		
	7.	x				x		
	8.	x				x		
	9.	x				x		
	10.	x		x		x		
	11.	x		x		x		
	12.			x		x		
	13.			x		x		
	14.			x		x		
	15.			x		x		
	16.			x		x		
	17.			x		x		
Sub Total	17	11	3	17	6	17	0	0
KHULNA	1.			x	x	x	x	
	2.	x		x	x	x		
	3.	x		x	x			
	4.			x	x	x		
	5.	x		x	x			
	6.	x		x	x			
	7.	x		x	x	x		
	8.			x	x			
	9.			x	x			
	10.	x		x	x			
Sub Total	10	6	0	10	4	10	1	0
BOGRA	1.			x		x		
	2.	x		x		x		
	3.	x		x		x	x	
	4.	x		x	x	x	x	
	5.			x	x			
	6.	x	x	x		x	x	
Sub Total	6	4	1	6	2	6	3	0
Grand Total	33	21	4	33	12	33	4	0

W = No. of workshops

P = No. of workers

Table 5.3: Summary of processes used in metal working workshops in the sample space

Type of processes	DHAKA		KHULNA		BOGRA		TOTAL	
	W	%	W	%	W	%	W	%
Casting	11	64.7	6	60	4	66.7	21	63.7
Forging	3	17.6	0	0	1	16.7	4	12.1
Welding	17	100.0	10	100	6	100.0	33	100.0
Plating & sheet metal work	6	35.3	4	40	2	33.3	12	36.4
Machining assy.	17	100.0	10	100	6	100.0	33	100.0
Press work	0	0.0	4	40	3	50.0	7	21.2
Heat treatment	0	0.0	1	10	3	50.0	4	12.1
Others	0	0.0	0	0	0	0.0	0	0.0
Total workshops	17		10		6		33	

Table 5.4: Classification of workshops in the sample space by products

Products	DHAKA		KHULNA		BOGRA		TOTAL	
	W	%	W	%	W	%	W	%
Agricultural pumps	14	82.3	2	20	0	0.0	16	48.5
Agricultural equipments	7	41.2	4	40	4	66.7	15	45.4
Spares, accessories for pumps equipments etc.	3	17.6	4	40	3	50.0	10	30.3
Engine spare	3	17.6	3	30	4	66.7	10	30.3
Other than agricultural pumps equipments spares	9	52.9	9	90	3	50.0	21	63.6
Total shops surveyed	17		10		6		33	

