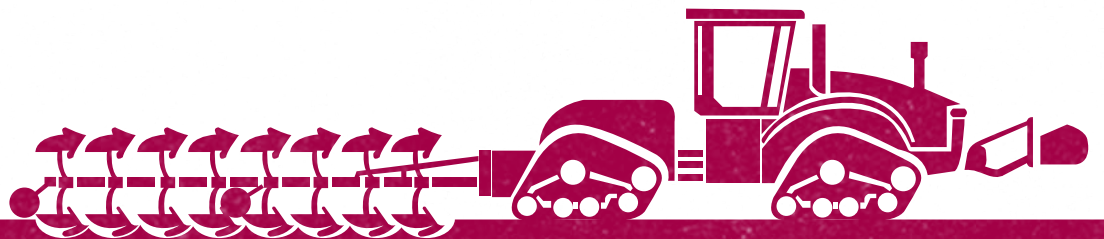
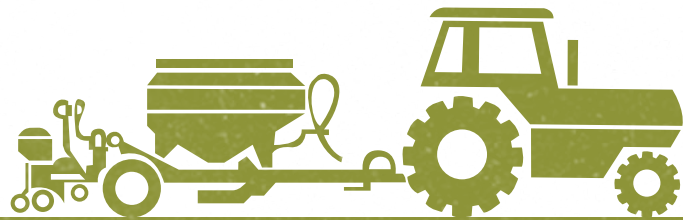
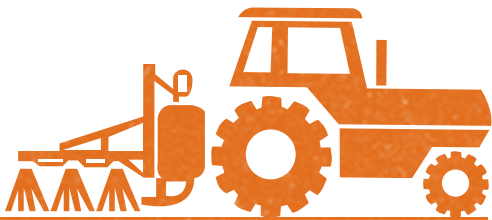
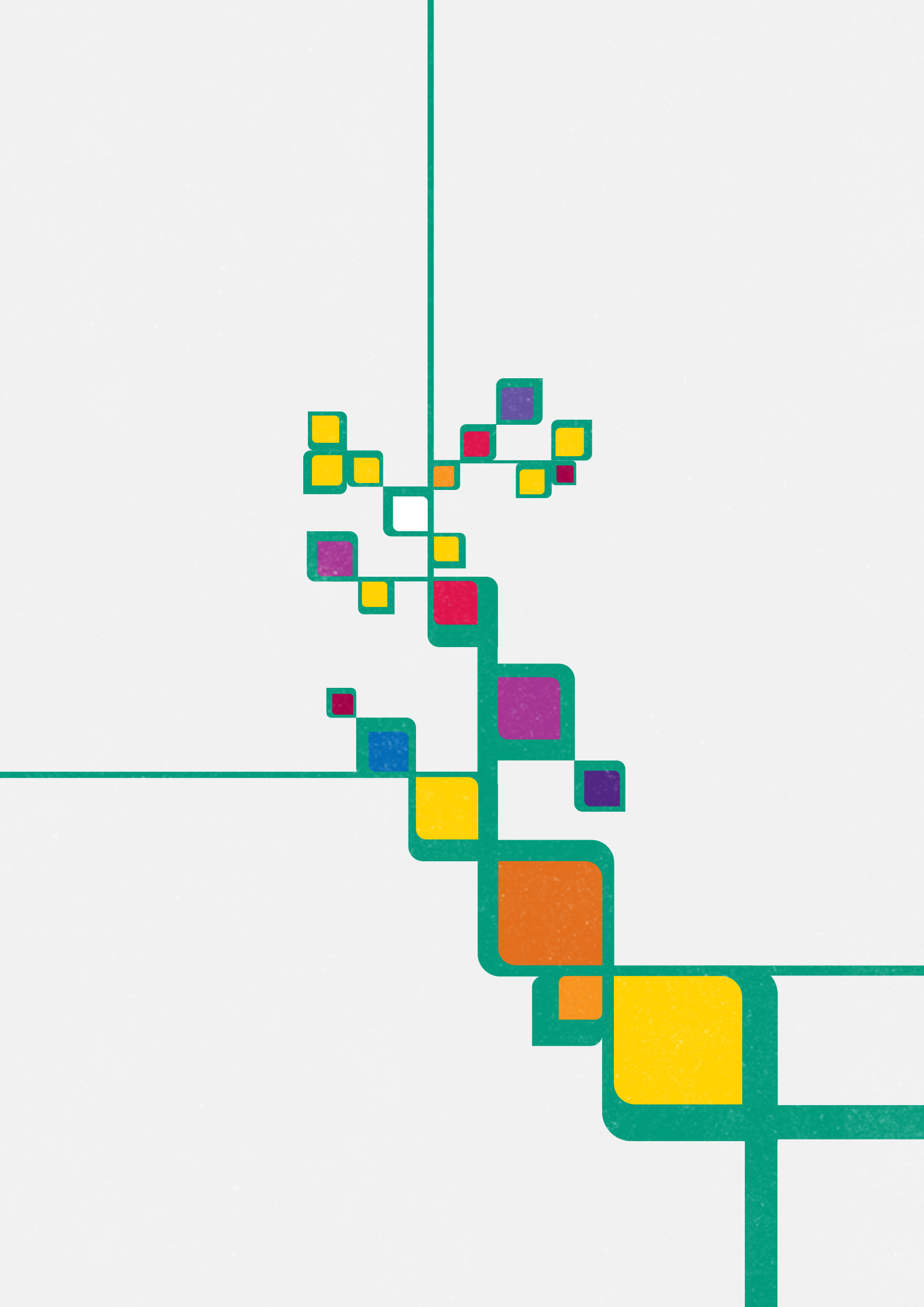


# Transforming Agriculture Through Mechanisation

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A Knowledge Paper on Indian farm equipment sector





# Transforming Agriculture Through Mechanisation

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A Knowledge Paper on Indian farm equipment sector



# Foreword



**A. Didar Singh**  
Secretary General,  
FICCI

Indian agriculture has marked its presence at the global level. India ranks among the top countries in the world in production of a number of crops including rice, wheat, sugarcane, fruits and vegetables. However, despite this potential, two prime bottlenecks that have emerged and can become insurmountable problem in the foreseeable future are the stagnant productivity per hectare and shortage of agriculture labour. There is ample evidence which suggests that productivity improves dramatically with usage of more farm power. It has been further estimated that use of proper equipment can increase the productivity by up to 30 percent and reduce the cost by about 20 percent.

Indian agriculture has since beginning of year 2000 moved far and wide beyond production of basic food grains. Indian farmer is fast adapting farm mechanisation than ever before. The sale of tractors in India cannot be taken as the only measure of farm mechanisation but to a greater extent it reflects the level of mechanisation. Indian tractor industry has emerged as the largest in the world and accounts for 1/3 of total global production.

While opportunities in Indian farm machinery sector are immense, the sector faces challenges on several fronts. Unlike other agricultural sectors, farm mechanisation sector has a far more complex structural composition. It has been observed that the sector's performance depends on the interplay of factors, that include, financial aspects such as capital and rate of interest, lack of data, small and scattered land holdings etc.

Innovation in farm machinery sector will drive the next phase of agricultural growth in the country. The Government of India has been encouraging mechanisation through different policy interventions. The technologies that have evolved in the farm machinery sector in last few years have enormous potential to realise the vision of 'Make in India' initiative which promotes innovation and investment.

The knowledge paper examines the current status of the farm mechanisation in India. The paper also identifies the problems in farm equipment sector and reflects suggestions and opinions of various stakeholders collected through structured interviews. Subsequently, the report proposes measures for transforming Indian agriculture through mechanisation. It also profiles the best practices of various countries. FICCI has always thrived in providing thought leadership. We wish this report helps in opening up another facet to the emergent knowledge base of the farm machinery sector.



**Rahul Kapur**  
Partner,  
Grant Thornton India LLP

To feed the ever-growing population that stands at 1.2 billion currently, India continues to face a significant challenge in its agriculture sector. The ever growing demand of farm produce is further challenged by a number of factors:

- Sluggish growth of total cultivable land in the country.
- India is gradually transforming in to services and manufacturing hub – a fact evident from the increasing contribution of services and the manufacturing sectors to the GDP.
- Rapid urbanisation has further led to migration of farm workers.

I believe that the only way to overcome these challenges is to increase farm mechanisation. This would increase the agricultural yield and reduce the manual efforts to a large extent.

Studies conducted by Ministry of Agriculture suggest a direct correlation between the increased yield and farm mechanisation. This will lead to increased savings in farm inputs such as seeds, fertilisers and drudgery etc.

