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Indian Agricultural Machinery Manufacturing Industry at Crossroads: Status, Progress and Prospect

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Preface

Farm machinery manufacturers play an important role in introducing and promotion of agricultural implements in farming sector. Presently, most of the agricultural implements are being manufactured by small and medium level manufacturers in India. However, there is no mechanism for collecting information from this sector for formulation of policies. This publication attempted to bridge this gap by providing first hand assessment of the current status of farm machinery manufacturing industry, its strength and weakness, function and future roadmap. It is based on a study covering five states viz., Punjab, Tamil Nadu, Chhattisgarh, Odisha and Gujarat in India from where the desired information were collected through cluster sampling technique. A total of 136 manufactures covering 25 manufacturing hubs located in these selected states were surveyed through personal interview method. Collected data were analysed for demand forecasting of farm implements using Structural Time Series Modelling technique. The study revealed that the size of a manufacturing units and their turnover are the crucial factors determining skill improvement and quality up grading for developed products. However, exposure to improved technical knowhow, interaction among manufacturers, research agencies, farmers and support from the government will improve quality of implements manufactured in India for domestic use and export as well.

The information made available here in this bulletin is expected to enable the researchers, manufacturers and the policy makers to identify the crucial factors responsible for growth and development of this industry and also to foresee the future trend of selection, adoption and development of new technologies for agricultural mechanization. It is also expected that the needs and aspirations of this sector will be given priority for formulation of suitable policies by the policy makers and administrators.

Authors are thankful to Department of Scientific and Industrial Research for funding the project and continuous support, Director ICAR-CIAE, Head, Agricultural Mechanization Division and Incharge (PME cell) for encouragement, guidance and motivation throughout the duration of project. The help and cooperation rendered by the manufacturers associations, Universities, State departments and others are also duly acknowledged.

(Authors)

CONTENT

Introduction

The study covered 5 states viz., Punjab, Tamil Nadu, Chhattisgarh, Odisha and Gujarat. Cluster sampling technique was used to identify manufacturing hubs. A pretested questionnaire was used for data collection keeping in view the several parameters under study. A total of 136 manufactures covering 25 manufacturing hubs located at 05 selected states i.e. Punjab (Ludhiana, Barnala, Moga, Ferozpur, Jalandhar, Goraya) Chhattisgarh (Durg, Raipur, Rajnandgaon, Bemetara and Bilaspur) Tamil Nadu (Coimbatore, Tiruppur, Erode, Namakkal, Salem, Madurai and Udumalpet) Odisha (Balasore, Banki, Berhampur, Bhubneswar, Cuttack, Jagatpur, Jagatsinghpur, Kendrapada) and Gujarat (Deesa, Gandhinagar, Jasdan, Mehsana, Rajkot, Surat, Unjha) were surveyed through personal interview method. The information on available infrastructure like area of industries, number of technicians and helpers, available tools, annual turnover, area of manufacturing unit and machinery used in manufacturing farm implements were collected. The statistical analysis was carried out using SAS (9.3) software. Demand forecasting of farm implements were done using Structural Time Series Modelling technique. A structural time series model is set up in terms of its various components, like trend, cyclic fluctuation and seasonal variations. Projections were made for all popular equipment that were being manufactured in the selected states till year 2030 along with confidence intervals.

Study revealed that medium manufacturers had about 50 percent share of the total population while small and large manufacturers contributed 25 percent each. Large and medium agricultural implements manufacturers are focusing more on tractor operated implements like Combine harvesters, rotavators, potato cultivation implements, paddy cultivation implements, maize threshers, laser land leveler, reapers and combine, based on the demand of the country. General implements like threshers, trolleys, seed drill, mouldboard plough, disc harrow, weeders and manual equipment based on local need is being manufactured by all categories of manufacturers. Majority of the small and medium manufacturers are facing interruption in electricity supply, labour shortage, lack testing centre and tool rooms. The large manufacturers were facing labour shortage, GST and taxes related issues in their day to day business. In

general, the demand of implements in all the surveyed states is increasing but some common machines used by the state since long time are showing negative trend such as cono weeder and laser land leveller in Tamil Nadu, potato digger, chaff cuter and reaper in Punjab, pedal thresher, cono weeder and hand winnower in Odisha, rotavator, potato planter and potato digger in Gujrat. Further, it was also identified some promising technologies in the selected states for the next few years. The technologies are brush cutter, millet dehuller, bund farmer and leveller for Tamil Nadu, forage reaper, rice track combine, laser leveller, mini combine, stubble cutter, straw chopper, straw cutter cum spreader, sms, roto seed drill for Punjab, paddy thresher and multi crop thresher for Chattisgarh, rotavator, power tiller, mini rice mill, mini dal mill, chaff cutter, groundnut dehusker for Odisha and groundnut digger, mulching machine, sprayer (tractor operated), MB plough, disc plough, seed drill, auto winder, groundnut thresher, turmeric planter, turmeric digger, seed cum fertilizer drill, land leveller, bund former, chisel plough, power weeder, power tiller, wheel hoe, manual seed drill, disc harrow for Gujarat state.

It can be concluded from the study that the size of a manufacturing units and their turnover are the crucial factors determining skill improvement and quality up grading for developed products. Hoverer, exposure to improved technical knowhow, interaction among manufacturers, research agencies, farmers and support from the government will improve quality of implements manufactured in India for domestic use and export as well.

Indian agriculture has marked its presence at global level producing a number of crops inclusive of cereals, pulses, oilseeds, cash crops, fruits and vegetables etc. In recent years, a shifting in cropping pattern has been observed in different parts of the country. This sifting is due to climate change and other glitches in production and productivity of the major crop grown in the country. There are two major bottlenecks like stagnant productivity and shortage of agricultural labourers, which can be resolved by promotion of farm mechanization. Indian farmers are fast adapting farm mechanization than ever before. Agricultural mechanization is critical for increasing productivity and also the income of small and marginal farmers. Without farm mechanization, achieving these targets may not be possible. Through diverse initiatives, the government is trying to transmit the benefits of mechanization to small and marginal farmers.

