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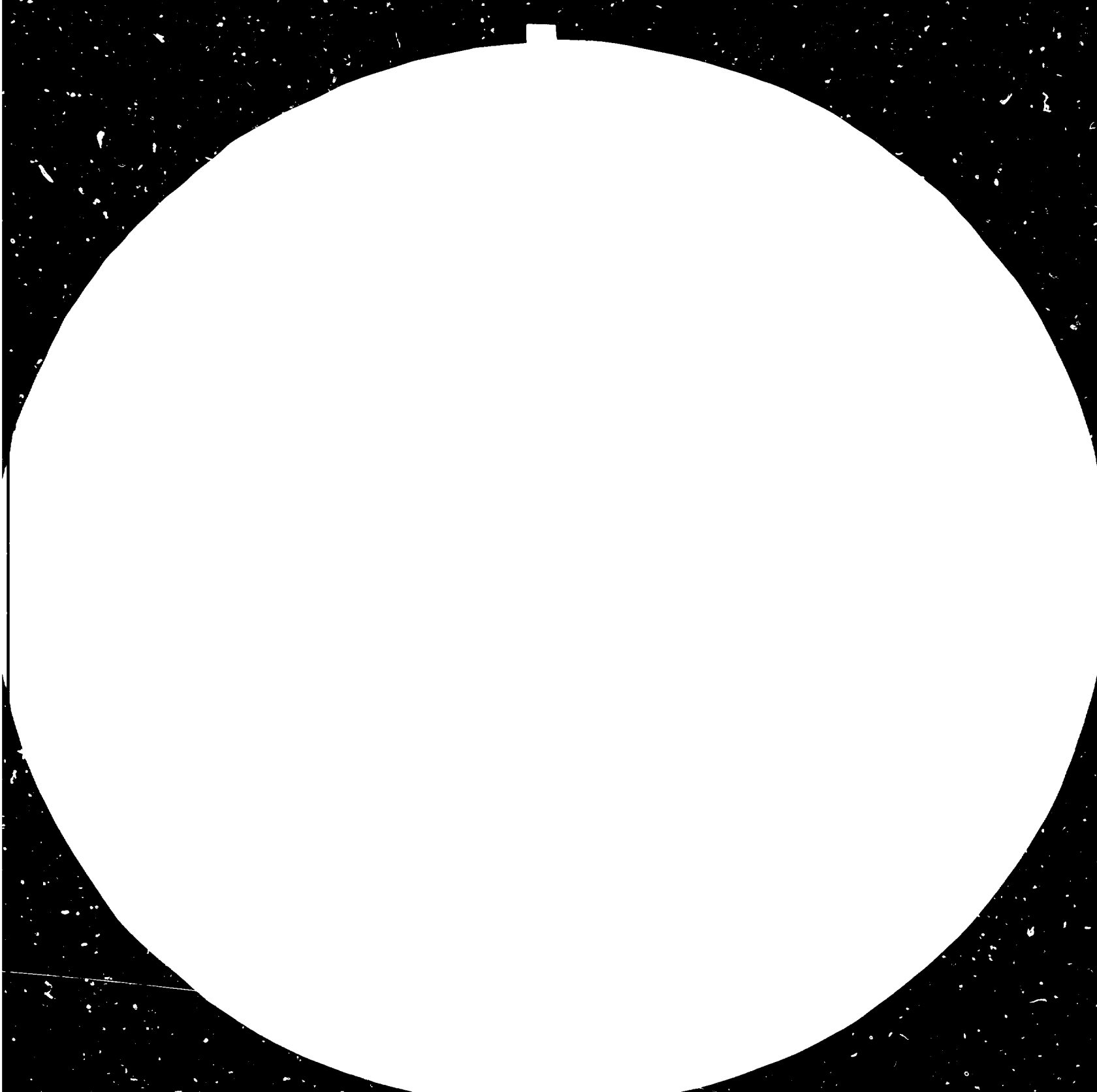
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[ESTABLISHMENT OF MULTI-PURPOSE AGRICULTURAL
MACHINERY PLANT]

(draft)]

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1. Introduction

The Second Consultation Meeting on the Agricultural Machinery Industry, held in Vienna, Austria, 17-21 October 1983, proposed the issue of the integrated manufacture of agricultural machinery and capital goods. After extensive discussion, the participants recognized the desirability of establishing multi-purpose agricultural machinery plant to meet the diversified requirements of farmers and allied sectors as well, as one of the most appropriate approaches to tackle the problem of agricultural mechanization and rural development in some developing countries.