Grant Thornton India LLP, in association with FICCI, through this report provides an analysis of agricultural equipment market in India including significant information about leading players of the industry. It also highlights the challenges and presents recommendations on how the various roadblocks can be overcome. We hope the report will encourage more discussions around Government's vision for sustainable agriculture and suggest how this industry will play a crucial role in achieving that.

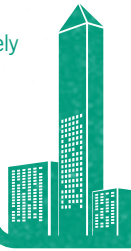
Agriculture and allied sectors contribute approximately

**14 percent to India's GDP**



It is expected to employ approximately 205 million people by 2019-20.

Rapid urbanisation growing population and growth of other sectors promising employment is impacting the farm productivity.

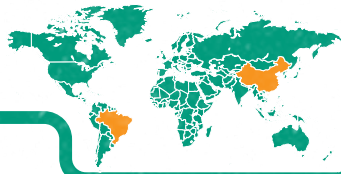


Use of proper equipment can increase the farm productivity by up-to **30 percent** and reduce the input cost by about **20 percent**.

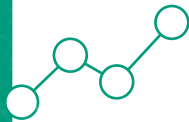


**333 million**

By the year 2050, the annual food grain production would need to grow to 333 million tonnes from the levels of 257 million tonnes recorded in 2014.



India, with a mechanisation level between 40-45 percent, lags in comparison to other BRIC countries such as **Brazil and China**.



Agricultural machinery market in India is estimated to grow at a CAGR of over **10 percent** during the period 2013-18.



**US\$ 6.5 billion**

The size of the farm equipment sector is estimated at approximately US\$ 6.5 billion and has seen strong growth in recent years.



The Indian market is dominated by **1,500 micro units, 2,500 small-scale units and 250 medium-sized companies**.



**Indian thresher** market remains largely unorganised.



**Tractor** accounts for most of the farm mechanisation in India. Country is also the largest market in the world for tractors.

Problems such as small and scattered land holdings, affordability and financing of farm equipment, poor levels of procurement mechanism, poor after sales service and over dependency on tractors instead of other kinds of machinery are some of the challenges.



# Summary

- Agriculture and allied sectors contributes approximately 14 percent to GDP and 49.6 percent of labour force.
- Importance of agriculture is higher in rural areas with 57 percent of rural population employed in the sector and 60 percent of the households dependent on it.
- Agriculture sector is facing a number of challenges
  - Small farm holdings, which are continuing to decrease in size.
  - Decreasing farm labour (estimated to drop to approximately 26 percent of labour force by 2050).
  - Future water scarcity crisis.
- Farm power availability in India is estimated at 2.02 kw/hectare.
- Mechanisation level in India is about 40-45 percent with states such as UP, Haryana and Punjab having very high mechanisation levels but north-eastern states having negligible mechanisation.
- Overall industry estimated at approximately US\$ 6.5 billion.
- Tractor is the largest segment with approximately 627,000 units sold in FY'15 (including exports); India is the largest tractor market in the world.
- Other major segments are threshers, rotavators and power tillers.
- These segments have similar structures with a few major players dominating most of the market share.

## Challenges:

- **Small and scattered land holdings** – Average farm size in India is less than 2 hectares, which is far lower than developed regions which are highly mechanised. Larger farm machineries are difficult to operate on such land holdings and in some cases actually completely unsuitable. Another factor to consider is that mechanising small and non-contiguous group of small farms is against economies of scale.
- **Equipment cost and poor after-sale service** – Farm equipment is capital intensive, making it a major investment for small and marginal farmers. Quality of after-sale service is another concern due to inadequacy of proper maintenance in remote regions of rural areas.
- **Tractor-isation and not mechanisation** – Tractor penetration has increased from one per 150 hectares to one per 30 hectares. However, such an increase in penetration has not been seen in other segments of farm equipment.
- **Financing of farm equipment** – Unwillingness of commercial banks to finance farm equipment is one of the biggest impediments to the increase in mechanisation level in India. The interest rates that farmers face are also very high and need to be addressed.



### Key recommendations:

- **Custom Hiring Centres** – Further establishment of custom hiring centres and development of an institutional framework for these centres are essential steps that need to be taken.
- **Make In India** – Can be used to support local manufacturing of farm implements currently being imported.
- **CSR Funds** – Corporate Social Responsibility funds can be used for capacity building initiative in the farm equipment space as well as promoting a sustainable agricultural ecosystem.
- **Need clarity in GST Bill** – Ensuring that in the GST bill, there should be a mechanism for distinguishing the implements used in automotive and agriculture sector (e.g. gearbox is used in both cars and tractors), so that implements used as part of farm equipment is not burdened with additional tax.
- **Credit Guarantee Fund:** It is pertinent to devise framework that would strengthen the credit policy for farm machinery in India. Credit guarantee fund currently facilitates loans for micro, small and medium enterprises (MSMEs). Similar models should be devised for farm machinery sector as well.

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## Abbreviations

AAP – Annual action plan	JV – Joint venture
AMMA – Agriculture machinery manufacturers association	KAMCO – Kerala agro machinery corporation limited
ASEAN – Association of Southeast Asian Nations	M&M – Mahindra and Mahindra
ATMA – Agriculture technology management agency	MIDH – Mission for integrated development of horticulture
BRICS – Brazil, Russia, India, China and South Africa	MSP – Minimum support price
CAGR – Compound annual growth rate	NIF – National Innovation Foundation- India
CHC – Custom hiring centres	NMAET – National mission on agriculture extension and technology
CSO – Central statistics office	NSSO – National Sample Survey Organisation
DAO – District agriculture officer	OIJIF – Oman India joint investment fund
DIPP – Department of industrial policy and promotions	PHTM – Post-harvest technology and management
EU – European Union	RKVY – Rashtriya Krishi Vikasa Yojana
FDI – Foreign direct investment	SBI – State bank of India
FFS – Farmers field schools	SEWP – State extension work plan
FIG – Farmers interest groups	SGRF – State general reserve fund
FMTTI – Farm machinery training and testing institutes	SLEC – State level executive committee
FPO – Farmer producer organisations	SAME – Sub-mission on agriculture extension
GDP – Gross domestic product	SMAM – Sub-mission on agriculture mechanisation
ICAR – Indian Council of Agricultural Research	SMPP – Sub-mission on plan protection and plant quarantine
GVA – Gross value added	SMSP – Sub-mission on seed and planting material
IFFCO – Indian Farmers Fertilizer Cooperative	TAFE – Tractors and farm equipment limited
IPM – Integrated pest management	





Section I:  
India's economic  
snapshot and role  
of agriculture sector

Financial reforms in the past one decade, tighter monetary policies aimed at securing the Indian economy from the turbulent global market conditions have not just helped the Indian market to grow but have also helped in attracting investments from around the world. Rising levels of reforms, presence of a large section youth population and growth across sectors have contributed to the overall growth.

India's GDP has performed well in the last one decade. Post the recession of 2008, growth rebounded in 2013 and 2014. India's GDP crossed US\$ 2 trillion for the first time in 2014. Per capita GDP in India has been increasing at a steady pace as well with a CAGR of 6.0 percent between 2005 and 2014.<sup>1</sup>

While the country is now known as the services hub for the entire world, its agriculture sector plays a key role globally. Geographically, India accounts for 2.4 percent of the world's total area and 4 percent of its water resources. While it is home for about 17 percent of world's population and 15 percent of the livestock, the country has seen a steady growth in the population, averaging an annual growth of 1.3 percent between 2011 and 2014, reaching 1.26 billion in 2014.<sup>2</sup>