There is a primary need to make small agricultural equipment which will be suited to the local needs. Our agricultural equipment should be such that a small landholder is able to buy or rent them to increase production and income of his farm. The demand of farm machinery is also affected by the cropping pattern of the region. The farm machinery manufacturers play an important role in promotion of the agricultural implements. Agricultural implement manufacturing is a significant segment of the small scale manufacturing sector of the country. The agricultural implement manufacturing activity is registered under small scale industries. There were 18354 units engaged in agricultural implement manufacturing activity with a gross output of 6,632.4 million per annum. This segment also provided employment to about 45 thousand persons and generated foreign exchange of about 69 million US$ through export of agricultural implements *(Arora, 2005).* There is an important role of local manufacturers in promotion of the implements. Most of the common agricultural implements are being manufactured by small and medium scale manufacturers. There is an ardent need for documenting their status, capability, strength and weakness of these manufacturers. At present, there is no mechanism or system for periodically collecting the data and information from this sector, analysing the collected data, storage and retrieval of the collected information as and when required as well as methodology for drawing appropriate inferences for formulation of policies. Only a few information were collected and documented by *Singh et. al. (2006)* and prepared a directory of Agricultural Machinery Manufacturers in India containing information on name, address, contact number and products of the manufacturers. Apart from this, *Mehta et. al. (2015)* also compiled a directory of crop production machinery manufacturers in India. *Singh et. al. (2009)* stated that the adoption level of improved agricultural implements in the Madhya Pradesh is very low as compared to other progressive parts of the country. They used well-developed structured proforma for this study for examining the availability of manufacturing facilities, type of implements being manufactured, selling price of equipment, area of manufacturing shed, number of years in business and annual turnover. The study reveals that majority of the manufacturers were of small (46.6%) scale. Among workshop machine, arc-welding set type machines are available with all manufacturers. Most of the manufacturers of all categories were making tractor operated cultivators (88.14%), seed-drills (77.9%), trolley (73.7%) and threshers (72%). Not much variation was observed across categories in selling

price of average cost of equipment. Some manufacturers were interested in making/adopting new implements and have some expectations from government organizations. In another study revealed that the size of a manufacturing unit and its annual turnover is the sole crucial factor determining the extent of access to information sources, linkage with research and development organizations, skill improvement and quality upgrading for developed products *Singh et. al. (2012)*. However, exposure to improved technical knowhow through trainings and manufacturers meeting with research organizations and support from the government in terms of subsidizing improved implements suitable for marginal and small farmers may also be helpful for them. However, widening the range of such studies to a pan-India territory will facilitate framing of appropriate policies for the promotion of agricultural mechanization in the country.

Keeping this in view, an effort was made to assess the current status of farm machinery manufactures on different aspects such as production potential and demand of agricultural implements, availability of workshop tools/machines, manufacturing of agricultural implements, constraints in making quality implements, selling of implements in domestic as well as in international market, annual turnover and experience in manufacturing of these implements with the following objectives:

- To study the present status of Agricultural Machinery Manufacturing Industries in India.
- To forecast the potential demand and technology shift in agricultural machinery manufacturing sector.

Methodology of the study

India has 28 states out of which 5 states were randomly selected, one of each in north, east, west, south and central region. The selected states are Punjab, Tamil Nadu, Chhattisgarh, Odisha and Gujarat. A questionnaire was prepared for data collection keeping in view the several parameters under study. Pretesting of the questionnaire was done by visiting few manufacturers prior to the survey. The cluster sampling technique was used in data collection. Data was collected from 136 manufactures covering 25 manufacturing hubs that are located in 05 different selected states i.e. Punjab (Ludhiana, Barnala, Moga, Ferozpur, Jalandhar, Goraya), Odisha (Balasore, Banki, Berhampur, Bhubneswar, Cuttack, Jagatpur, agatsinghpur, Kendrapada), Gujarat (Deesa, Gandhinagar, Jasdan, Mehsana, Rajkot, Surat, Unjha), Tamil Nadu (Coimbatore, Tiruppur, Erode, Namakkal, Salem, Madurai and Udumalpet) and Chhattisgarh (Durg, Raipur, Rajnandgaon, Bemetara and Bilaspur). The information on available infrastructure like area of industries, total number of technicians and helpers employed, available tools, annual turnover, area of manufacturing unit and machinery and technology used in manufacturing farm implements were collected.

A developed pretested questionnaire was used for collection of data to estimate the production potential and future demand. The cluster sampling technique was used in data collection from the states. The statistical analysis was carried out using SAS (9.3) software. The information on available infrastructure like area of industries, number of technicians and helpers, available tools and machinery used in manufacturing farm implements were estimated. Goodness of fit test was used to predict the proportion of manufacturers for a given parameter under study like annual turnover, area of manufacturing unit, number of technician and helpers etc. For this purpose, many probability distribution function like normal, lognormal, exponential and beta were fitted and best fit distribution were used in predicting the proportion of manufacturers.

Demand forecasting of farm implements were done using Structural Time Series Modelling Technique. Structural time series models are formulated in such a way that their components (Trend, cyclic or seasonal fluctuations) are considered as random. The parameters are estimated using Kalman Filter. Kalman filter is a recursive procedure for computing optimal estimator of the state space at a particular time. It is a set of mathematical equations that provides an efficient solution of the least square method. Here, the structural time series models were fitted using PROC UCM available in SAS (9.3) software.

Interaction with Manufacturers and Collection of Information

Interaction meetings were organised at Punjab Agricultural University (PAU), Ludhiana on April 27, 2019, All India Agricultural Machinery Manufacturers Association (TN Chapter), Coimbatore on June 21, 2019, OUA&T, Bhubaneswar on November 05, 2019, Directorate of Agriculture, Govt. Of Chhattisgarh, Raipur on August 23, 2019 and Junagarh Agricultural University, Junagarh, Gujarat on February 20, 2020 (Fig. 1) for discussion regarding collection of information for forecasting and projecting market trends for agricultural machinery manufacturing sector in India. Local manufactures of agricultural implements and senior faculty members of universities, participants from research organisations, industries, state departments and president/office bearers of state chapters of all India agricultural machinery manufacturers association, participated. Issues related to manufacturing of agricultural implements and problems faced by the manufacturers were discussed. Information about institute, technologies developed and information required for proforma were shared. After interaction meeting manufacturers were contacted one to one basis (Fig. 2) and proforma was filled with the information provided by the manufacturers on various aspect. A copy of proforma used in the study is enclosed in Annexure-I.

Fig. 1: Interaction meeting with manufacturers in selected states

Fig. 2: Collection of information from manufacturers

Analysis of Data

All the manufacturers covered in this study were divided into three groups according to their annual turnover in rupees; i.e. small (having annual turnover less than 1 crore rupees), medium (annual turnover between 1 and 5 crore rupees) and large (more than 5 crore rupees). The distribution of the manufacturers into different categories of annual turnover is depicted in Fig. 3.

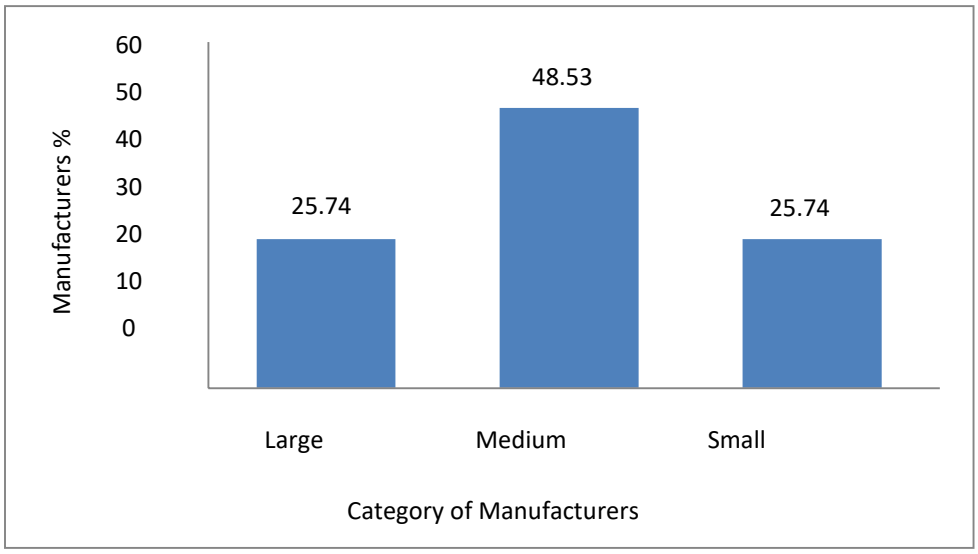

Fig. 3: Percentage of Manufacturers in Different categories

The medium manufacturers were in the majority with 48.53 percent share of the total population. Small and large manufacturers contributed 25.74 percent and 25.74 percent respectively to the total population of manufacturers of agricultural implements. Their state wise distribution is given in Table-1 & 2.