This paper, mainly based on the experience of such plants in China, is to assess the validity and necessity for establishing the multi-purpose plant, to identify the prerequisites for successful operation of the plant. For reference, this paper briefed the Tongxian Agricultural Machinery Manufacture and Repair Plant. At the end, the paper made some suggestions trying to help realize the recommendations by the Second Consultation Meeting.

2. Validity and Advantages of Establishing Multi-Purpose Plant

A multi-purpose agricultural machinery plant could be understood as a universal plant which will not only serve the agricultural sector, but also serve the related capital goods and even the public utility and household. The plant will make, mostly in batch-level production, simple hand tools, intermediate implements and also the motorized equipment, to suit the diversified requirements of farmers. The plant will not only manufacture but will also repair farm implements and tractors.

As is well known to all, application of appropriate farming tools and equipment, integrating with biological and chemical measures, is the basic way to increase agricultural productivity, unit yield and total production. It is also the most effective way to solve the critical problem of feeding billions of underfed people of the world.

It is obvious, agricultural production is closely related with natural conditions (like climate, soils, crops, etc.) and economic, technical and societal conditions as well. These conditions will vary from region to region, from country to country, they will differ from place to place even in the same country. Consequently, there is no unique agricultural production system applicable everywhere, which results in the emergence of various different mechanization modalities

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as well as various different farming tools and equipment. Probably the farming systems and tools used in some developing countries present a more complex picture.

In the less mechanized developing countries, whether with intensive farming or with extensive farming, have some thing in common, inter alia, low produce commodity, more or less self sufficient, poor infrastructure especially the transportation facilities. Almost all kinds of tools and equipment have to be manufactured and sold in the vicinities. As the farming technic and economic conditions are progressing unevenly among farmers, simple hand tools and sophisticated machines are needed for production simultaneously. In a word, the farmers need all sorts of tools. They need tillage tools, seeders, planters, pumps, dusters, sprayers, cultivators and harvesting implements. Intensive farming operators always intend to broaden the scope of business, they try to make use of all local available resources to develop diversified economy. They need tools and equipment for fishery, animal husbandry, forestry and sideline occupations. They need feed grinders, hay and forage handling implements, agricultural produce primary processing machines, oil expellers, cotton gins, flour mills and the food processing equipment. They also need facilities for storing and transporting agricultural products.

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The problem needs careful and down-to-earth consideration: how to start to build the industry to meet so many diversified requirements in a country where there is no industrial environment.

The evolution of industry has shown that specialization production is a progressive mode of production which has been practiced almost in all developed countries. A plant, specialized in making a single product or even a single part, is easily to be equipped for mass production. It is apparent that the cost of mass production is low, quality is good and the plant management is comparatively easy. However, the specialization production, though it is progressive, is not applicable to the developing countries, especially at the beginning of industrialization. The establishment of multi-purpose plant, making use of local resources and manpower and applying appropriate technology, to meet the local needs, would be the most practical solution. To emphasize the principle of self-reliance, the multi-purpose plant is the starting point to initiate the development of indigenous industry for the developing countries.

In most developing countries, tractors and power units are imported from outside, so the multi-purpose plant must be capable of repairing them in time to guarantee seasonal farming operations.

Due to the fact that the multi-purpose plant might be the only machinery plant in the district, it must, aside from serving

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agriculture, extend its service to other sectors, like repair of automobiles and construction machines as well as the manufacture of tools or parts which use the similar technology and materials as the agricultural machines. Furthermore, in order to fully utilize the existing facilities, the plant is encouraged to build and repair the equipment for public utility and even the household appliance.