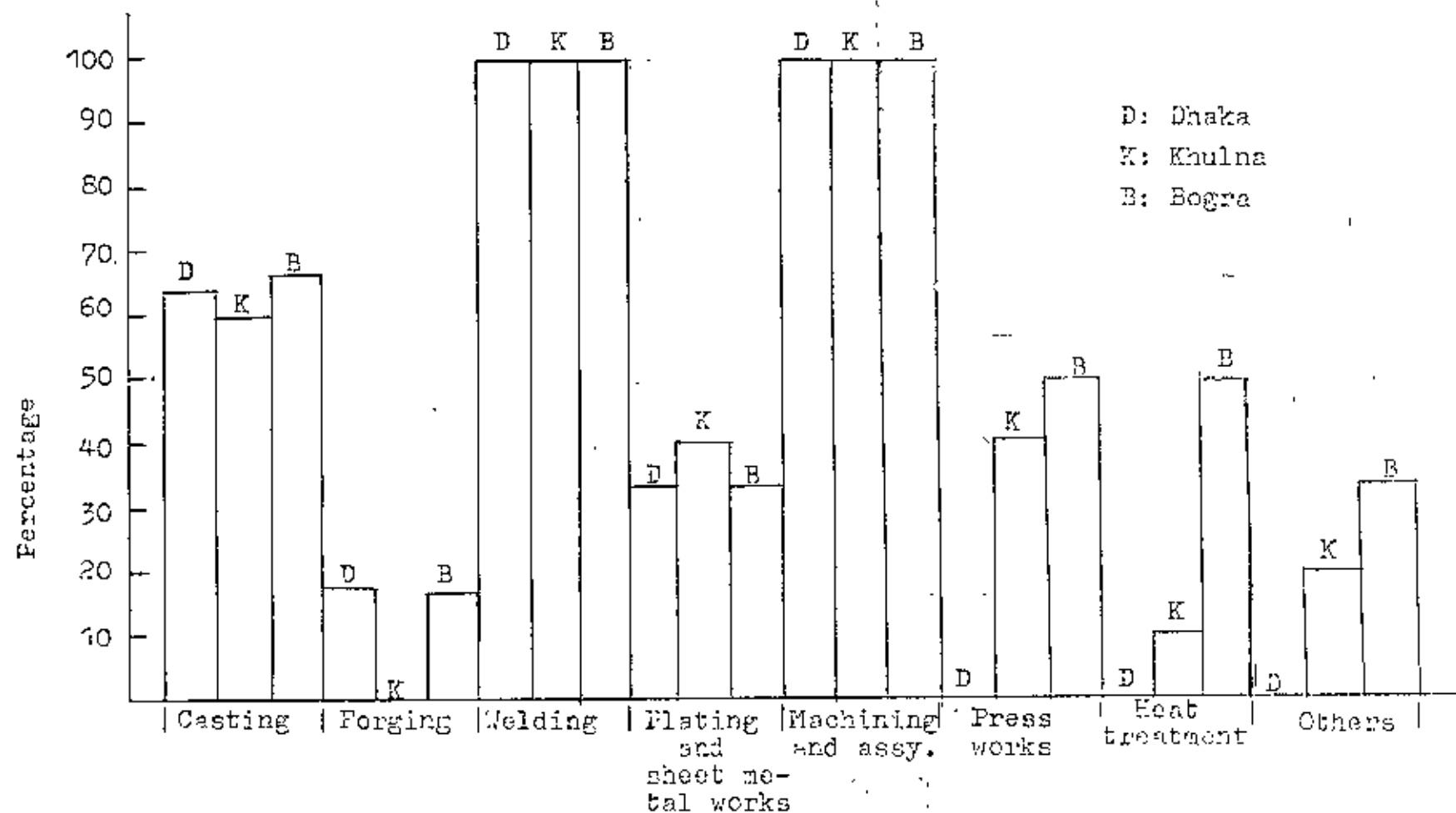


Fig. 5.1: Graphical representation of Table 5.3 for different production processes (zone wise)

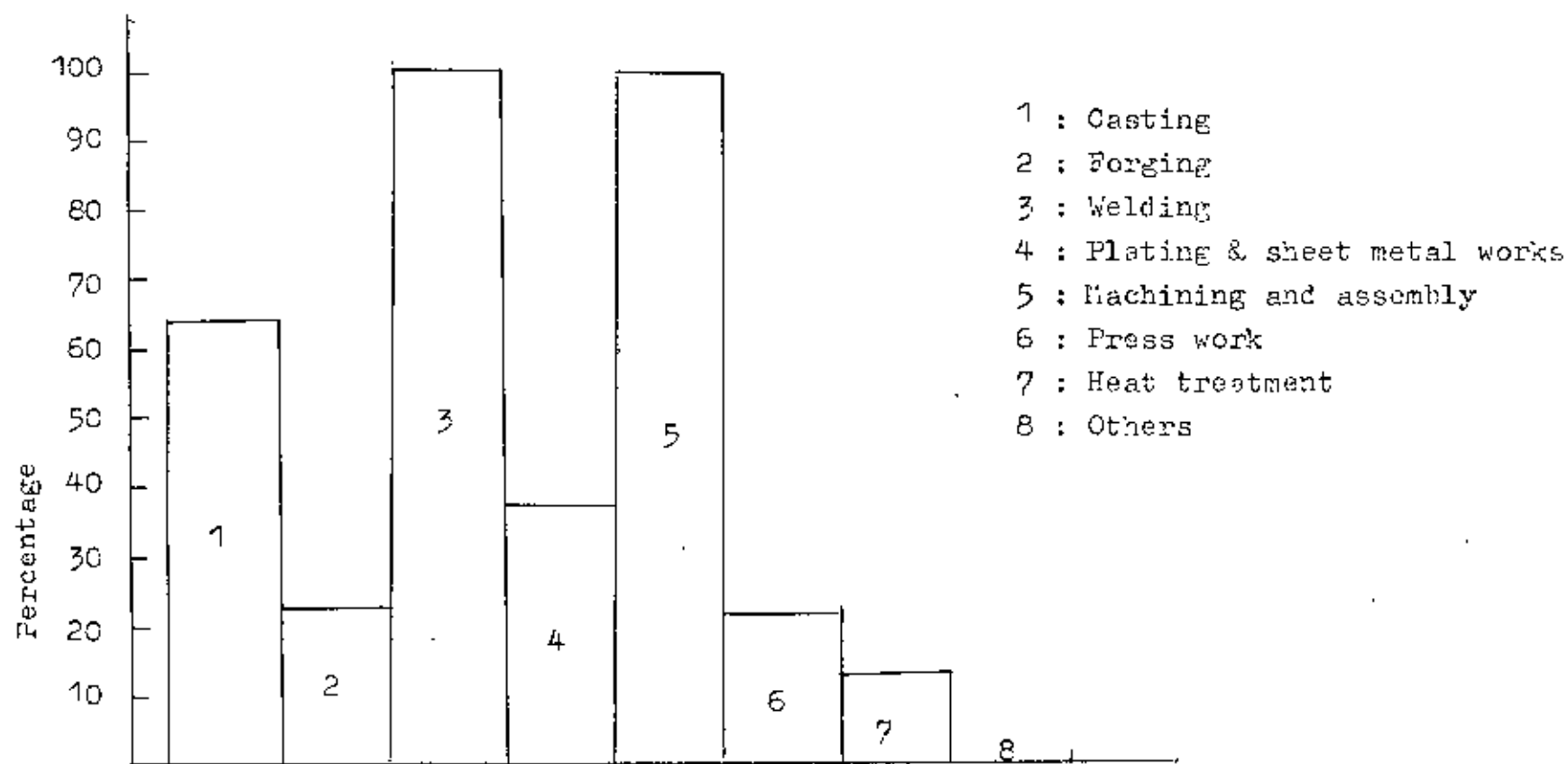


Fig. 5.2: Graphical representation of Table 5.3 for different production process (Total)