#### India GDP

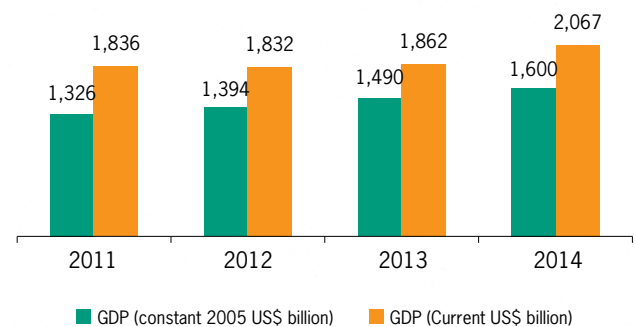


Figure 1: Year-on-year GDP

Source: World Bank estimates, retrieved November 18, 2015

#### Population and GDP (per capita)

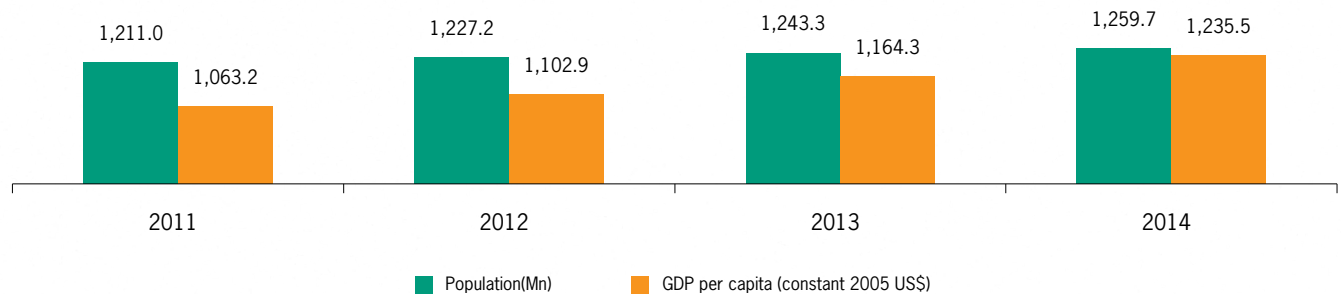


Figure 2: Population and GDP per capita

Source: World Bank estimates, retrieved November 18, 2015

#### Gross Domestic Product (GDP) composition by sector (Constant 2004-05 prices)



Source: Government of India

Source 1,2: GT analysis based on World Bank estimate

# 1.1 Agriculture sector overview

Agriculture being one of the primary employment sector to millions across the country becomes vital for the country's growth. India ranks third in farm and agriculture output globally. It is also the largest producer, consumer and exporter of spices and related products. Agricultural exports constitute 10 percent of the country's exports, and is the fourth-largest exported principal commodity.

India is also among the top producers of wheat, rice, sugarcane and fresh fruits. But production of some of the major crops such as wheat, rice, pulses and oilseeds, declined in 2014 on account of poor monsoons and other local challenges. Production of major crops in India is summarised below:

**GDP of agriculture and allied sector (US\$ billion)**

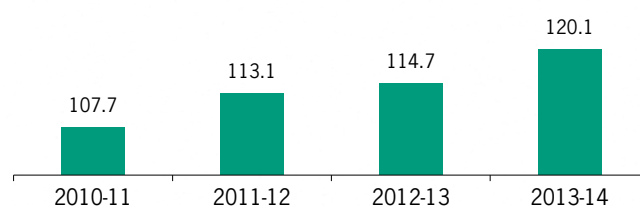


Figure 3: GDP of agriculture and allied sectors Y-o-Y

Source: Central Statistics Office, Ministry of Statistics and Programme Implementation, Govt. Of India; 1 INR = 0.015 US\$, exchange rate as of November 23, 2015

**Table 1: Production of major kharif and rabi crops (million tonnes)**

	2009	2010	2011	2012	2013	2014
<b>Rice</b>	89.1	96	104.3	104.4	106.5	102
<b>Wheat</b>	80.8	86.9	93.9	92.5	95.9	95.8
<b>Pulses</b>	14.7	18.2	17.2	18.5	19.3	18.4
<b>Food grains</b>	218.1	244.5	257.4	255.4	264.8	257.1
<b>Oilseeds</b>	24.9	32.5	30	31	32.9	29.8
<b>Sugarcane</b>	29.2	34.2	35.8	33.9	35	35.5
<b>Cotton (mn bales)*</b>	2.4	3.3	3.5	3.4	3.7	3.5

Source: Department of Agriculture and Cooperation, Ministry of Agriculture Annual report 2014-15, March 2015; \*bales of 170 kg (cotton) and 180 kg

Productivity in the country has been highly variable due to erratic monsoons, which in turn presents a strong case for farm mechanisation and use of more stable irrigation sources such as micro irrigation systems etc.

**Year-on-year total yield (kg/hectare)**

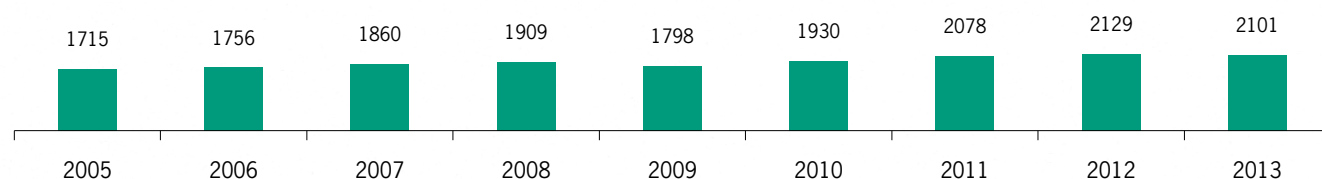


Figure 4: Year-on-year yield in India

Source: CEIC: A Euromoney Institutional Investor Company, August, 2015

# 1.2 The current status

Despite agriculture sector being a key contributor to employment in the country, its contribution to the overall GDP has seen a decline. According to the Central Statistical Organisation (CSO), the agriculture and allied sector contributed approximately 13.9 percent of India's GDP (at constant 2004-05 prices) during 2013-14, down from 14.6 percent in 2010-11. This decline in agriculture sector's and increase in service sector's increase in share of GDP is consistent with a growing economy.

A similar trend is also seen in the agricultural labour force. During last decade, the overall workforce in agriculture and allied activities has dipped by 11 percentage points, indicating a rise in secondary and tertiary sectors, self-employment and regular jobs, which is also consistent with economic growth.

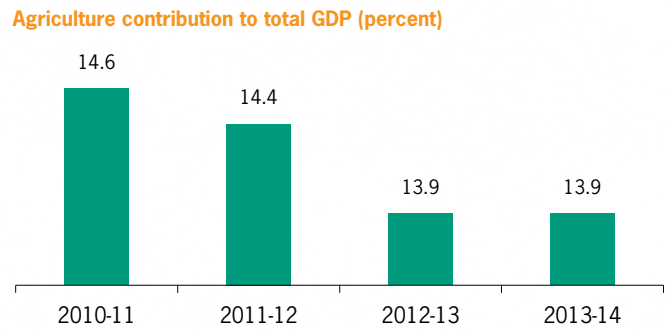


Figure 5: Agriculture contribution to GDP

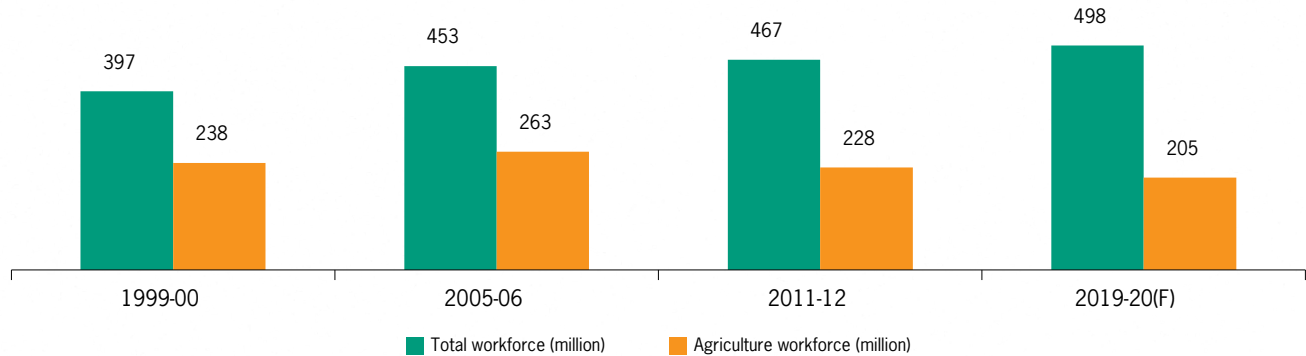


Figure 6: Total workforce vs. agricultural labour force

Source: Planning Commission, National Sample Survey Organisation (NSSO).

Despite the decline, the sector remains a dominant source of and contributor to overall employment and the GDP. 49 percent of the labour force is still employed in the sector and over 60 percent of rural households depend on agriculture as their principal source of livelihood. The number of people employed in the agriculture sector stood at 228 million in 2011-12 and while this number is predicted to drop further to 205 million people by 2019-20, that would still represent over 40 percent of the work force.<sup>3</sup> Additionally, a significant chunk of the GDP still comes from this sector.

Source 3: Grant Thornton analysis based on Planning Commission and National Sample Survey Organisation (NSSO) estimate

# 1.3 Government's vision for the agriculture sector

Sector's continued growth, its contribution towards employment generation, its significance for rural population in the country, and its role in ensuring food security has made the government more inclined towards bringing reforms across the sector. As per government estimates, during the Twelfth Five Year Plan (2012-17) period, the sector employed 57 percent of the rural population. Agriculture and allied sectors has witnessed an accelerated annual growth and rose to 3.7 percent in the eleventh plan from the earlier 2.4 percent in the tenth plan.