In China, the farmers summarize the experience of developing agriculture in the past years as follows: "If the farmers want to be prosperous, they must develop diversified economy besides crop production. If the agricultural machinery plants want to get a foothold in the country and become flourishing, they must do whatever the farmers need".

This transition, alongside with the new agricultural policy (job responsibility), has produced historical effects on Chinese rural economy, namely: record high agricultural production, prosperity of farmers and the categories and amount of agricultural implements bought by farmers have been greatly increased, and the demand of some sorts have already surpassed the capacities of the agricultural machinery plants.

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3. Some Prerequisites for Successful Operation of a Multi-Purpose Agricultural Machinery Plant

Before everything else, the governmental support, especially in policy making and financial aid at the early stage, is of vital importance for successful establishment and operation of a multi-purpose plant.

Here are some requirements to be met for the plant:

3.1 Feasibility Study

Experience in the past has fully shown that the feasibility study of a plant, regardless of size, before starting design, is of paramount importance for its successful establishment and operation. Qualified experts (engineers, agronomists, economists) must go together to the country to investigate the conditions at the grass roots, such as the specific needs of the farmers, categories and volume of products, purchasing power and potential market, local resources, infrastructure especially the transportation facilities, the available source of materials and purchased parts or components, as well as the economic analysis of the plant. The feasibility study must be discussed, debated and corrected if necessary, and approved finally by relevant authorities.

To be a multi-purpose plant, the requirements of allied sectors besides agricultural machinery must also be taken into consideration.

A plant, designed on assumptions, is doomed to failure.

3.2 Higher Level of Management

It is obvious that the management skill of a multi-purpose plant, in comparison with the specialization plant, is much more complicated. The directors will meet new issues and handle new problems everyday, such as rationalization of product mix and production volume to meet the seasonal farming needs, choice of appropriate technology to minimize production cost, control of stockyard in order to reduce capital tie-up, making readjustment of the production plan and timely despatch production. So, the directors usually do not appreciate the job of running a multi-purpose plant. It is absolutely necessary to convince the management staff that the multi-purpose plant is the most appropriate way to start with, and the experience of successful operation will eventually lead to the establishment of local manufacture industry. The management staff must be well trained so that they are well equipped with necessary knowledge and skills to run the plant.

3.3 Standardization

It seems too early to consider standardization before a multi-purpose plant is put into operation. Yet it deserves great attention and taking immediate and effective measures at the beginning. At least there are two reasons:

- (a) A multi-purpose plant does not imply that it must make every parts or components itself, especially at the early stage. As

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a matter of fact, it must, through some kind of contracts, buy the standard parts and components already mass produced in other plants within or outside the countries, such as plow shares, rasp bars for threshers, cultivator tines, knife-sections for reapers, nozzles for sprayers, etc. It will reduce the cost of manufacturing if made by itself, and expediate the production of implements.

(b) Standardization is an important technical policy for a country to develop industry and also necessary for international co-operation. Negligence of standardization will sooner or later cause troubles not only for industry itself, but also for the end-users.

3.5 Workers and Facilities

The workers of a multi-purpose plant must be multi-skilled or expert in one thing and good at many. For example, the machinists, at least the foremen must be capable of operating lathe, drill, grinder, planer, making some calculations and simple drawings.

The machines tools must be universal in function. After changing different jigs and fixtures, they can be fitted to work on different jobs with different dimensions and configurations.

As to the technic of repair, it is most desirable to replace the worn out parts with new ones if sufficient spare parts are available. If not, certain special repair rigs must be provided to expedite repair work and guarantee the quality. It is encouraged

to use simple and reliable repair technology without involving sophisticated skills and facilities, such as the metal gluing technic.

It is advisable, according to the experience of some plants already in operation, to set up a simple foundry shop with a small cupola and some melting pots for melting non-ferrous metals. This will greatly increase the capability of repairing, manufacturing and widening the scope of service.

3.6 Post-sale Service

Post-sale service is one of the critical factors which determine whether the plant can get a foothold or not, yet it is often ignored. Set up a service unit and send workers to visit farmers and follow-up the machines sold and make some minor repairs right in the countryside. In the slack season, open up training courses for the farming hands to teach them to operate the machines correctly and maintain the machines in good shape. This will in turn help the plant to get a good reputation and thrive. The training course must be subsidized by the Government.