Table-1: Numbers of manufacturers surveyed in various states

Category	Punjab	Tamil Nadu	Chhattisgarh	Odisha	Gujarat	Total
Large	7	8	6	04	10	**35**
Medium	14	12	17	11	12	**66**
Small	7	4	12	08	04	**35**
Total	**28**	**24**	**35**	**23**	**26**	**136**

Table-2: States and hubs with number of manufacturers surveyed

Sl. No.	States	Number of Hubs	Hubs	Number of manufacturers surveyed (L+M+S)
1.	Punjab (28)	6	1. Ludhiana 2. Barnala 3. Moga 4. Ferozpur 5. Jalandhar 6. Goraya	(3+3+1)=07 (3+1+0)=04 (1+3+1)=05 (0+5+1)=06 (0+0+2)=02 (0+2+2)=04
2.	Tamil Nadu (24)	7	1. Coimbatore 2. Tiruppur 3. Erode 4. Namakkal 5. Salem 6. Madurai 7. Udumalpet	(6+6+2)=14 (1+0+0)=01 (1+3+0)=04 (0+2+0)=02 (0+1+0)=01 (0+0+1)=01 (0+0+1)=01
3.	Chhattisgarh (35)	5	1. Durg 2. Raipur 3. Rajnandgaon 4. Bemetara 5. Bilaspur	(3+2+0)=05 (2+7+1)=10 (1+3+1)=05 (0+1+4)=05 (0+4+6)=10
4.	Odisha (23)	8	1. Bhubaneshwar 2. Cuttack 3. Jagatpur 4. Balasore 5. Kendapada 6. Jagatsinghpur 7. Banki 8. Berhampur	(1+3+1)=05 (0+0+1)=01 (0+1+0)=01 (1+2+0)=03 (0+2+3)=05 (1+3+2)=06 (1+0+0)=01 (0+0+1)=01

5.	Gujarat (26)	7	1. Deesa 2. Gandhinagar 3. Jasdan 4. Mehsana 5. Rajkot 6. Surat 7. Unjha	(0+5+1)=06 (1+1+0)=02 (1+1+1)=03 (1+0+0)=01 (3+1+1)=05 (3+1+1)=05 (1+3+0)=04

The average floor area of the production workshop for different categories of manufacturers is presented in Fig. 4. It was observed that floor area is directly proportional to business turnover.

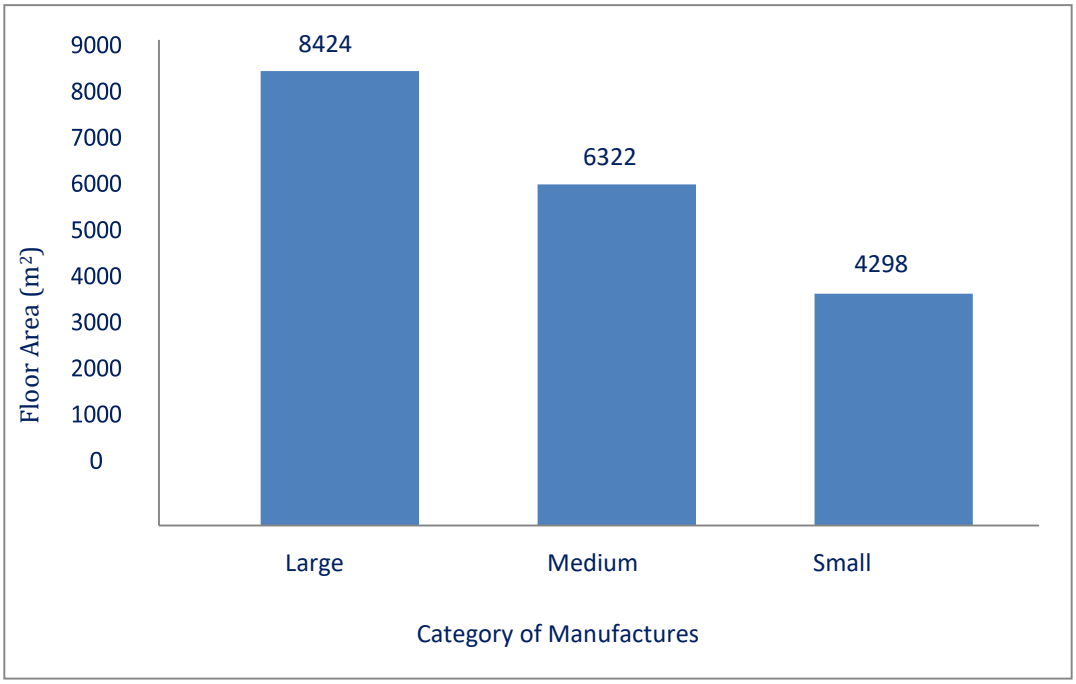

Fig. 4: Average floor area (m^2) for different categories of manufacturers

The average number of regular employees and the manufacturing experience of the manufacturers in years are shown in Fig.: 5. The large manufacturers employed more skilled workers for scaling up the productions compared to small and medium manufacturers though the average manufacturing experience of medium manufactures was more than small and large.

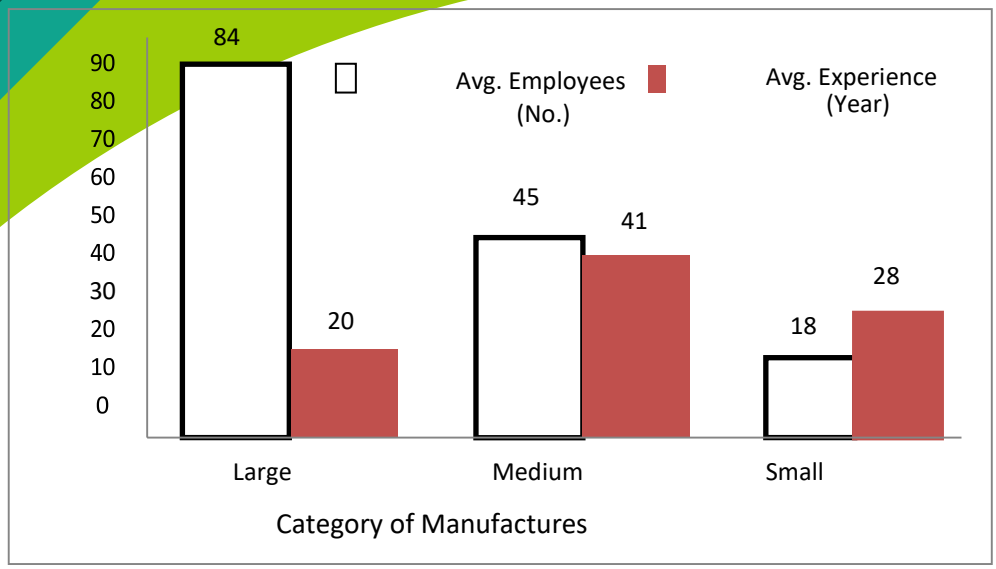

Fig. 5: Average number of regular employee and manufacturing experiences (years) of the manufacturers.