As the sector witnessed growth in the past decade, the Ministry of Agriculture, Government of India had planned on focussing on sustaining the current growth momentum by stabilising food grain production and ensuring food security in the longer run. The focus is also on the conserving high production areas in the country. Thus, in recent times, the need for new technologies to break yield barriers, utilise inputs more efficiently and diversify to more sustainable and higher value cropping patterns has been considered.

Government witnessed some key challenges for the sector before initiating the Twelfth Five Year Plan:

- Shortage of farm labour
- Youth participation in agriculture
- Inadequate mechanisation
- Distribution of subsidies vs public investment

The Plan aimed at correcting the shortcomings through incurring public expenditure on agriculture and infrastructure to ensure proper functioning of the market and increase productivity and overall efficiency by better delivery of credit services and quality inputs.

To enhance farm viability, the Plan focused on –

- Including small and women farmers at all points of value chain.
- Use information technology for precision farming.

The plan was directed towards achieving the following Missions-

1. National Food Security Mission
2. National Mission on Agriculture Extension and Technology
3. National Mission on Sustainable Agriculture
4. National Horticulture Mission

The aim of the government is to increase the growth of agriculture sector through its Rashtriya Krishi Vikasa Yojana (RKVY). The Scheme is being implemented throughout India with 100 percent central assistance. And increasing the level of farm mechanisation in India's agriculture sector is a part of the scheme. Under this, substantial funding have already been allocated in the budget 2014-15.

In addition to this, through a number of other schemes, 10 percent assistance for women beneficiary is allocated to procure agricultural machinery, implements and equipment by the government. In order to reduce the drudgery and increasing efficiency in farm operations, a number of agricultural implements and hand tools suitable for farm women have been developed by research and development organisations under Indian Council of Agricultural Research (ICAR).

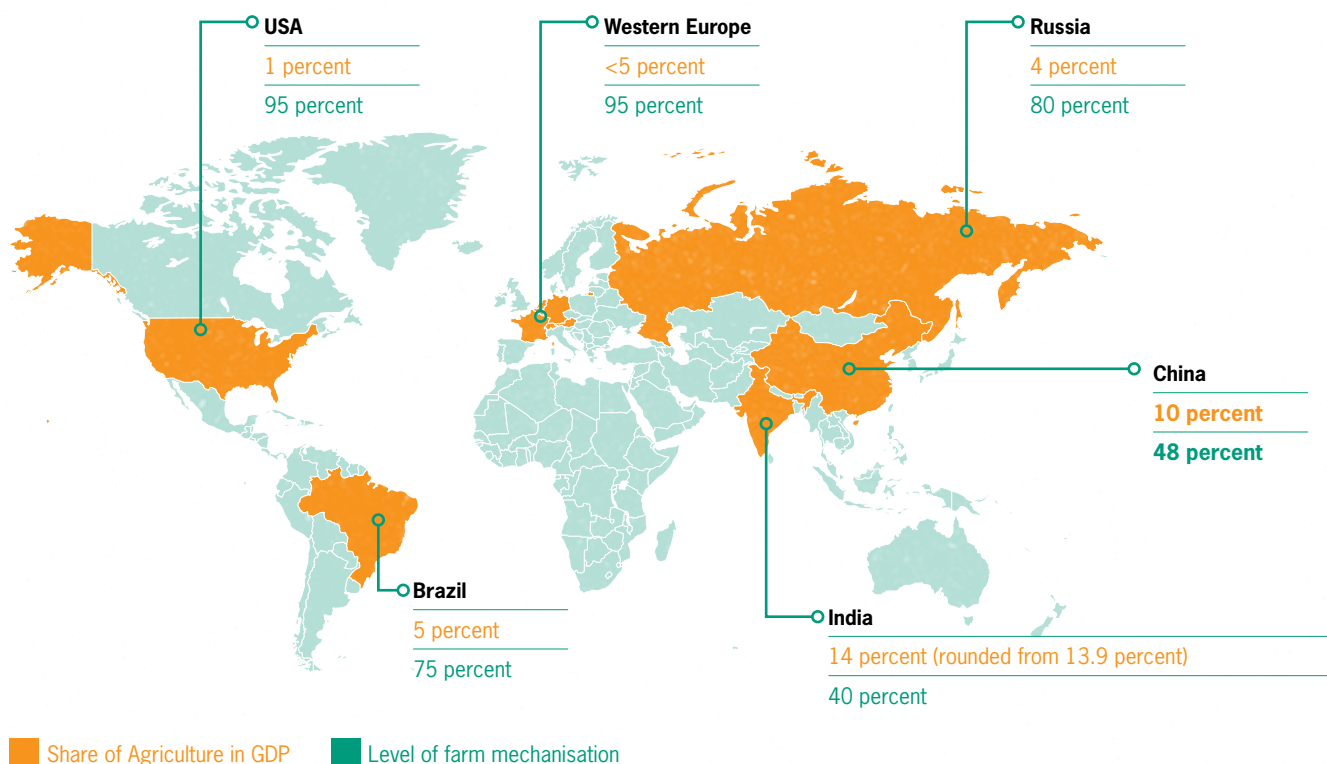


Section II:  
Farm equipment  
sector – An  
overview

Mechanisation has been identified as a key tool to increase the production globally. As our market too is considerably reliant on increasing agriculture produce, further promotion of farm mechanisation is essential

It is estimated that the global demand for agricultural equipment will reach nearly US\$ 200 billion by 2018, with Asia contributing more than 60 percent to the total.

Global spotlight: Share of agriculture in GDP vs. level of mechanisation



Source: World Bank Indicators, CIA Fact book, Mechanisation and Farm Technology Division of Department of Agriculture and Cooperation, Trading Economics, FAO Yearbook 2013



The revenue generated by the agriculture equipment industry in Asia was US\$ 88,075.9 million in the year 2013, registering a CAGR of 16.1 percent during 2008 -2013.

# 2.1 Value chain and equipment use

The agriculture sector value chain includes all the steps involved from preparation of soil to harvesting and post-harvest processing. For every step in the production lifecycle, use of equipment enhances the efficiency of the unit involved. Farm mechanisation not just reduces labour time and post-harvest loss but also helps to cut down production cost in the long term.