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4. Introduction of Tongxian Agricultural Machinery

Repair and Manufacture Plant

In the whole country of China, there are about 2200 agricultural machinery manufacture and repair plants at county level. Most of the plants are run by the local governments, with only a few owned collectively. An average plant has around 120 workers, 7 technical personnel, 4000 square meters or production area, and 42 principal machine tools and equipment.

The Tongxian plant, as introduced below, is in the bigger scale category, well equipped and operated quite successfully. It serves the farmers of the whole county with a farming area of around 50,000 hectares. It also sells products, like small air compressors for braking systems used on tractors and automobiles in several provinces. The yearly production value amounts to 3,000,000-4,000,000 Chinese yuan and making a net profit of around 50,000 yuan.

(1) Scale

Production area - 5200 square meters

Engineers and technicians - 13

Workers - 375

Principal machine tools and equipment - 70

Materials consumed yearly: steel - 80 tons

pig iron - 310 tons

Electric power consumed - 600,000 KWH

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(2) Range of Products and Service

Tractors repaired - 200 units

Small air compressors for tractors and automobiles - 4 sizes
- 11,000 units

Tractor spare parts

Feed mills, complete set, 4 tonages, for animal husbandry

Fodder crushers

Wheat and rice reapers

Corn planters

(3) Machine Tools and Equipment (principal)

Foundry shop: Cupola (2 tons), moulding machines (2),
sand preparation machines, core dryers and
melting pots

Forging shop: pneumatic hammer (150 kg), friction press (300 tons),
drop hammer, muffle furnace (2), oil baths, electric
welder and gas welders

Machine shop: general purpose lathes (12), cylindrical, face,
centreless grinding machines; tool grinder; milling
machine, boring machine, honing machine, radial
drill and press drills

Repair shop: general purpose lathes, universal milling,
boring machine, honing machine, crankshaft,
cylindrical, face grinding machines,
magnetic defect detector,
18 special repair rigs and test stands

for washing and cleaning
for chasis repair
for piston and crankshaft dismantlement
and repair (D + R)
for cylinder head D + R
for gearbox D + R
for fuel pump and nozzle D + R and test
hydraulic system test stand
electric system test stand
hydraulic dynamometers (2)

Service shop: (to repair machine tools and make jigs and
fixtures)

universal lathes
gear cutters, milling machines
grinding machine

Mechanical and Chemical Laboratory:

instruments for checking elements in metals
(C, Si, Mn, S, P)
universal strength test machine
metallurgical microscope
moulding sand analysis instruments

This plant has a field service team with 5 men visiting
farmers to follow-up the machines sold and also doing trouble-
shooting on the farm. This plant also serves as a special repair
agency for 3 big manufacturers of China, making tractors and diesel

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engines. The Tongxian plant is responsible for repairing the machines sold by the manufacturers around the county.

The director of the plant graduated from college of agricultural mechanization in 1965 - emphasized, inter alia, the importance of balancing the plan between repairing and manufacturing, and the importance of providing qualified management staff and workers. The average grade of craftsmanship is 4 (the top grade is 8), he suggested that the average level should be higher, even through there are a few machinists on the 7 grade.

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5. Summary and Suggestions

(1) Based upon Chinese experience, the multi-purpose agricultural machinery plant is a desirable and practicable mode (with different levels as needed) for developing agricultural machinery industry to serve agriculture as its major role, and for the purpose for full utilization of the existing facilities and manpower, it will serve the allied sectors or even the public utility as well. Such multi-purpose plant will, in fact, accomplish the function as a "Nucleus" for developing endogenous rural industry.

However, a multi-purpose plant is not simply an enlarged "artisan shop". It must be well planned and well managed. Management staff and workers must be well trained to be capable of handling manifold technical and economical problems.

(2) Some Suggestions for International Co-operation:

(a) Propose UNIDO to organize an expert group to study the issue in depth. Experts, from both the developing and developed countries, must be well informed of the experience and problems pertinent to the establishment and management of multi-purpose agricultural plant;

(b) UNIDO convene a small scale consultation meeting with the purpose of identifying the needs of the "receiving" countries and

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the capacities of "offering" countries. Through consultation, the meeting will match the partners of co-operation.