Large and medium agricultural implements manufacturers are focusing more on tractor operated implements like combine harvester, rotavator, potato cultivation implements, paddy cultivation implements, maize threshers, laser land leveler, reapers and track combine. While general implements like threshers, trolleys, seed drill, mouldboard plough, disc harrow, weeders and manual equipment based on local need is being manufactured by all categories of manufacturers as given in Table-3. Some manufacturers of Odisha & Chhattisgarh are still manufacturing animal drawn implement as tribal farmers of both states are using animal power.

Table-3: Share (%) of agricultural implement manufactured by different category of manufacturers

Name of Implement	Large manufacturers (More than 5 Crore)	Medium manufacturers (1-5 Crore)	Small manufacturers Less than 1 Crore)
Tractor Operated			
Tractor	5.71	0.00	0.00
Mulcher	8.57	7.58	5.71
Shredder Cum Pulveriser	5.71	0.00	5.71
Sub Soiler	11.43	1.52	5.71

Rotavator	65.71	16.67	5.71
MB Plough	20.00	12.12	5.71
Chisel Plough	0.00	6.06	0.00
Reversible MB Plough	11.43	3.03	2.86
Cultivator	60.00	37.88	42.86
Disc Plough	14.29	6.06	2.86
Harrow	2.86	1.52	2.86
Disc Harrow	22.86	12.12	5.71
Cage Wheel	2.86	27.27	34.29
Post Hole Digger	2.86	1.52	2.86
Leveller	14.29	24.24	20.00
Laser Leveller	8.57	1.52	0.00
Ridger	8.57	6.07	11.43
Seed Drill	20.00	12.12	20.00
Seed Cum Fertilizer Drill	8.57	6.06	2.86
Zero Till Drill	2.86	1.52	2.86
Roto Seed Drill	2.86	0.00	0.00
Potato Planter	20.00	18.18	11.43
Pneumatic Precision Planter	2.86	0.00	0.00
Sugar Cane Transplanter	2.86	0.00	0.00
Tractor Drawn Rice Transplanter	2.86	0.00	0.00
Happy Seeder	2.86	3.03	8.57
Bund Maker	8.57	4.55	11.43
Water Channel Maker	5.71	0.00	0.00
Tractor Operated Sprayer	0.00	1.52	0.00
Forage Reaper	2.86	1.52	8.57
Front Mounted Reaper	25.71	3.03	2.86

Sugarcane Stubble Shaver	2.86	0.00	0.00
Maize Cutter	2.86	1.52	2.86
Chaff Cutter	25.71	10.61	20.0
Multi Crop Thresher	31.43	7.58	0.00
Hadamba Thresher	2.86	1.52	2.86
Groundnut Thresher	2.86	9.09	8.57
Tractor Combine	17.14	4.55	0.00
Trolley	5.71	15.15	28.57
Petrol/ Diesel Engine or Electric Motor Operated			
Sprayer/Pump	11.43	7.58	8.57
Brush Cutter	0.00	1.52	2.86
Paddy Thresher	28.57	21.21	25.71
Wheat Thresher	5.71	1.52	2.86
Maize Thresher	8.57	1.52	0.00
Screw Conveyer	5.71	0.00	0.00
Grader	5.71	3.03	0.00
Milking Machine	0.00	1.52	2.86
Self-Propelled			
Power Weeder	8.57	0.00	2.86
Sugar Cane Weeder	0.00	0.00	2.86
Paddy Weeder	2.86	1.52	2.86
Weeder (Rotary/Drum)	5.71	3.03	0.00
Lawn Mowers	11.43	0.00	0.00
Power tiller operated			
Turmeric digger	2.86	0.00	0.00
Trolley	8.57	7.58	2.86
Bullock Drawn			
Bullock Drawn Plough	0.00	1.52	0.00
Bullock Drawn Puddler	0.00	4.55	0.00
Bullock Drawn Seed Drill	8.57	0.00	0.00

Manually operated			
Manual Rice Transplanter	0.00	0.00	2.86
Manually Operated Seed Drill	8.57	1.52	2.86
Cycle Hoe	0.00	3.03	0.00
Mandawa Weeder	2.86	10.61	17.14
Cono Weeder	14.29	10.61	2.86
Pedal Thresher	2.86	9.09	14.29
Hand Winnower	5.71	9.09	8.57
Winnowing Fan	0.00	3.03	0.00
Other Item			
Drip/Sprinkler Irrigation Set	0.00	4.55	0.00
Water Tanker	0.00	9.09	22.86

It was revealed from Table-3 that the large manufacturers have diversified production of farm machinery obtaining for rotavator, cultivator, front mounted reaper, chaff cutter and tractor operated multi crop thresher as most favoured items. Further, they also include motor operated paddy thresher, lawn mover, animal drawn seed drill and manually operated cono-weeder in their production plan. The medium manufacturers selected tractor operated cultivator, land leveler, motor operated paddy thresher, potato planter and rotavator as their major products along with bullock drawn puddler and cono weeder for small farmers. The small manufactures focused on manufacturing of conventional and other equipment like cultivator, cage wheel, trolley and motor operated paddy thresher and water tanker. Sometimes they also produce other implements such as seed-drill, planter, ridger etc. only on demand.

The manufacturers of agricultural implements have expressed diversified opinion regarding constraints (Table-4). The majority of the small and medium manufacturers are facing interruption in electricity supply, labor shortage, testing center related problem and lack of tool hubs. The large manufacturers were facing labor shortage, GST and taxes related issues in their day to day business.