Table 5.5: Level of production in metal working (Agricultural) workshops

Production type	DHAKA		KHULNA		BOGRA		TOTAL	
	W	%	W	%	W	%	W	%
Complete manufacturing (from own produced parts) ¹	12	70.6	5	50	4	66.7	21	63.6
Assembly of own & other locally produced items ²	10	58.8	1	10	0	0.0	11	33.3
Assembly from locally produced & imported items ³	5	29.4	3	30	1	16.7	9	27.3
Semi-finished products ⁴	3	17.6	1	10	0	0.0	4	12.1
Parts & components ⁵	5	29.4	2	20	3	50.0	10	30.3
Others like sheet metal, welding etc. work	4	23.5	5	50	4	66.7	13	39.4
Total workshop surveyed	17		10		6		33	

1. A few items like shafts and bearings which are being imported for centrifugal pumps or the parts that are manufactured ^{by} local industries like washers for hand pumps, nut bolts etc. are excluded in the item "Complete Manufacturing"
2. Components from own production and parts, components and semifinished products from other related industries. As for example castings from large foundries are some time machined and assembled at the workshops of Tipu Sultan Road, Dhaka
3. Only assembly works with bought components (both local and foreign made). For example, some workshops assemble the centrifugal pump sets with the pump components, engines rotor or pump base plates as received from different sources. No workshop assembles only imported items.

4. Semi finished parts are those, that require further operations.
5. Parts and components are those, that are ready for next assembly works without further operation.

Table 5.6: Trades of workers in metal working (Agriculture) workshops

Trade of workers	DHAKA		KHULNA		BOGRA		TOTAL	
	W	%	W	%	W	%	W	%
Lathe operator	125	13.7	67	15.0	26	10.3	218	13.54
Drill operator	36	4.0	24	5.4	8	3.2	68	4.22
Shaper "	18	2.0	12	2.7	7	2.8	37	2.30
Fitters	44	4.8	25	5.6	12	4.7	81	5.03
Welders	50	5.5	20	4.5	7	2.8	77	4.78
Milling M/c "	12	1.3	0	0	2	0.8	14	0.87
Multiple M/c "	14	1.5	29	6.5	8	3.2	51	3.17
Electrician	14	1.5	13	2.9	8	3.2	35	2.17
Helpers	235	25.8	113	25.4	17	6.7	365	22.67
Foundry workers	363	39.8	143	32.1	158	62.5	664	41.25
Total numbers workers	911	100.0	446	100.0	253	100.0	1610	100.0

Table 5.7: Employment of workers in workshops having foundry

Trade of workers	Dhaka	Khulna	Bogra	Total	%
Foundry	343	145	135	623	44.4
Machine shop	450	191	54	695	49.5
Others	66	18	11	95	6.1
Total nos. of workers	849	354	200	1403	100.0
Total nos. of workshops	11	6	4	21	

Table 5.8: Level of general education of workers in metal working (agricultural) workshops

Education level	DHAKA		KHULNA		BOGRA		TOTAL	
	P	%	P	%	P	%	P	%
Primary or less	340	37.3	340	76.2	138	54.6	816	50.8
Between primary and class viii	382	41.9	61	13.7	71	28.0	516	31.9
Class ix & x	122	13.4	23	5.2	31	12.3	176	10.9
S.S.C. & above	67	7.4	22	4.9	13	5.1	102	6.3
Total workers	911		466		253		1610	

Table 5.9: Level of technical education of workers in metal working (agricultural) workshops

Vocational/ Technical edu- cation	DHAKA		KHULNA		BOGRA		TOTAL	
	W	P	W	P	W	P	W	P
No training	15	0	4	0	6	0	25	0
Upto 6 months	1	7	5	16	0	0	6	23
6 - 12 months	1	2	1	1	0	0	2	3
12 - 24 months	2	3	0	0	0	0	2	3
Total worker		12		17		0		29

Table 5.10: Experience of workers in metal working (Agricultural) workshops

Experience	DHAKA		KHULNA		BOGRA		TOTAL		
	W	P	W	P	W	P	W	P	%
Upto 12 months	17	47	10	87	6	84	33	218	13.5
12 - 24 months	17	364	10	156	6	77	33	597	37.0
Above 24 months	17	500	10	203	6	92	33	795	49.5
Total workers		911		466		253		1610	100.0

Table 5.11: Knowledge of (Tech.) drawing reading of workers in metal working (agricultural) workshops

Type of Drawing	WT*	DHAKA	KHULNA	BOGRA	TOTAL	
		P	P	P	P	%**
Workshop	911	33	15	8	56	6.14
Foundry	664	21	22	3	46	6.92
Electrical	35	6	2	0	8	22.85
Total workers		60	39	11	110	