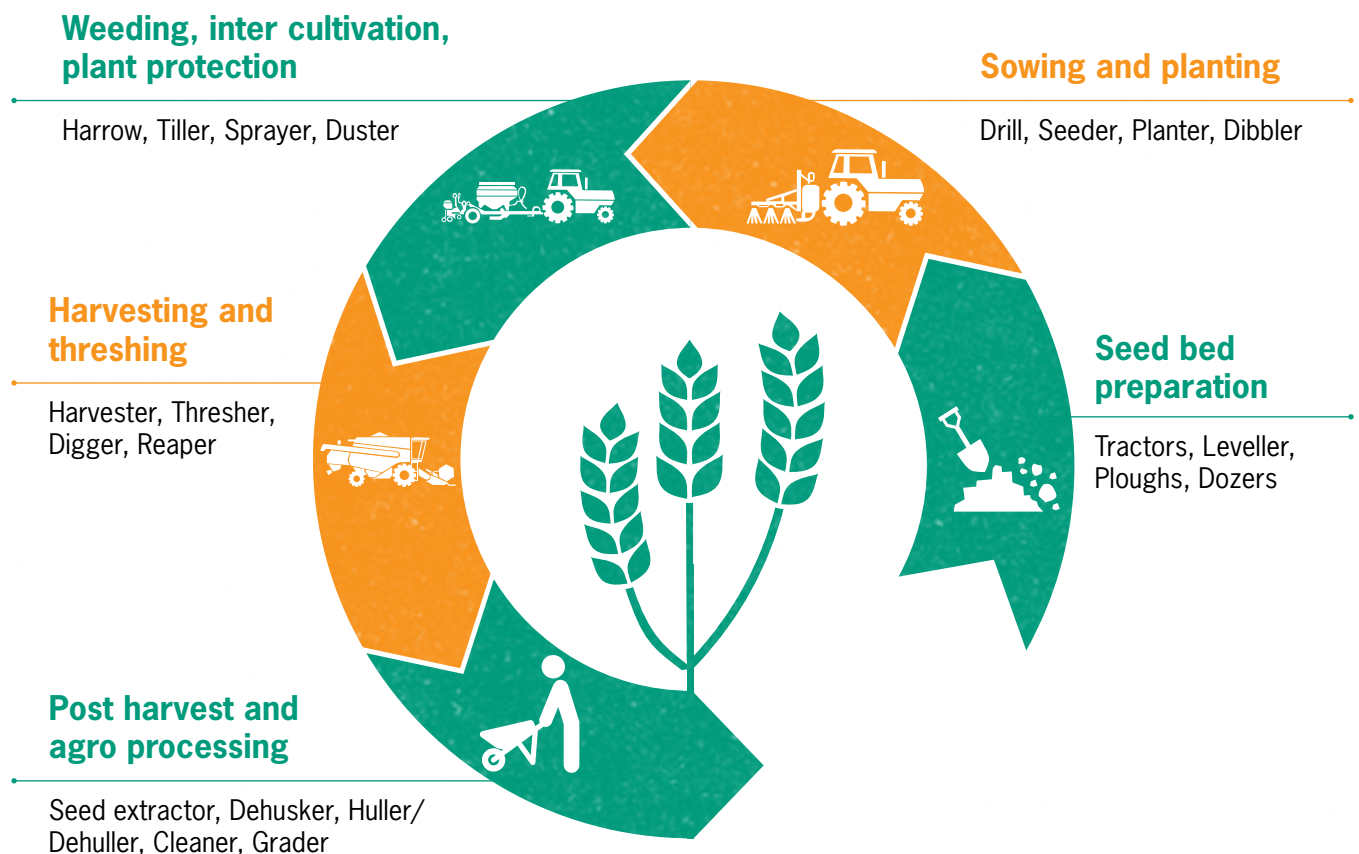


Figure 7: Agriculture value chain and types of equipment



## 2.2 Farm mechanisation in India

The agriculture sector in India has witnessed a considerable decline in the use of animal and human power in agriculture related activities. The trend has paved a way for a range of agricultural tools. A large number of these are driven by fossil fuel operated vehicles such as tractors, diesel engines. This has resulted in a shift from the traditional agriculture process to a more mechanised process. Though the level of mechanisation in India is lower as compared to other developed countries, it is certainly on growing.

The role of tractors in the Indian agriculture sector reflects the growing trend of tractor-isation in the country. Custom hiring of farm equipment is a prevalent practice in India, especially among small land owners who find ownership of large farm machines expensive and uneconomical.

The government is therefore promoting farm mechanisation by subsidising purchase of equipment as well as supporting bulk buying through front-end agencies. The government also provides credit and financial assistance to support local manufacturing of farm mechanisation equipment. Given the labour scarcity and the government's subsidy programs, adoption of farm mechanisation is set to increase.

Indigenously developed agricultural hand tools and implements have also evolved over time and despite the strides agricultural machinery has made, continue to play a critical role in agriculture. This is on account of the small and irregular farm sizes, lack of machinery available for smaller land holdings, lack of awareness and skills among farmers and inability of farmers to afford more advanced technologies.

Hand tools have also been developed for all levels of the value chain. In 2010, when the size of the agricultural labour force was 269.74 million, the estimated number of hand tools in use was 809.22 million, which equates to about 3 hand tools per labourer<sup>4</sup>. However, the prevalence of these tools comes with the issue of safety.

An ICAR study (2004-2007) showed that 34.2 percent of accidents in agriculture were due to hand tools, with sickles and spades involved in 46 percent of farm injuries. Implications of injuries due to hand tools are severe as these injuries are very painful and disabling due to delayed treatment. A survey conducted in India showed that 70 percent of agricultural hand tools injuries had a recovery time of more than seven days. Thus, developing farm machinery more suited to the local conditions is essential so that injuries and problems that come with the use of hand tools can be abated while making agricultural practices more productive.

### Extent of mechanisation at various level of value chain



Soil working and seed bed preparation

**40**  
percent



Seeding and planting

**29**  
percent



Plant protection

**34**  
percent



Irrigation

**37**  
percent



Harvesting and threshing

**60-70**  
percent for wheat and rice;  
<5 percent for others

Source 4: Grant Thornton analysis based on 'Testing of hand tools and non-motorised machines used in agriculture in the Asia Pacific region' by Shreemat Shreshta, Agricultural Engineering Division, Nepal Agricultural Research Council, available on UNESCAP CSAM website.

## 2.3 Benefits of farm mechanisation

Farm mechanisation has been known to provide a number of economic and social benefits to farmers. Primary among the economic benefits is the improved yield that comes as a result of greater level of mechanisation. Looming water scarcity crisis along with the need to ensure food security in the country, the benefits of farm mechanisation makes it a crucial component of shaping the future of Indian agriculture.

**Input savings:** Studies have shown a direct relationship between farm mechanisation (farm power availability) and farm yield. Farm mechanisation is said to provide a number of input savings:

- Seeds (approximately 15-20 percent)
- Fertilizers (approximately 15-20 percent)
- Increased cropping intensity (approximately 5-20 percent)

**Increase in efficiency:** Aside from the above stated inputs, farm machinery also helps in increasing the efficiency of farm labour and reducing drudgery and workloads. It is estimated that farm mechanisation can help reduce time by approximately 15-20 percent. Additionally, it helps in improving the harvest and reducing the post-harvest losses and improving the quality of cultivation. These benefits and the savings in inputs help in the reduction of production costs and allow farmers to earn more income.

### Relationship between farm power and productivity

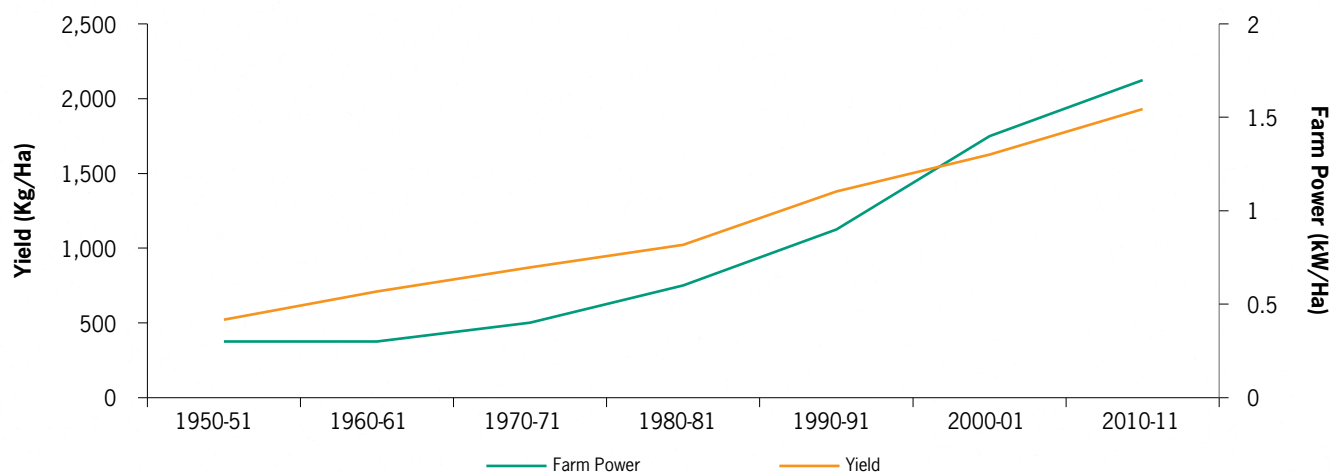


Figure 8: Relationship between farm power and productivity

Source: Ministry of Agriculture

**Social benefits:** There are various social benefits of farm mechanisation as well:

- Helps in conversion of uncultivable land to agricultural land through advanced tilling techniques and also in shifting land used for feed and fodder cultivation by draught animals towards food production.
- Decrease in workload on women as a direct consequence of the improved efficiency of labour.
- Improvement in the safety of farm practices.
- Helps in encouraging the youth to join farming and attract more people to work and live in rural areas.

Note: Information on hand tools and their prevalence comes from 'Testing of hand tools and non-motorised machines used in agriculture in the Asia Pacific region' by Shreemati Shrestha, Agricultural Engineering Division, Nepal Agricultural Research Council, available on UNESCAP CSAM website.



## Section III: Need for farm mechanisation in India

# 3.1 Growing population and productivity

Growing at 1.3 percent annually, India’s population stood at 1.26 billion in 2014. This is estimated to reach to 1.6 billion by the end of 2050.<sup>5</sup> Owing to the large geographical area under cultivation, the Indian agriculture and allied sectors support 18 percent of the world’s population and 15 percent of the global livestock. With land and water being limited, there is stress on their availability. Rising population, boost in infrastructure development and limited availability of resources restrict the availability of cultivable land.

Even though food grain production in India has increased significantly over the years, it is variable due to the dependence on monsoons. However, to meet the future demand for food by the year 2050, the annual food grain production needs to grow to the level of 333 million tonnes. Thus, there is a need for significant increase in the productivity levels to meet this demand. In comparison to other countries, India’s productivity in terms of wheat and rice growth is much lower (refer figure 10).