Table-4: Constraints faced by different category of manufacturers of various states

Sates	Category	Type of constraints faced
Punjab	Large	1. GST related issue 2. Subsidy related 3. Taxes related problem 4. Testing centre related
	Medium	1. GST related issue 2. Labour related problems 3. Subsidy related 4. Taxes related problem 5. Testing centre related
	Small	1. Electricity problem 2. Focal point related 3. GST related issue 4. Labour related problems 5. Loan related issue 6. Subsidy related 7. Testing centre related
Tamil Nadu	Large	1. Electricity problem 2. GST related issue 3. Labour related problems 4. Loan related issue 5. Subsidy related 6. Taxes related problem 7. Testing centre related
	Medium	1. GST related issue 2. Labour related problems 3. Subsidy related 4. Taxes related problem 5. Testing centre related
	Small	1. Electricity problem 2. GST related issue 3. Labour related problems 4. Loan related issue 5. Subsidy related 6. Taxes related problem 7. Testing centre related
Chhattisgarh	Large	1. Govt. policies related 2. Labour related problems 3. Subsidy related 4. Testing centre related 5. Tool room related

	Medium	1. Govt. policies related 2. GST related issue 3. Labour related problems 4. Subsidy related 5. Testing centre related 6. Tool room related
	Small	1. Govt. policies related 2. Labour related problems 3. Loan related issue 4. Subsidy related 5. Testing centre related 6. Tool room related
Odisha	Large	1. Govt. policies 2. Labour shortage 3. Officers coordination deficit 4. Tool room requirement
	Medium	1. Banking less support 2. Funding problem 3. Tool room required
	Small	1. Farmers neutrality 2. Govt. policies 3. Labour shortage
Gujarat	Large	1. Govt. policies 2. Labour related problems 3. Loan related issue 4. Subsidy related problem 5. Taxes related problem 6. Testing related problems 7. Tool room requirement
	Medium	1. GST related issues 2. Labour related problems 3. Subsidy related problem 4. Testing related problem
	Small	1. GST related issues 2. Subsidy related problems 3. Testing related problem

The level of awareness among the manufacturers for business promotion was very limited. The use of electronic and print media for promoting their products is quite low as indicated in Table-5) whereas only few manufacturers belonging to medium and large category are using these sources. Most of the manufacturers mainly depend on feedback collected from the clients and farmers.

Table-5: Method of popularization (in percent)

Source of Information	Large	Medium	Small
Board/Flex/Hording	71.43	27.27	22.86
Newspaper	65.71	30.30	28.57
Online/Web	20.00	4.55	2.86
National Exhibitions/Farm Fairs	71.43	33.33	34.29
Radio	14.29	1.52	0.00
Television	14.29	0.00	0.00
Van Campaigning	2.86	1.52	0.00

Large manufacturers had shown more inclination towards skill and quality up-gradating as they have better infrastructure, higher annual turnover, market reputation and higher investing capacity as presented in Table-6. Hiring of skilled manpower is beyond the capacity of small and medium manufacturers. Some large manufacturers have large farmlands (on the ownership or hiring basis) for testing of their implements, whereas small and medium cannot afford this.

Table-6: Improvement of skills and quality upgradation for products

Particulars	Large	Medium	Small
Exempt GST on Raw Material	22.86	7.58	14.29
Testing Centre Requirement	25.71	19.70	17.14
Training Arranged for the Skilled Workers	28.57	6.06	14.29
Loan Taken for Investment on Scaling Up of Production	22.86	4.55	20.00

Examining the extent of adoption of improved production technologies reveals that common workshop tools like arc welding, drilling machine and grinders are commonly available as mentioned in Table-7, with most of the manufacturers of all categories. However, the adoption of specific types of tools is solely governed by the manufacturing capacity. Overall, manufacturers across different categories have adopted varying levels of improved manufacturing practices as per their requirements.

Table-7: Adoption of improved production technologies

Particulars	Large	Medium	Small
Abrasive Cutter	14.29	10.61	0.00
Anodizing	2.86	0.00	0.00
Arc Welding Set	94.29	83.33	82.86
Band Saw	20.00	3.03	2.86
Band Saw	51.43	27.27	17.14
Bench Drill	100.00	100.00	100.00
Bench Grinder	77.14	46.97	71.43
Bending Machine	31.43	16.67	14.29
CNC Lathe	25.71	6.06	0.00
CNC Milling	5.71	0.00	0.00
Crane Machine	57.14	28.79	8.57
Electric Portable Drill	62.86	37.88	34.29
Forging Press	8.57	6.06	0.00
Furnace	11.43	6.06	0.00
Gas Cutting	0.00	4.55	0.00
Gas Welding	31.43	28.79	14.29
Hand Saw	14.29	9.09	14.29
Hand Shearing Machine	57.14	42.42	34.29
Hydraulic Cutter	2.86	0.00	0.00
Hydraulic Press	74.29	50.00	20.00
Lathe Machine	100.00	100.00	85.71
Mig Welding Set	62.86	24.24	20.00
Milling Machine	54.29	31.82	17.14
Moulding	2.86	1.52	0.00
Pedestal Grinder	34.29	16.67	17.14
Pillar Drill	77.14	54.55	48.57
Plaining Machine	11.43	3.03	0.00
Plasma Cutter	40.00	13.64	5.71
Pneumatic Riveting	5.71	0.00	0.00
Portable Grinder	88.57	69.70	60.00
Powder Coating	14.29	3.03	0.00
Power Press	77.14	69.70	17.14
Power Saw	71.43	30.30	42.86
Press Brake	42.86	28.79	22.86
Pyramid Rolling Machine	28.57	18.18	5.71
Quenching Tank	0.00	1.52	0.00
Radial Drill	42.86	16.67	14.29

Sand Blasting	11.43	0.00	0.00
Shaping Machine	25.71	18.18	14.29
Shearing Cum Punching Machine	20.00	19.70	8.57
Spot Welding	11.43	3.03	0.00
Spray Painting	94.29	81.82	85.71
Surface Grinder	54.29	56.06	37.14
Tool and Cutter	11.43	12.12	0.00
Under Crank Shearing	20.00	4.55	2.86

It can be concluded from the data collected from five states that, the size of a manufacturing units and their turnover are the crucial factors determining skill improvement and quality up grading for developed products. However, exposure to improved technical knowhow through trainings, frequent interaction meets among manufacturers, research agencies, farmers& allied agencies and support from the government will improve quality of implements manufactured in India for domestic use and export as well. Based on the demand by local farmers and the farmers of other states manufacturers of agricultural implements are shifting the manufacturing of implements. State wise New Technology coming up is given in Table-8.

Table-8: New Technologies coming up in different states

State	New Technology coming up
Tamil Nadu	Brush Cutter, Millet Dehuller, Bund Farmer And Leveller
Punjab	Forage Reaper, Rice Trac Combine, Laser Leveller, Mini Combine, Stubble Cutter, Straw Chopper, Straw Cutter Cum Spreader, SMS, Roto Seed Drill.
Chattisgarh	Paddy Thresher And Multi Crop Theresher
Odisha	Rotavator, Power Tiller, Mini Rice Mill, Mini Dal Mill, Chaffcutter, Groundnut Dehusker
Gujarat	Groundnut Digger, Mulching Machine, Sprayer (Tractor Operated), MB Plough, Disc Plough, Seed Drill, Auto Winder, Groundnut Thresher, Turmeric Planter, Turmeric Digger, Seed Cum Fertilizer Drill, Land Leveller, Bund Former, Chisel Plough, Power Weeder, Power Tiller, Wheel Hoe, Manual Seed Drill, Disc Harrow

Interaction webshop with manufacturers on agricultural machinery manufacturing sector in India: present challenges and future strategies