* Workers in the respective trade

** Percentage to total number of workers in the respective trade

Table 5.12: Mode of Job Instruction in metal working (Agricultural) workshops

Medium of instruction	DHAKA	KHULNA	BOGRA	TOTAL	
	W	W	W	W	%
Drawing & specification supplied by owner	16	2	2	20	60.6
Sample of the job	17	9	6	32	96.9
Own design and drawing	3	1	2	6	18.2
Verbal instruction	5	4	2	11	33.3
Total workshop surveyed	17	10	6	33	100.0

Table 5.13: Use of Measuring tools in metal working (agricultural) workshops

Measuring Tools	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
Scale	17	10	6	33	100.0
Calipers	17	10	6	33	100.0
Vernier calipers	14	10	6	30	90.9
Micrometer	9	0	3	12	36.3
Dial gauges	2	0	1	3	9.1
Bevel protectors	7	0	1	8	24.2
Thread gauge	12	10	5	27	81.8
Snap gauges	2	0	0	2	6.1
Plug gauges	3	5	2	10	30.3
Others	1	0	1	2	6.1
Total workshop surveyed	17	10	6	33	

Table 5.14: Workers knowledge of fits & tolerance, standard of quality control in metal working (agricultural) workshops

Category	DHAKA		KHULNA		BOGRA		TOTAL		%*	%**
	W	P	W	P	W	P	W	P		
No knowledge	11	-	10	-	2	-	23	-	69.7	-
Fits & tolerance	6	8	0	0	4	9	10	17	30.3	1.06
Standard for quality control	0	-	0	-	0	-	0	-	0.0	-

* Percentage of workshop to the total number of workshop visited

** Percentage of worker to the total number of workers in the industry

Table 5.15: Sample checking practice

Category	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
No practice	16	7	2	25	75.7
Occasional sample checking	1	1	4	6	18.2
First piece inspection	1	2	0	3	9.1
Total workshop surveyed	17	10	6	33	

Table 5.16: Method of measurement & inspection of job of the workshops

Method	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
Visual inspection	17	10	5	32	96.9
Physical measure- ment	8	9	5	22	66.7
Others	0	0	0	0	0.0
Total workshop surveyed	17	10	6	33	

Table 5.13 & Table 5.16 may be read together

Table 5.22: Operational constraints of the metal working (agricultural) workshops

Nature of problems	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%*
Demand of products	3	7	3	13	39.4
Supply of electricity	17	0	6	23	69.7
Shortage of working capital	9	7	4	20	60.6
Blocked capital with customers	0	3	0	3	9.1
Customers purchasing capacity	0	0	2	2	6.1
Job procurement	1	0	0	1	3.0
Marketing	0	0	0	0	0.0
Labour unrest	1	0	00	1	3.0
High cost of prodn.	4	1	4	9	27.3
Shortage of raw material	7	0	4	11	33.3
Old machinery & equipments	3	0	0	3	9.1
Too much materials wastage	1	6	0	7	21.2
Ineducate production machinery...	5	0	0	5	15.2
Highly unutilized capacity	3	0	1	4	12.1
Insufficient repair facility for machinery	2	0	2	4	12.1
Others (competition, workers departure etc.)	5	0	0	5	15.2
Total workshop surveyed	17	10	6	33	

* Percentage to total number of workshops surveyed

Table 5.17: Percentage of defects of products in terms of annual production volume in Taka of metal working (agricultural) workshops

Percentage of defects	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
1 to 10%	12	10	5	27	81.8
Between 10 - 15%	4	0	0	4	12.1
Between 15 - 25%	1	0	1	2	6.1
More than 25%	0	0	0	0	0.0
Total workshops	17	10	6	33	100.0

Information collected through interview of Managers

Table 5.18: Classification of the workshops according to the cause of defects of products manufactured

Cause	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
Due to workers	15	10	6	31	93.9
Poor raw materials	11	7	3	21	63.6
Others (power failure, tools etc.)	7	0	0	7	21.2
Machine in accuracy	0	0	0	0	0.0
Shortage of total measuring instrument	0	0	0	0	0.0
Absent of quality control practice	0	0	0	0	0.0
Total workshop surveyed	17	10	6	33	

Table 5.19: Knowledge of workers on production parameters

Category	DHAKA P	KHULNA P	BOGRA P	TOTAL P	%
Different metals	82	36	13	31	8.13
Material composition	80	24	8	112	6.95
Heat treatment	2	2	3	7	0.43
Different cutting tools	105	51	12	168	10.43
Cutting condition	107	51	5	163	10.12
Idea of importance of quality control	96	0	3	99	6.14
Different production processes for the operation	0	0	1	1	0.06
Surface finishing	0	0	0	0	0.0
Different measuring tools & techniques	138	68	19	225	13.97
Total workers in the workshop surveyed	911	446	253	1610	