India population estimates (Billions)

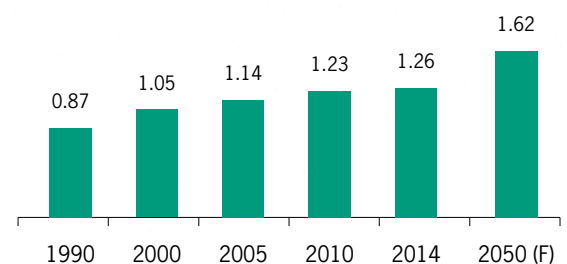
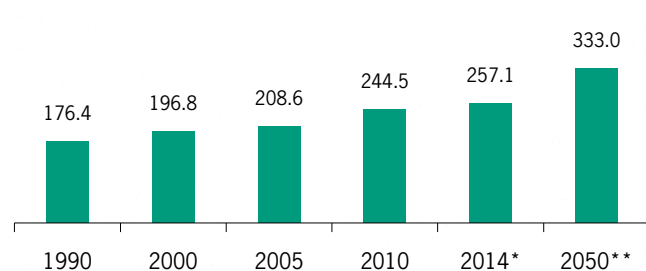


Figure 9: India population estimates

India food grain production (million tonnes)



India's relative rice and wheat productivity (yield per hectare)

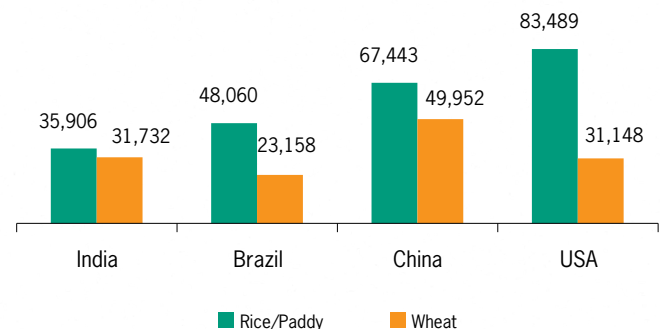


Figure 10: India food grain production and relative rice and wheat productivity

Source: Dept. of Agriculture and Co-operation; World Bank estimates; \*\* estimated

Source 5: Grant Thornton analysis based on World Bank estimates

## 3.2 Rapid urbanisation and farm labour

The agriculture sector in India, for a long time, has depended on cheap and surplus labour. One of the stated reasons behind sufficient supply of such labour was lack of opportunities. However, the situation is now changing with more opportunities available in factories and services as well as the government's rural employment creation program, which guarantees 100 days of employment on public-works projects.

Another ongoing trend in India is rapid urbanisation. The trend has been consistent with a growing economy and growth of infrastructure. The World Bank estimates suggest that by year 2050 over half of the Indian population would be urban, a marked change from 2005 when only 29 percent of the population was in that bracket. Rapid urbanisation reduces the availability of farm hands and thus puts strain on farm labour. Estimates suggest that by 2050, percentage of agricultural workers of the total work force would drop to 25.7 percent from 58.2 percent in 2001.

With the strain for diminishing resources, added value placed on the productivity of agricultural practices and growing urbanisation resulting in a reduction of available farm labour, there needs to be a greater push to ensure further proliferation of technologies that allow for better usage of the land.

Percentage of agricultural workers to total workers (percent)

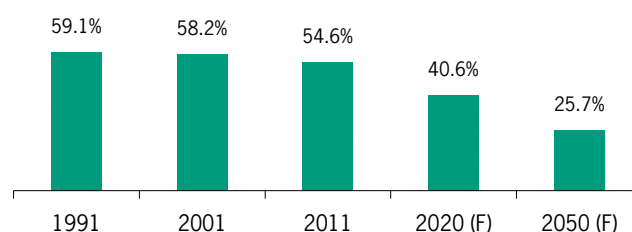


Figure 11: Agricultural workers as a percent of labour force

Source: World Bank estimates

Population demographics (percent)

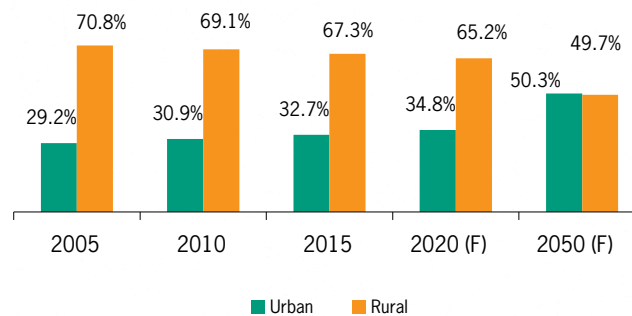
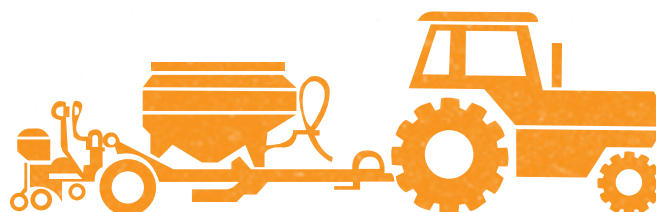


Figure 12: Population demographics

Source: World Bank estimates



## 3.3 Global benchmarking

Within the Asian region, China dominates in terms of production and sale of agriculture equipment. China is also predicted to contribute the most to growth of the agricultural equipment industry in Asia-Pacific and is expected to have a share of 59.5 percent of revenue generated by the industry in the region in 2018, reaching a value of US\$ 103,659.7 million during the year. While India, Japan and Australia are expected contribute 7.2 percent, 3.0 percent and 1.5 percent respectively.

**Table 2: Global benchmark: Key facts and figures**

Country		India	China	Japan	Australia
Production	Revenue (US\$ billion)	6.37	58.87	5.03	1.92
	Volume (Units)	7,47,826	42,13,212	17,51,510	22,300
Major players	Domestic	Mahindra & Mahindra and Sonalika	YTO Group's First Tractor Co. Ltd and Foton Lovol	Kubota and Yanmar	Gernonimo and John Berends implements
	International	John Deere and Case New Holland	John Deere and Case New Holland	John Deere	John Deere, Case IH and Kubota
Export (US\$ billion)		NA	9.38	1.71	0.14
Import (US\$ billion)		NA	2.25	NA	1.60
Types of Equipment		Tractors, rotavators, threshers, power tillers, combine harvesters, rice transplanters	Tractors, rice transplanters, combine harvesters, cotton processing machinery, etc.	Bush cutter, tractors, rice tansplanter, power sprayer and duster, etc	Tractors, combine harvesters, balers

In 2011, China overtook the European countries and the US to become the largest producer of farm equipment in the world. In order to cover the technological gap between the domestic and international firms in China, the government is open to the establishment of joint ventures between Chinese and foreign enterprises. In return, the multinational companies enjoy access to the vast Chinese market.

In India, presence of a large number of non-banking financial Corporations (NBFCs) has encouraged farmers to buy agriculture machinery on credit. Of the entire machinery, tractors have the highest number of share in the overall sales. These accounted for 66.1 percent share in the total number of agricultural equipment sold in India in FY'2013. However, the overall market for agriculture equipment has witnessed a slowdown recently, largely due to reduced sales of tractors and combine harvesters.

Sources: China Association of agricultural machinery manufacturers  
 Ministry of agriculture of the People's Republic of China  
 Japan agricultural machinery manufacturers association  
 Australia bureau of agricultural and resource economics and sciences (ABARES)  
 Department of agriculture, Government of Australia  
 Asia Pacific agricultural equipment industry outlook to 2018, August 2014  
 International Trade Administration Agricultural Machinery Top Markets Report, July, 2015

## 3.4 Learnings from other countries

While farm mechanisation in India has made strong strides, there is much that is needed. Countries such as the United States and other European countries are completely mechanised. Countries such as China and Japan have also seen higher penetration of farm machineries. In comparison to these, Indian agricultural sector still lags and requires an increase in farm equipment.