The participants included ICAR officials; CIAE officials; Officers from DSIR; Senior Officers, CEOs, MDs of Tractor and Agricultural Machinery Manufacturing Units from across India; Representatives from Agricultural Machinery Manufacturers Association; and some scientists of CIAE. Following are the several points raised by the Industry to overcome the difficulties of production, marketing, servicing, custom hiring and other such related issues for smooth handling of mechanization problems of India so that the farm operations did not affect by the impact during- and after-COVID-19 pandemic:

Issues of general in nature

1. Emphasis need to be given on mechanization in place of tractorization.
2. Support in policy to include small machineries into essential Agri inputs which will enable farmers to acquire small machineries easily from their Kisan card & other financial schemes of the government.
3. Machinery on custom hiring are often moved from one place to other within a state or between states during peak periods. To reduce the burden on the farmers during these testing periods, these machineries shall be permitted to be taken without toll charges and clearances should be given on fast track modes.
4. Regional/location specific Agricultural Mechanization Parks with live demonstrations need to be established for popularizing the production and post-production machinery among stake holders.
5. The machinery manufacturing industry workers and labourers who migrated to their home states due to COVID-19 are highly skilled persons. Possibility of engaging such skilled persons in machinery manufacturing industries in their home state regions need to be explored.
6. Skilling of unskilled workers who migrated due to COVID-19 is also important to avoid labour shortages in some areas of the country.
7. Affordable small farm mechanization solutions should be identified and introduce through R&D to Commercialization.
8. Import of cheap quality and small machines like Power Tillers, Power Weeders, Brush cutters, Sprayers etc. needs to be discouraged to protect the interest of the Indian farmers and the machinery manufacturers.

Issues related to testing of machinery

1. Many at times it takes a long time to obtain the test reports from testing centres. Due to this introduction of new machinery or re-inclusion of already existing machinery gets delayed. This will aggravate the mechanization problems during COVID-19 periods. To avert these delays in obtaining the test results need to be condoned and the machinery shall be included in the government schemes conditionally.
2. Hike in testing fees every year needs to be relooked as testing fee hike has become extra burden on manufacturers particularly during Covid-19 period.
3. Testing codes for need based post-harvest equipment and machinery need to be introduced so that these can also be promoted under various government schemes during and after COVID-19 pandemic.
4. Standardization of the equipment needs to be focused so as to reduce the defects and increase safety. Greater emphasis can be given on emission and safety parameters while testing machinery than its operational parameters like it is done for automobiles and other similar machinery.
5. To avoid congestion and over burden on certain testing centres, the machinery shall be transferred to nearby testing centres with SAUs and other with other agencies to speed up the process of testing.

Issues related to subsidy and policy support

1. Possibility of introducing Credit guarantee fund supported "Finance scheme" for machinery purchase by farmers, rather than subsidy need to be explored.
2. Greater supports through subsidies and other Government policies need to be provided for establishing the Custom Hiring Centres is needed
3. More than 80% Indian farm holdings are under marginal and small categories with a holding size of less than 2 ha. Mechanization of these farms invariably requires small tractors with supporting implements and machinery. Subsidy schemes should be extended to lower horse power tractors and associated implements and machinery.
4. A relook at the subsidy given on high horse power tractors is needed.
5. Policy should be in place to support Animal Husbandry & straw management equipment
6. Possibilities of reducing the subsidy for imported equipment and promoting Indian manufactured machines should be explored.
7. Long term support policy for agricultural mechanization should be in place
8. Post-harvest & agro-processing machinery need to be promoted through subsidy schemes so that efficient Value Addition to Farm Produce be done and farmer incomes increase.

9. At present the EMDs and Security/performance deposits are very high and are to be given in each state for empanelment. The concepts of One Country One Empanelment policy need to be implemented so that even the small manufacturers participate in the schemes.
10. Agricultural machinery manufacturing needs to be supported under MSME sector companies with a Technology Up gradation Fund (TUF), like other sectors, which would be a real boost to the sector.
11. A promotion fund for the Agricultural machinery manufacturing needs to be established for strong market initiatives with support of R&D and Government institutions.
12. Financial support by public and private institutes may be provided at lower rate of interest for MSME in order to overcome crisis due to COVID-19 pandemic and to support domestic production of agricultural machineries and reduce production cost as well.

Findings and recommendation:

The analysis indicated that medium manufacturers had about 50 percent share of the total population while Small and large manufacturers contributed 25 percent each. Large and medium agricultural implements manufacturers are focusing more on tractor operated implements like Combine harvesters with SMS, Rotavators, Potato cultivation implements, paddy cultivation implements, maize threshers, Laser land leveller, reapers and combine, based on the demand of the country. General implements like threshers, trolleys, seed drill, mouldboard plough, disc harrow, weeders and manual equipment based on local need is being manufactured by all categories of manufacturers. Majority of the small and medium manufacturers are facing interruption in electricity supply, labour shortage, lack testing centre and tool rooms. The large manufacturers were facing labour shortage, GST and taxes related issues in their day to day business. In general, the demand of implements in all the surveyed states is increasing but some common machines used by the state since long ⍰me are showing negative trend.

Conclusions:

The farm machinery manufacturing sector plays a vital role in production and promotion of the improved agricultural implements in India. But currently this industry is operating at severe under capacity due to lack of demand aggravated by pandemic condition. However, the potential can be increased by providing facilities such as tool rooms and capacity building of workers. It is estimated that a demand potential of 1903 thousand manually operated, animal operated, electricity operated, IC engine operated and tractor operated farm equipment per year exists in these states, which has a monitory potential of Rs. 7977 crores. Exposure to improved technical knowhow, interaction among manufacturers, research agencies, farmers and support from the government will improve quality of implements manufactured in India for domestic use and export as well. It can be concluded from the study that the size of a manufacturing units and their turnover are the crucial factors determining skill improvement and quality up gradation for developed products. In general, the demand of implements in all the surveyed states is increasing but some common machines used by the state since long time

are showing negative trend due to change in farm power sources, cropping pattern and government policies.

Suggestion for future:

The technology forecasting has been done on the basis of collected data from 5 states only at this stage. It is necessary to study more states of the country to draw meaningful conclusion on the technology forecasting.