Table 5.20: Shopwise time utilization of the production facilities

a. Lathe

Utilization %	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
>0 - 25%	0	0	0	0	0.0
>25 - 50%	0	1	2	3	9.09
>50 - 75%	2	0	1	3	9.09
>75 - 100%	15	9	3	27	81.81
Total workshop surveyed	17	10	6	33	100.0

b. Drill

Utilization %	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
> 0 - 25%	3	2	0	5	15.15
> 25 - 50%	2	1	3	6	18.18
> 50 - 75%	3	2	2	7	21.21
> 75 - 100%	9	5	1	15	45.45
Total workshop surveyed	17	10	6	33	100.0

c. Shaper

Utilization %	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%*
> 0 - 25%	1	0	2	3	12.5
> 25 - 50%	1	2	0	3	12.5
> 50 - 75%	2	1	1	4	16.6
> 75 - 100%	10	1	3	14	58.4
Total workshops having shaper	14	4	6	24	100.0

* Percentage to total number of workshops having shaper

d. Welding set

Utilization %	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%*
> 0 - 25%	4	8	4	16	48.48
> 25 - 50%	4	1	1	6	18.18
> 50 - 75%	0	0	0	0	0.0
> 75 - 100%	9	1	1	11	34.34
Total workshops having welding sets	17	10	6	33	100.0

* Percentage to total number of workshops having welding set

e. Milling machine

Utilization %	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%*
> 0 - 25%	0	0	0	0	0.0
> 25 - 50%	2	0	1	3	50.0
> 50 - 75%	1	0	1	2	33.33
> 75 - 100%	1	0	0	1	16.67
Total workshop having milling machine	4	0	2	4	100.0

* Percentage to total number of workshops having milling machine

f. Workshop grinder

Utilization %	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
> 0 - 25%	3	4	0	7	23.33
> 25 - 50%	10	2	4	16	53.34
> 50 - 75%	0	0	0	0	0.0
> 75 - 100%	4	1	2	7	23.33
Total workshops having grinder	17	7	6	30	100.0

* Percentage to total number of workshops having workshop grinder

g. Foundry equipment

Utilization %	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%*
> 0 - 25%	0	1	0	1	4.76
> 25 - 50%	3	0	2	5	23.81
> 50 - 75%	3	2	0	5	23.81
> 75 - 100%	5	3	2	10	47.62
Total workshops having foundry	11	6	4	21	100.00

* Percentage to total number of workshops having foundry equipt.

h. Carpentry

Utilization %	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
> 0 - 25%	1	0	0	1	14.28
> 25 - 50%	0	0	2	2	28.57
> 50 - 75%	0	0	0	0	0.0
> 75 - 100%	2	0	2	4	57.15
Total workshops having carpentry	3	0	4	7	100.0

* Percentage to total number of workshops having carpentry

Table 5.21: Amount of subcontract work executed by the workshops
(percentage of the sales revenue)

Percentage of subcontract	DHAKA W	KHULNA W	BOGRA W	TOTAL W	%
1 to 10%	13	5	5	23	69.69
10 - 20%	0	1	1	2	6.06
20 - 30%	2	1	0	3	9.09
More than 30%	2	3	0	5	15.15
Total workshops surveyed	17	10	6	33	100.00

As informed by the managers on query

5.4 Major Findings of the Survey Analysis

Reference (Table)

Machining, assembly, welding are the common processes that are being employed by the metal working workshops. Material treatment, plating and machine forging are not so widely practiced 5.2, 5.3

Casting industries are mostly engaged in the manufacture of various agricultural pumps. Other workshops are engaged in the manufacture of spare parts for various machinery and their components 5.4

Casting industries mostly produce finished products (63.6%) from unprocessed raw materials. Production of semi finished parts and components are not so practiced by the workshops (12.12%) 5.5

Majority of the workforce of the industry are employed in the casting process in foundry (41%). In 21 number workshops having foundry, 44% workers working foundry and 49% in the workshops. Among different machine operators, Lathe operators are the majority (13.54%). Milling machine operators number is very negligible (0.87%). This also indicates that milling machines are rarely used in the industry. 5.6, 5.7

A great number of workers are educated upto class eight (79%). Workers having education above class eight represent only 21% of the total work force. Technically educated or vocationally trained peoples are almost absent. Out of a total 1610 number workers in the 33 workshops visited, only 34 persons have some sort training/technical education. 24 workshop have got not such technically educated or trained people. 5.8, 5.9

About 54% of the total work force have got experience in the industry for more than two years. Fresh recruitments within the last one year is quite low (13.5%). 5.10

Reference
(Table)

Worker's knowledge of reading technical drawings of any sort is very poor. Out of 911 number machine operators & helpers, 56 people can read workshop drawing to some extent. It has been observed that out of 110 people who can read drawing, 81 (74%) learned through experience & working with people who can read drawing.

5.11

Almost all the workshops follow the sample supplied by the owner for production purpose (97%). At the same time 60% of the total workshops manufacture their products following drawings and specification of the products.

5.12

The mostly used measuring tools are scale, callipers, thread gauges, micrometers and vernier callipers. Machine operators have good knowledge of vernier reading. The use of plug gauges in the mass producing casting industries is also noteworthy (30%)

5.13

State of knowledge of quality control by way of sample checking among the workers, is very poor. Only the workers working in the large foundry workshops have got working knowledge of fits and tolerances. Workers are not at all aware of any standard, for quality or production. In 76% of the total workshops visited there did not exist any sort of quality control practice. In the rest of the workshops there existed the practice of sample checking. Visual inspection is most commonly used. Physical measurements of the dimension are checked during production stage after production no further inspection or measurement at the store or before delivery are usually made. Destructive tests or inspection with X-Ray or ultrasonic devices is totally absent & people does not have any knowledge of it.