**Table 3: Economy overview**

Region	GDP (US\$ billion)	GDP- per capita (US\$)	GDP- agriculture sector share (percent)	GDP- real growth rate (percent)	Major Agricultural products	Import of agriculture machinery (percent)	Export of agricultural products (percent)	Labour force in agriculture (percent)
<b>United States of America</b>	17,419	54,800	1.6	2.4	Wheat, corn, maize, soya beans, sugar cane, sugar beet, potatoes, tomatoes, rice, paddy, barley, cotton seed etc.	4.9	9.2	0.7
<b>France</b>	2,829	40,400	1.7	0.4	Wheat, Sugar beets, Cereals, Wine grapes, Dairy products, Fish, Potatoes	7.5	10	3
<b>Canada</b>	582	44,800	1.7	2.5	Wheat, Barley, Oilseed, Tobacco, Dairy product, Fish, Forest products, soya bean, oat, lentils.	6	70 produce of pulses and crops are exported.	2
<b>China</b>	10,360	12,900	9.2	7.4	Rice, Wheat, Potato, Corn, Peanuts, Tea, Barley, Cotton, Millet, Apple, Oilseed, Fish, Pork.	15	20	33.6
<b>Japan</b>	5,960	37,400	1.2	-0.1	Vegetables, rice, fish, poultry, dairy products, pork, beef, barley, sugarcane, wheat, potato, legumes.	Mainly meat, processed food, cereals and oilseeds and products.	Fishery and forestry products.	2.9

## Canada



### Mechanisation

Over 95 percent of agricultural activities have been mechanised in Canada. The productivity has increased both because of mechanisation and improvements and innovations through biotechnology. Canadian farmers buy over US\$ 2 billion worth of machines and implements annually, including an average of 19,000 tractors, 3,500 swathers, 4,000 grain combines and balers, plows, dickers and other tillage and harvesting tools. Farming is carried out using seeding equipment, hay and forage equipment, grain-harvesting equipment and tractors in large extents.

### Government support

Cash advances are provided to young farmers and new entrants. The whole farm profit is subsidised rather than crop prices or farm revenues. The agricultural policies are restrictive in Canada but the farmers benefit in the form of higher output prices, less competition. There are loans and credit facilities at low interest rate to purchase farm equipment.



## United States of America

### Mechanisation

In the US, 95 percent of the farming is mechanised. The level of mechanisation can be gauged by the fact that a farmer who supplied food for 26 persons in 1960 supplies food for 144 people as a result of higher levels of farm mechanisation. Almost all the farm activities in the US are carried out using advanced machinery and equipment. Farmers make large capital investments, from US\$ 97,000 for a 160 horsepower tractor to US\$ 170,000 for a 4-wheel drive model.

### Government support

US government heavily subsidises grains, oilseeds, cotton, sugar, and dairy products.

Farmers receive subsidies in the form of direct payment, price supports, regulations that set minimum prices by different characteristics, export subsidies, import barriers in the form of quotas, tariffs etc.



## France

### Mechanisation

France boasts a 99 percent level of mechanisation, with 54 percent of the metropolitan France under agriculture comprising of total 680,000 highly mechanised farms. The market for agricultural equipment is large amounting to about Euro 6.3 bn. Most of the agricultural equipment used for farming include tractors, combine harvesters, balers and haymaking, self-propelled forage cutters, soil tillers and agriculture transport vehicles.

### Government support

French farmers rely on European Union subsidies for half their income. The exports are subsidised and farmers also get subsidies to import agricultural machinery and equipment.



## China



### Mechanisation

China has around 60 percent of farm activities mechanised. Main agricultural equipment used include tractors, combine harvesters (self-propelled and tractor-mounted), rice transplanters and cotton processing machinery. Level of mechanisation for various activities such as ploughing, planting and harvesting levels are 76.1 percent, 49.2 percent and 46.9 percent, respectively.

### Government support

The Government of China provides subsidies on agriculture equipment and machinery purchase, which is approximately 30 percent of the price of the equipment.

Both direct and indirect subsidies are given to the farmers. Direct subsidy includes mainly price subsidies whereas indirect subsidies are in the form of remitting agricultural tax, special discount rates etc.

## Japan



### Mechanisation

Japan is one of the most agriculturally mechanised nations in Asia Pacific region and the tractor power per hectare of agricultural land is 7 HP which is at par with that of the US, the UK and France. The main equipment used comprises of bush cutter, plant protecting machinery, walking type tractor, tractors, rice transplanters and grain combine harvesters.

### Government support

Government subsidies for agriculture in Japan amounted to US\$ 68,266.5 in 2014. Government grants subsidies to the farmers on the loss incurred to make them competitive in the market. Government impose high import tariffs on agricultural imports.

### Yield per hectare

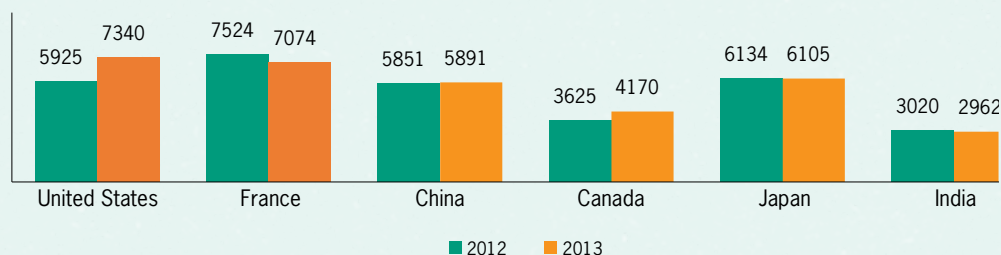
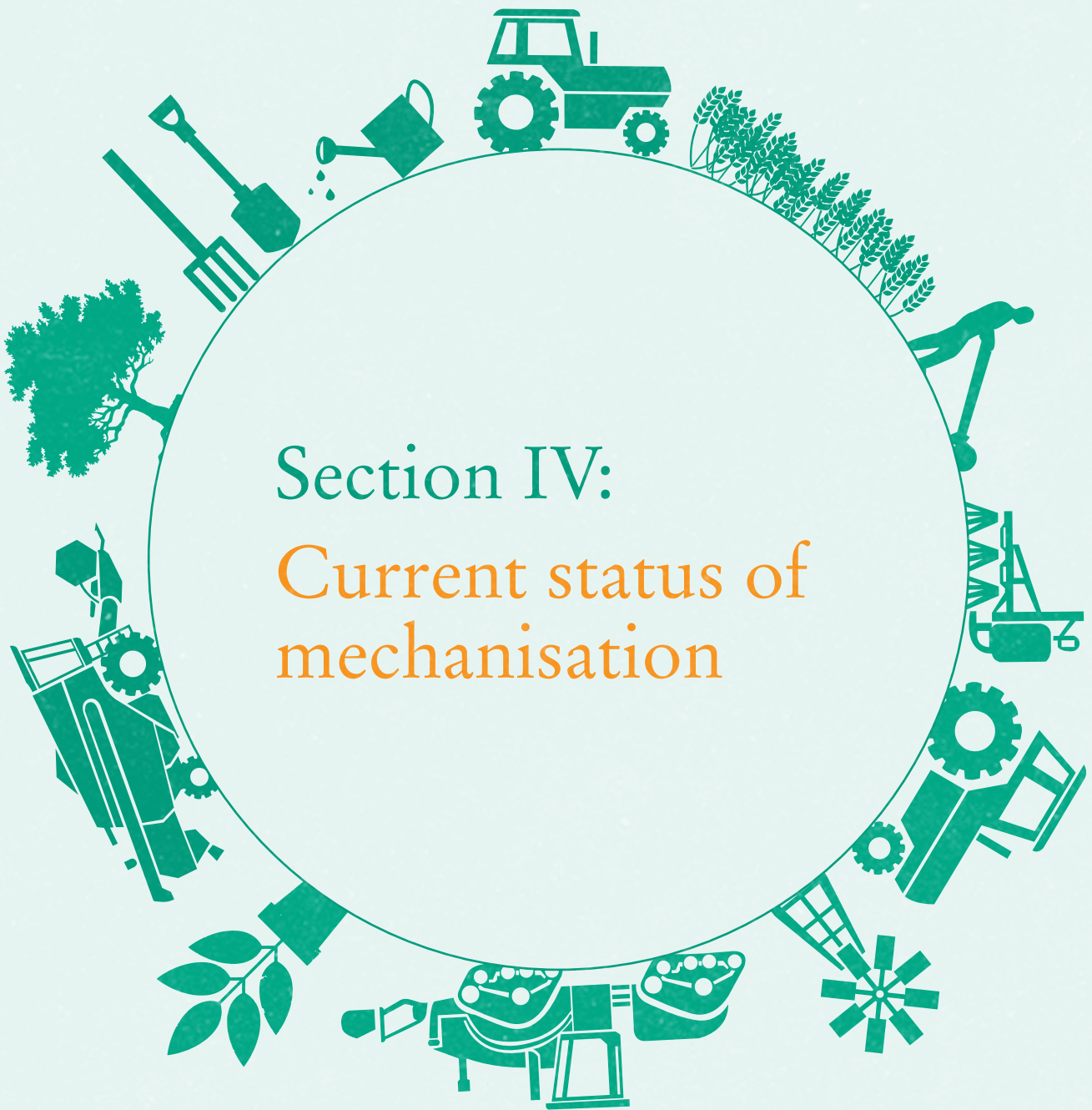


Figure 13: Country wise relative productivity

Source: World Bank estimates

There is direct relationship between the productivity level and farm mechanisation. Countries with higher levels of farm mechanisation are able to increase their productivity and therefore are better equipped to meet their demand factors. India's demand factors are likely to rise dramatically. Thus, there is a need to enhance the level of farm mechanisation in the country.