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Annexure I

List of Manufacturers

Sl. No.	State	Local Place	Manufacturers name
1	Chhattisgarh	Bemetara	Aadishakti Fabrication
2	Chhattisgarh	Bemetara	Chouhan Agro Industries
3	Chhattisgarh	Bemetara	Khalsa Agro Industries
4	Chhattisgarh	Bemetara	Punjab Agriculture Works
5	Chhattisgarh	Bemetara	PawanKrishiUpkaran
6	Chhattisgarh	Bilaspur	Mohan Mishra Agro Industry
7	Chhattisgarh	Bilaspur	M.P.K Trolly And Kirshi Equipment
8	Chhattisgarh	Bilaspur	Kissan Agro
9	Chhattisgarh	Bilaspur	Jaiswal Agro
10	Chhattisgarh	Bilaspur	Agrasen Agri Implements
11	Chhattisgarh	Bilaspur	MaaMahamaya Agro Industries
12	Chhattisgarh	Bilaspur	Krishna Agro Industries
13	Chhattisgarh	Bilaspur	Shri Madan Trailors
14	Chhattisgarh	Bilaspur	Vicky Agro Udyog
15	Chhattisgarh	Bilaspur	Shankar Appliences Anil Agencies
16	Chhattisgarh	Durg	Surjeet Agriculture Industries
17	Chhattisgarh	Durg	Vardhman Agencies
18	Chhattisgarh	Durg	Guru Nanak Agriculture India Private Limited
19	Chhattisgarh	Durg	Yuvraj Agriculture And Fabrication
20	Chhattisgarh	Durg	Lohan Agriculture Fabrication
21	Chhattisgarh	Raipur	Kinger Agrico Pvt. Ltd.
22	Chhattisgarh	Raipur	Agrotec Corporation
23	Chhattisgarh	Raipur	Gomti Agro Industries
24	Chhattisgarh	Raipur	M.S Sales (Emson Auto)
25	Chhattisgarh	Raipur	Ranjeet Agro Implements
26	Chhattisgarh	Raipur	Agrasen Engineering Works
27	Chhattisgarh	Raipur	Arun Trade Combines
28	Chhattisgarh	Raipur	Sapna Industries
29	Chhattisgarh	Raipur	Nirmal Agrico Industries
30	Chhattisgarh	Raipur	Kanhaiya Industries
31	Chhattisgarh	Rajnandgaon	Baliram And Sons
32	Chhattisgarh	Rajnandgaon	Piyush Agro Industries
33	Chhattisgarh	Rajnandgaon	Ms. Vedant Poly Agro.
34	Chhattisgarh	Rajnandgaon	Aakash Agro Industries
35	Chhattisgarh	Rajnandgaon	Swastik Agro Industries
36	Punjab	Barnala	Standard Combine Harvester Agriculture Works

Sl. No.	State	Local Place	Manufacturers name
37	Punjab	Barnala	Panesar Agriculture Industries
38	Punjab	Barnala	Balkar Combine & Straw Reaper Guru Nanak Agri. Engg. Works
39	Punjab	Barnala	Standard Corporation India Ltd.
40	Punjab	Ferozpur	AvtarMechenical Works
41	Punjab	Ferozpur	New Guru Nanak Engg. Works Talwandi Bhai
42	Punjab	Ferozpur	Super New Punjab Engg. Works Talwandi Bhai
43	Punjab	Ferozpur	Bharat Mech. Works Talnwandi Bhai
44	Punjab	Ferozpur	New DashmeshEngg. Works Talwandi Bhai
45	Punjab	Ferozpur	GurpreetEngg. Works Talwandi Bhai
46	Punjab	Ferozpur	Malkeet Engineering Works Talwandi Bhai
47	Punjab	Goraya	Sadhu Singh And Sons
48	Punjab	Goraya	Guru Ram Dass Agro Co.
49	Punjab	Goraya	Gurekam Industries
50	Punjab	Goraya	Darshan Singh & Co.
51	Punjab	Jalandhar	Sehra Motor & Tractor Engg. Works
52	Punjab	Jalandhar	Guru Nanak Agriculture Implements Mfrs.
53	Punjab	Ludhiana	Rajarh Agricultural Works
54	Punjab	Ludhiana	Amar Thresher Pvt. Ltd.
55	Punjab	Ludhiana	Passi Agro-Tech Enterprises
56	Punjab	Ludhiana	Saeco Strips Pvt. Ltd.
57	Punjab	Ludhiana	Falcon
58	Punjab	Ludhiana	Charlie Agricultural Sprayers
59	Punjab	Ludhiana	New Swan Multitech Ltd.
60	Punjab	Moga	BasantDroli Industries
61	Punjab	Moga	Droli Mechanical Works Potato Machinery & Agriculture Implements
62	Punjab	Moga	Arson Agro Industries
63	Punjab	Moga	Akhtiar Agro King Madho Agro Industry
64	Punjab	Moga	Madho Mechanical Works
65	Punjab	Moga	Madho Engineering Works
66	Punjab	Moga	Jhandeana Industries
67	Punjab	Moga	Rattan Agro Industries
68	Tamil Nadu	Coimbatore	Perfura Technologies Pvt. Ltd.
69	Tamil Nadu	Coimbatore	Sri Balaji Industries
70	Tamil Nadu	Coimbatore	Sri CheranTrailor
71	Tamil Nadu	Coimbatore	BheemRenaaissance Power Products Pvt. Ltd.
72	Tamil Nadu	Coimbatore	S.K.V.Agro Distributors
73	Tamil Nadu	Coimbatore	K.S.N.M

Sl. No.	State	Local Place	Manufacturers name
74	Tamil Nadu	Coimbatore	Magnificent Engineers
75	Tamil Nadu	Coimbatore	Valampuri Industries
76	Tamil Nadu	Coimbatore	Kovai Engineering Works Pvt. Ltd.
77	Tamil Nadu	Coimbatore	Shri Sai Industries
78	Tamil Nadu	Coimbatore	AgroneTurnwellEquiipments
79	Tamil Nadu	Coimbatore	Ramakumar Industries
80	Tamil Nadu	Coimbatore	Yuva Agro Systems
81	Tamil Nadu	Coimbatore	Kovai Classic Industries
82	Tamil Nadu	Coimbatore	Sharp Garuda Farm EquipmentsPvt. Ltd.
83	Tamil Nadu	Erode	Sakthi Vinayaka Trailers
84	Tamil Nadu	Erode	Sri Dhanalakshmi Lathe Works
85	Tamil Nadu	Erode	DharaneeAgrovatoar
86	Tamil Nadu	Erode	Karumalaian Agro Industry
87	Tamil Nadu	Madurai	Royal Industries &Trailars
88	Tamil Nadu	Namakkal	Valarpirai Agencies
89	Tamil Nadu	Namakkal	Dhevakane Enterprises Agricultural Implements
90	Tamil Nadu	Salem	Sri Saravanakumar Agencies
91	Tamil Nadu	Tiruppur	Sri Andal Agri Based Implements
92	Tamil Nadu	Tiruppur	Gomdadhi Engineering Service
93	Tamil Nadu	Udumalpet	SreeJayamurugan Agro Links
94	Odisha	Balasore	M/S Gopal Engineering
95	Odisha	Balasore	Balasore Agro Pvt. Ltd.
96	Odisha	Balasore	Brundabanjew Enterprises
97	Odisha	Balasore	Annapurna Agro Industrial Pvt. Ltd.
98	Odisha	Balasore	Durga Agro Engineering
99	Odisha	Banki	Charchika Industries
100	Odisha	Berhampur	Sheet Profile Company
101	Odisha	Bhubaneswar	Prachi Works Pvt. Ltd.
102	Odisha	Bhubaneswar	Unicus Engineering Private Limited
103	Odisha	Bhubaneswar	Sree Ram Udyog
104	Odisha	Cuttack	Siddheshwar Engineering
105	Odisha	Cuttack	Sahoo Engineering Works
106	Odisha	Cuttack	Pradhan Engineering Works
107	Odisha	Cuttack	Sai Shakti
108	Odisha	Cuttack	Tarini Coir Industry
109	Odisha	Jagatpur	ITI Techno Agro. Pvt.Ltd.
110	Odisha	Jagatpur	Shree Enterprises
111	Odisha	Jagatpur	MaaBhagbati Techno Yard