5.14, 5.15

5.16

Percentage of rejects of the products throughout the year is well within 10%. Workers negligence, lack of skill and quality consciousness and of cost of production are the major causes of defects. (94%) poor raw materials also account to a great extent.

5.17, 5.18

Reference
(Table)

State of Technical Know-how have been revealed during study as very poor. On the average 10% of the total workers in the industry have got some idea of different metals, metal composition, cutting tools and different cutting condition. But they are almost ignorant of Heat treatment surface finishing, plating works and different production processes.

5.19

As regards to the utilization of different production facilities Lathe is used almost throughout the working hours round the year. 82% of the total workshops operate lathe more than 75% of the total working period. Next comes Drills, Shapers and welding sets. Use of milling machine is rather uncommon. Out of 22 number foundry workshops furnace are utilized for melting metals for more than 75% of the total working period at their rated capacity in 10 number industries.

5.20

Job received through subcontract does not represent any significant volume, 75% of the workshops have production of 10% of their total annual revenue through subcontract.

5.21

Shortage of working capital (61%), energy supply (70%), demand (39%), high cost of production are the major problems faced by the owners and management of the industry. As regards technical problems shortage of raw materials (33%), Too much materials wastage (21%) and inadequate production machinery (15%) are noteworthy. Shortage of raw materials may well be correlated with the shortage of working capital. Too much material wastage may be related with the poor state of technical know-how, lack of quality consciousness, reluctance to the increased cost of production of the workers.

5.22

5.4.1 It has been revealed on analysis that Forging operation is totally absent for the sample space for the workshops of Khulna zone. The same thing has been observed for the operations of Heat Treatment and Press Work for Dhaka zone. By taking of a larger sample size, it could be expected that the picture would change to some extent. These processes are in fact being practised by very few number workshops of these zones.

5.4.2 As this research work has been carried out as a project work instead of Thesis work, workshops of three particular zones have been surveyed due to limitations of time and limited scope of work. Choice of a larger number of zones covering the entire country and a bigger sample size for each zone, would have yielded a better picture of the total population of workshops of the country.

CHAPTER - 6

CONCLUSION, RECOMMENDATION AND SCOPE OF FUTURE WORK

6.1 Conclusion and Recommendation

The economic viability of Bangladesh depends on the growth and development of rural economy. Efforts are therefore being made on a top priority basis to develop agriculture. But agriculture with low productivity can not guarantee the desired growth. Industrialization for manufacturing of agro supporting implements can play its role as an integral part of agriculture for generating permanent employment and revitalizing rural economy. And in view of the magnitude of the rural scene, small scale metal working workshops, producing agricultural implements have been categorized as pragmatic field where industrialization efforts should be geared up with greater emphasis.

Keeping in view of the necessity of the time for increased agricultural productivity with upto date technological input in respect of manufacturing agricultural implements the present study was undertaken with specific objectives in the field of development of human resources in the metal working industries producing agricultural machineries and implements. The manufacturing processes to be followed for production of these implements have been identified. The technological know-how and technology of these implements have been listed.

It has been observed that the capability of workers to read workshop drawings, their knowledge of quality of products and its control is very poor. In some workshops the need for quality maintenance has not been understood. Only 36% of the shops use micrometers. 50% of the workers are primary dropouts. Only 6.3% of the workers have grade X education. Out of 1840 workers of 33 workshops only 29 have technical training for 6 months or more. Only 8% of the workers have any knowledge of metals, 0.43% have some knowledge of heat treatment. 6.14% of the workers have some idea on importance of quality control whereas only 1.06% of workers know about fits and tolerance. None in the entire industry appeared to have idea of grades of surface finishing. Most of the workers are on job trained (through "ostads"). About half of them have above two years of on-job training.

Supply of electricity (62.7%), shortage of capital (60.6%), demands of products (32.4%) and shortage of raw materials (33.3%) are the major hinderances towards higher productivity and contribution of the shops.

Promotion and expansion of technological know-how of the workers in the rural working sector, to produce durable, cheap and better quality agricultural implements should be taken as the first step towards increased productivity on the agricultural sector of economy. And for this purpose the prime need is a well

thoughtout plan of small and medium scale metal working workshops development, having properly trained, qualified and skilled manpower as main productive force and also introduction of upto date technology for production of the selected implements. For development of the workshops and of the human resources of this particular sector of metal working industry the necessary steps include the provision of sufficient promotional and expansional programmes, production, marketing and informational facilities and as well as setting up of appropriate institutions, manned with qualified and experienced people with the objective of technology transfer to the metal working workers and entrepreneurs. In this context it may be noted that qualitative and quantitative development of these workshops can be achieved through introduction of proper technology and efficient running of the workshops. This can be possible only when the desired inputs are channelized with all earnestness in time.