China may be asked to host the meeting and participate in the exchange of experience.

(3) If China is requested to be a partner of co-operation in establishing multi-purpose agricultural machinery plants, the following items of service, either some or all of them, may be offered by the qualified Chinese institutions on the basis of mutual benefit. The modality and the terms of the co-operation could be discussed and agreed upon through consultations.

- a) Despatch of specialists to participate in or to be responsible for the work of feasibility study
- b) Project planning and designing
- c) Building up of the whole plant
- d) Supply of all or a part of the production equipment and facilities
- e) Supply of materials, purchased parts or components
- f) Despatch of agricultural tools, machines and experts to conduct field test and evaluate whether they suit the local conditions
- g) Training of R + D personnel and workers at appropriate multi-purpose plants or research institutes in China
- h) Despatch of engineers and workers to co-operate in running the newly built plant with the counterparts of the receiving side until they can master the technique
- i) Follow-up with either the production technique or R + D of products.

Annex : Typical Designs of Agricultural Machinery Manufacture and

Repair Plants

These designs are to be modified to suit the specific conditions of the place wherein the plant is to be built. Some kinds of special repair rigs and test stands will be added if necessary.

Option 1 - Plant at County Level

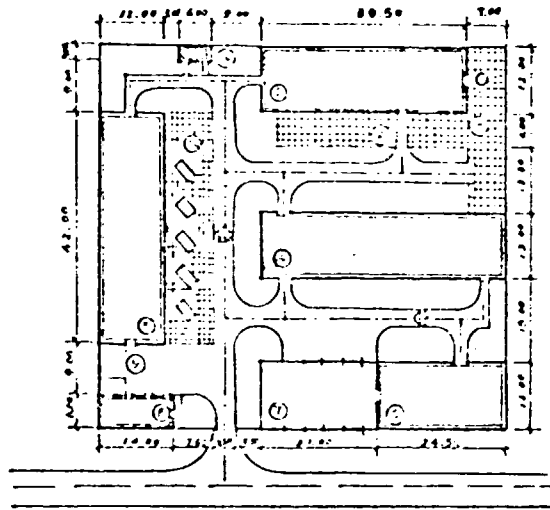
Range of service

- Manufacture of pumps, flour mills, threshers, silage cutters, winnowers, etc.
- Repair of tractors 200 units/year, automobiles 100 units/year, farm implements.
- Repair of equipment for county small scale industries.

Scale of the Plant

No.	Items	Personnel:		Principal Equipment	Building Area sq. m.
		Worker	Staff		
1.	foundry and forging shop	25	1	12	462
2.	space reserved				
3.	for foundry				
4.	machine shop	50	1	29	546
5.	tractor and automobile repair shop	23	1	27	504
6.	carpenter + electric shop	7		1	294
		8		17	
7.	stock yard + ware house	1			
8.	office		5		84
9.	water well				
10.	w.c.				
Total		114	8	86	1890

Layout of the Plant



Option 2 - Plant at County Level

Range of Service

- Repair of tractors (150 units/year), auto (100 units/year) engines (35 hp. 570 units/year), pumps 1500 units/year, and other farming implements (total weight of machines repaired 3000 tons/year).
- Repair of various equipment of medium scale local industries (total weight of various equipment repaired per year 1000 tons).
- Manufacture of spare parts (150 tons/year)

Scale of the Plant

No.	Item	Personnel: Worker Staff		Principal Equipment	Building Area sq. m.
1.	Forging shop + heat treatment	31	4	7	346
2.	foundry shop	31	3	2	272
3.	w.c.				18
4.	stock yard				
5.	wood working shop	6	1	2	194
6.	machine + repair shop	96	9	30	529
7.	power unit repair	45	4	37	388
8.	machine shop + assembly		1		720
9.	w.c.				18
10.	dining house				147
11.	office		20		105
12.	ware house	3	2		126
Total		212	44	78	2863

Layout of the Plant