Sl. No.	State	Local Place	Manufacturers name
112	Odisha	Jagatpur	Frontier Engineering
113	Odisha	Jagatpur	Behera Engineering Works
114	Odisha	Jagatpur	Nilachala Engineering Works
115	Odisha	Jagatsinghpur	Seetal Agro Inputs Pvt. Ltd.
116	Odisha	Kendrapada	Taradevi Agro Implements
117	Gujarat	Deesa	Shree Savitri Agriculture Works
118	Gujarat	Deesa	VageshwariAgricuture Works
119	Gujarat	Deesa	Raj Agro Industries
120	Gujarat	Deesa	Panchal AmrutlalKeshavlal
121	Gujarat	Deesa	Jay Ambe Agriculture
122	Gujarat	Deesa	Annapurna Agriculture Equipment
123	Gujarat	Gandhinagar	Moba Mobile Automation (I) Pvt. Ltd.
124	Gujarat	Gandhinagar	Vishwakarma Agricultural Works
125	Gujarat	Jasdan	Bharat Engineering Works
126	Gujarat	Mehsana	Bhagwati Krushi Udhyog Pvt Ltd
127	Gujarat	Rajkot	Bharat Agro
128	Gujarat	Rajkot	Jayant Engineering Works
129	Gujarat	Rajkot	Yogi Agro Industries
130	Gujarat	Rajkot	Khedut Agro Engineering Pvt. Ltd.
131	Gujarat	Rajkot	Geeta Industries
132	Gujarat	Rajkot	Mausam Agro Pvt. Ltd.
133	Gujarat	Rajkot	Balaji Agro Engineering
134	Gujarat	Surat	Jay Bajrang Industries
135	Gujarat	Surat	Sitaram Industries
136	Gujarat	Surat	Jackbro Global Pvt. Ltd
137	Gujarat	Surat	M N Agro Industries
138	Gujarat	Surat	Shakti Engineering Works
139	Gujarat	Unjha	Martiaen Engineering Co.
140	Gujarat	Unjha	Bajaj Thresher
141	Gujarat	Unjha	Makwel Industries
142	Gujarat	Unjha	Vishwas Thresher

Annexure II

ICAR - Central Institute of Agricultural Engineering
Nabibagh, Berasia Road, Bhopal – 462038

Proforma for Farm Machinery Manufacturers' Survey

1. General information

Name of the Industry: Address:	
Phone / Email /Fax	
Year of establishment:	
Floor area of industry :	
No. of dealers, if any	
No. of Technical Staffs -	
No. of Helpers -	
No. of Office Staffs -	
No. of Salesman -	
No. of Service Engineer -	

2. **List of machines manufactured (put * if testing is done)**

S no	Implements	Prod^{n} Potential	Actual Prod^{n}	Import / Procured	Price	Source / Destination
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

3. **List of imported machines and reason for not manufacturing**

S No	Machines	Reason
1		
2		
3		
4		
5		
6		
7		

4. Information on available workshop machinery

Sl. No.	Type of Facility	Quantity Nos.	Details (Specifications and cost etc.)
	Manufacturing facility available		
1	Casting		
i	Furnace		
ii	Moulding Machine		
iii	Facility for ferrous/non-ferrous metal		
iv	Die casting		
2	**Milling**		
i	Horizontal milling		
ii	Vertical milling		
iii	Universal milling		
3	**Shaping Machine**		
4	**Planing machine**		
Sl. No.	**Type of Facility**	**Quantity Nos.**	**Details (Specifications and cost etc.)**
5	**Sheet Metal Working**		
i	Hand shearing machine		

ii	Power saw		
iii	Band saw		
iv	Abrasive cut off machine		
v	Plasma cutting		
6	**Drilling**		
i	Pillar drills		
ii	Radial drill		
iii	Bench drill		
iv	Electric Portable drill		
7	**Turning**		
i	Engine lathe		
ii	Under crank shearing machine		
iii	Press Brake		
8	**Forming**		
i	Power press		
ii	Hydraulic press		
iii	Fly press		
iv	Shearing cum punching machine		
v	Forging press		
vi	Pyramid rolling machine		
9	**Grinding**		
i	Pedestal grinder		
ii	Bench grinder		
iii	Surface grinder		
iv	Tool & Cutter grinder		
v	Portable grinder		
Sl. No.	**Type of Facility**	**Quantity Nos.**	**Details (Specifications and**

			cost etc.)
10	**Joining**		
i	Arc welding		
ii	Gas welding		
iii	Spot welding		
iv	Riveting machine		
11	**Finishing**		
i	Sand blasting		
ii	Acid / Alkaline pickling		
iii	Tumbling		
iv	Electroplating		
v	Anodizing		
vi	Spray painting		
vii	Power coating		
12	**Non-traditional machining**		
i	Electro discharging machine		
ii	Electro chemical machining		
iii	Laser Beam Machine		
iv	CNC Lathe		
v	CNC Milling		
13	**Heat treatment**		

i	Furnaces		
ii	Quenching Tank		
14	**Hydraulic crane**		

5. **Reasons for not manufacturing any particular machine / additional facilities required to enhance capability of manufacturing:**

Machines	Difficulties faced	Government / other support required

6. **Year wise sale of implements (Put a * for implements under subsidy)**

Implements (Please write the names) ⇨	1	2	3	4	5	6	7	8	9	10	11	12
2000												
2001												

2002												
2003												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
2013												
2014												
2015												
2016												
2017												
2018												

7. **Mode of advertisement (tick):**

Medium	Board / Flex / Hoardings	Newspaper	Radio	Television	Participation in national / international exhibitions / farm fairs
Annual expenses					

8. **Collaboration with other manufacturers for manufacturing / sale:**

9. **Annual turnover and average profit:**

Year	Annual turnover	Profit

10. **Demand of other implements as per change in cropping pattern:**

11. **Whether aftersales service is offered:**

12. **List of very popular brands of implements manufactured by your industries.**

13. **Any problems/difficulty related to farm implements manufacturing:**

14. Procurement of raw materials and standard components

Components	Type/make	Source of procurement	Quantity per year, kg or No.
Steel Sheets			
Steel Angles			
Steel Box Sections			
Steel Rods			
Non-ferrous Metals			
Pipes			
Bearings			
Bearings blocks			
Gears			
Chains			
Sprockets			
Shovels			
Sweeps			
Tynes			
Springs			
Spools/Bushes			
Fluted Rollers			
Bells (V. flat)			
Pulleys			
Fasteners (nut and bolts)			
Any Other 1. Washers 2. 3.			

15. Annual expenditure on procurement of raw-materials (Rs. Lakhs): _____