6.2 Scope for Future Work

The study was limited to the workshops, situated in industrialized urban areas. Due to certain limitations the study could not be extended to the workshops of Sub-divisional or Panchayat level where the agricultural implements have been thought to be manufacturing the implements should be rural oriented and manned by people who have day to day relationship in respect of the works and livelihood with the common people of villages. The

study of the rural based workshops and of the workers working there, would definitely yield precise informations regarding appropriate technology for manufacture of implements their exact demand pattern over the years and technology transfer procedures to the industry.

By identifying the agricultural implements, the production processes and the technology input requirement for the workers, the works in this field cannot be considered as finished. There is much more still left to be done in this sector. Future studies may be guided to -

- i) to identify the constraints in technology transfer or resistive factors to the rural working workshops processes, for producing agricultural implements
- ii) to design and innovate through R&D works, appropriate agricultural implements and their production processes, for production by rural workshops
- iii) establishment of demand pattern for different agricultural implements for respective, say the Ugazille or subdivision basis and accordingly develop design or production facilities, technology requirements may be assessed for establishment of some ideal workshops for each Ugazille or Sub-division.
- iv) Setting up of details of improved development schemes after obtaining base line data from rural area
- v) Study may also be directed to the design and production of improved implements like the old, old, old, even with components and to the recovery of technology for it requirements for the workers
- vi) Study may be carried on diversification of rural working workshops in line with the requirements of various products in the industrial, transportation, construction and household sectors and on inputs of associated technology requirements and development of appropriate production facilities.

B I B L I O G R A P H Y

- (1) Bangladesh Bureau of Statistics, "Statistical Pocket Book of Bangladesh" 1981-82, 1982-83. Govt. of Bangladesh
- (2) Huq Rafiqul and K.Laskar, "A Study on Wayside Engineering Shops in Dhaka" - undergraduate thesis, Department of Mechanical Engineering, BUET
- (3) Azim, M.A. "A Study on Wayside Engineering Shops in Dhaka" Journal of Institute of Engineers', Bangladesh, Vol.6, Numbers 3-4, July-October, 1978
- (4) Hossain Sazzad, et al, "Studies on Spare Parts Manufacturing in Bangladesh" undergraduate thesis, Department of Mechanical Engineering, BUET, Dhaka
- (5) Technonet Asia, JICA and Others, "Small and Medium Scale Metal Working Industries, Bangladesh and Sri Lanka" April, 1979 - March, 1980 published by - Technonet Asia, Tanglin, P.O. Box - 160, Singapore 9124
- (6) JICA, "The study on Development Plan of Small Scale Industries" September, 1980
- (7) Appropriate Technology Cell, "Survey Report on Present Available Manufacturing Capacity in Private Sector for Production of Simple Agricultural Tools and Implements" BARC, 1980
- (8) Sharafat, A.M. "Evaluation of Workers' Job Performance and its Relation with Labour Productivity in Manufacturing Units" M.Sc. (Engg.) Thesis, January, 1984, Deptt. of I.P.E.
- (9) Agricultural Engineering Division, "Indigenous Agricultural Tools and Equipments of Bangladesh" BARC, 1982
- (10) Ministry of Commerce & Industries, "Directory of Selected Industrial Products" Govt. of Bangladesh, January, 1984
- (11) Article on, "Subsidies on Agriculture" The Daily Ittefaq, 14.6.84.

ANNEXURE - I

Study on the Technological Inputs for the Workers of
Small and Medium Scale Metal Working Workshops in the Field
of Production of Agro Supporting Implements in Bangladesh.

Name of the Company/Workshop:

Owner:

Address, Telephone etc:

Q U E S T I O N N A I R E

✓ for appropriate answer

- 1) Type of process employed:
 1. Casting
 2. Forging
 3. Sheet metal working & Welding
 4. Plating
 5. Mechaning, assembly etc.
 6. Press work
 7. Material treatment
 8. Others
- 2) Main product of firm:
 1. Agricultural pumps
 2. Agricultural equipments
 3. Agricultural spares & accessories
 4. Engine spares
 5. Others
- 3) Main production type:
 1. Fabrication from parts product by them
 2. Assembly from locally produced items
 3. Assembly from imported & locally produced items
 4. Semifinished products
 5. Parts & components
 6. Others

4)	Number of workers in different trade:	1. Lathe operator	Persons
		2. Drill "	
		3. Shaper "	
		4. Welders	
		5. Fitters	
		6. Milling	
		7. Multiple machines	
		8. Electrician	
		9. Helpers	
		10. Moulders & others	
		Total	Persons
5)	Workers education level:	1. Primary or less	Persons
		2. Upto class viii	
		3. Class ix to x	
		4. S.S.C and above	
6)	Vocational/Technical education:	1. None	Persons
		2. Upto 6 months	
		3. 6 to 12 months	
		4. 12 to 24 months	
7)	On the job training;	1. Upto 12 months	Persons
		2. 12 to 24 months	
		3. Above 24 months	
8)	Knowledge of technical drawing:	1. Workshop drawing	Persons
		2. Foundry "	
		3. Electrical "	
		4. Others	
9)	Manufacturing depends on:	1. Drawing & specification supplied by owner	
		2. Sample of the job	
		3. Own design & drawing	
		4. Verbal instruction	

- 10) Measuring tools used:
1. Scale
 2. Callipers
 3. Vernier callipers
 4. Micrometer
 5. Dial gauge
 6. Bevel protectors
 7. Thread gauge
 8. Snap gauge
 9. Plug gauge
 10. Others
- 11) Knowledge of quality:
1. None
 2. Fits & tolerance
 3. Standard for quality control
- 12) Presence of quality control:
1. None
 2. Occasional sample checking
 3. First sample checking
- 13) Method of quality control:
1. Visual inspection
 2. Physical measurement by instrument
 3. Others
- 14) Average percentage of defects for different products:
1. 1 to 10%
 2. 10 to 15%
 3. 15 to 25%
 4. More than 25%
- 15) Cause of defects:
1. Machine accuracy
 2. Shortage of proper measuring instruments
 3. Due to workers
 4. Absence of quality control practice
 5. Poor quality of raw materials

- 16) Technical know-how:
1. Different metals
 2. Material composition
 3. Heat treatment
 4. Different cutting tools
 5. Different cutting condition
 6. Idea of quality control
 7. Different production process
 8. Surface finishing
 9. Different measuring tools & techniques
- 17) Estimated utilization of production machinery of total working hour:
1. Lathe %
 2. Drill %
 3. Shapers %
 4. Welding sets%
 5. Milling machines %
 6. Grinders %
 7. Foundry equipments %
 8. Carpentry %
- 18) Amount of sub-contract received in percentage of annual sales volume in Taka
1. 1 to 10%
 2. 10 to 20%
 3. 20 to 30%
 4. More than 30%
- 19) Problems for the management:
1. Sales
 2. Demand
 3. Marketing
 4. Price
 5. Payment
 6. Labour unrest
 7. Energy supply
 8. Shortage of working capital

9. Shortage of raw material
10. Too much material wastage
11. Old machinery & equipments
12. Highly unutilized capacity
13. High cost of production
14. Inadequate production
machinery
15. Lack in customers purchasing
capacity
16. Insufficient repair capacity
for production machinery

ANNEXURE - II

Name and address of the workshops visited during field survey.

<u>Name of Company/Workshop</u>	<u>Address</u>
<u>DHAKA ZONE</u>	
1. M/s. Kazal Parvez Ltd.	189, Tejgaon Industrial Area,
2. M/s. Meen Co Casting Industries	210/B, Tejgaon Industrial Area
3. M/s. Ittefaq Industries Corporation	198/A, Tejgaon Industrial Area
4. M/s. Ideal Casting Industries	492, Tejgaon Industrial Area
5. M/s. Ecco Industries	232/234, Tejgaon Industrial Area
6. M/s. Loma Engineering Corporation	190, Tejgaon Industrial Area
7. M/s. Bikrampur Engineering Works	4/2, Tejgaon Industrial Area
8. M/s. Essential Products Ltd.	186, Royer Bazar,
9. M/s. Comilla Engineering & Casting Ltd.	A/97, BSCIC Industrial Area Tongi
10. M/s. Bangladesh Foundry & Engineering Works	118, BSCIC I.A., Tongi
11. M/s. General Engineering Works	B/38-39, BSCIC I.A., Tongi
12. M/s. Badda Metal Industries	1400, BSCIC I.A., Tongi
13. M/s. Bikrampur Engineering Works	Station Road, Tongi
14. M/s. S.K. Engineering	10, Hatkhola
15. M/s. Shahinoor Engineering Works	Hatkhola, Tipusultan Road
16. M/s. Quality Engineering Works	25/5, Tipusultan Road
17. M/s. Joynal Abedin & Co.	15/18, 19 Tipusultan Road

KHULNA ZONE

- | | | |
|-----|--|------------------------|
| 1. | M/s. National Iron Foundry & Engg. Works | Junction Road |
| 2. | M/s. H.N. Poddar & Co. | Jessor Road |
| 3. | M/s. Pubali Engg. Works | Ser-e-Bangla Road |
| 4. | M/s. National Engg. Co. | Cemetery Road |
| 5. | M/s. Bangladesh Allied Industries | Junction Road |
| 6. | M/s. Quashem Foundry & Engineering Works | Old Jessor Road |
| 7. | M/s. Hafiz Engineering Works | 264, Ser-e-Bangla Road |
| 8. | M/s. Mafiz Engg. Works | KDA Avenue |
| 9. | M/s. Metro Metallic Ind. | Old Jessor Road |
| 10. | M/s. M. Hossain & Bors. | BSCIC, Shiromoni |

BOGRA ZONE

- | | | |
|----|-----------------------------|-------------------------|
| 1. | M/s. Standard Engg. Works | Rangpur Road |
| 2. | M/s. Feroz Metal Works | BSCIC Industrial Estate |
| 3. | M/s. Mustafa Jahangir Bros. | BSCIC Industrial Estate |
| 4. | M/s. Bhandari Iron Works | College Road |
| 5. | M/s. Bogra (Pvt.) Ltd. | BSCIC Industrial Estate |
| 6. | M/s. Zahed Metal Industries | Rangpur Road |