Section IV:  
Current status of  
mechanisation

# 4.1 Level of mechanisation and region wise development

Farm mechanisation in India stands at about 40-45 percent. This is still low when compared to countries such as the US (95 percent), Brazil (75 percent) and China (57 percent). While the level of mechanisation lags behind other developed countries, the level of mechanisation has seen strong growth through the last decade. The farm power availability on Indian farms has grown from 1.47 kW/ha in 2005-06 to 2.02 kW/ha in 2013-14.

## Farm power availability on Indian farms

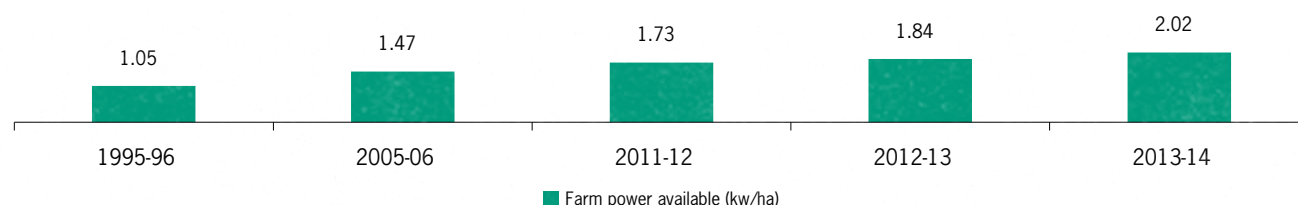


Figure 14: Farm power availability on Indian farms

Source: Country presentation paper, Agricultural Machinery Manufacturers Association (AMMA) India, October 2014

In India, the level of mechanisation varies greatly by region. States in the north such as Punjab, Haryana and Uttar Pradesh have high level of mechanisation due to the highly productive land in the region as well as a declining labour force. The state governments in these states have also provided timely support in promoting mechanisation of farms. The western and southern states in the country have a lower level of mechanisation due to the smaller land holdings prevalent in these regions as well as the land holding being more scattered. As a result, in many cases, mechanisation has been uneconomical leading to the lower development.

In north-eastern states, the level of mechanisation is extremely low. There are a number of reasons behind this. Factors such as hilly topography, high transportation cost, lack of state financing and other financial constraints due to socio-economic conditions and dearth of agricultural machinery manufacturing industries have hindered the growth of farm equipment sector within these states.

Operation-wise, the level of mechanisation varies from 42 percent for soil working and seed bed preparation, 29 percent for seeding and planting, 34 percent for plant protection and 37 percent for irrigation.<sup>6</sup>

Source 6: Country presentation paper, Agricultural Machinery Manufacturers Association (AMMA) India, October 2014

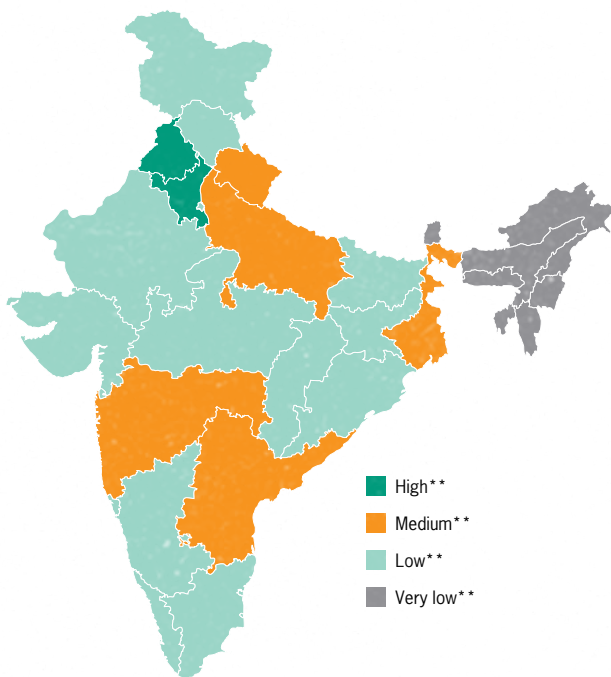


Figure 15: India relative development of mechanisation

Source: State of Indian Agriculture, Department of Agriculture report, 2012-13

\*\* Based on relative scale of farm power availability as shown in the report

Table 4: Level of mechanisation in percent, by crop and value-chain process

Crop	Seedbed preparation	Sowing/ planting/ transplanting	Weed and pest control	Harvesting and threshing
Paddy	85-90	5-10	80-90	70-80
Wheat	90-95	80-90	70-80	80-90
Potato	90-95	80-90	80-90	70-80
Cotton	90-95	50-60	50-60	0
Maize	90-95	80-90	70-80	50-60
Gram	90-95	50-60	60-70	30-40
Sorghum	80-90	30-50	60-70	20-30
Millets	80-90	30-40	60-70	20-30
Oilseeds	80-90	30-40	60-80	20-30
Sunflower	80-90	40-50	80-90	60-70
Fodder Crop	80-90	20-40	80-90	10-20
Vegetable Crop	70-80	5-10	80-90	< 1
Horticulture Crop	60-70	30-40	40-50	< 1

Source: Country presentation paper, Agricultural Machinery Manufacturers Association (AMMA) India, October 2014

## 4.2 Market segmentation

The four major segments of equipment, tractors, threshers, tillers and rotavators have shown steady growth over the past five years.

Tractor is, by far, the largest segment in the equipment category with an annual sale of 600,000-700,000 units. FY'14 witnessed sales of 697,675 (including exports) tractor units. Despite a sales slowdown in FY'15 (to 626,839 including exports), the tractor market (including exports) is expected to grow at a CAGR of 8-9 percent<sup>7</sup> in the next five years as long-term industry drivers remain favourable.

**Table 5: Farm equipment annual market size**

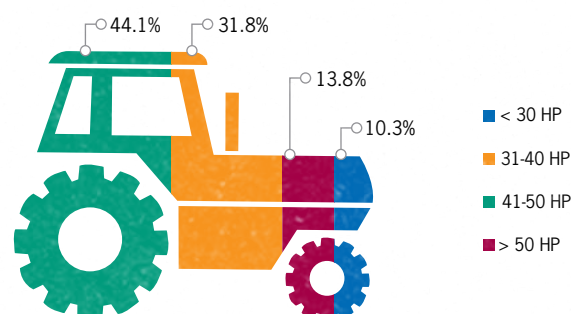
Equipment	Annual market size (units)	Estimate year
Tractor	600,000-700,000	2014
Thresher	100,000	2014
Rotavator	60,000-80,000	2014
Power Tiller	50,000-60,000	2014
Zero-Till Seed Drill	25,000-30,000	2014
Power Weeder	25,000	2014
Combine Harvester	4,000-5,000	2014
Self-Propelled Vertical Conveyer Reaper	4,000-5,000	2014
Laser Land Leveller	3,000-4,000	2014
Rice Transplanter	1,500-1,600	2013
Multi-Crop Planter	1,000-2,000	2014

Source: Trend of agricultural mechanisation in India, United Nations Economic and Social Commission for Asia and the Pacific, CSAM policy brief, June 2014

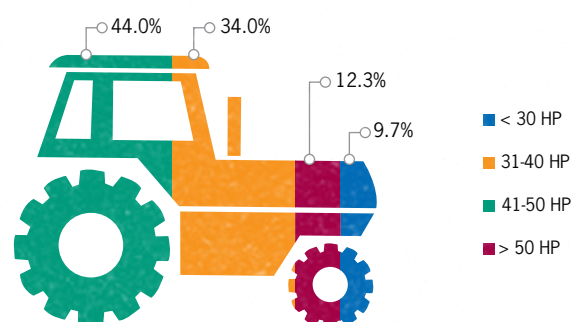
Source 7: ICRA Research Services, June 2015 report

Within the tractor market, the 41-50 HP segment is the largest selling unit, registering about 44 percent of the total tractor sales (domestic + exports) in FY'15. Next largest segment is the 31-40 HP segment, which has gained 2.2 share points in share of volume, which has been sourced mainly from the > 50 HP segment.

**Tractor sales by segment FY'11**



**Tractor sales by segment FY'15**



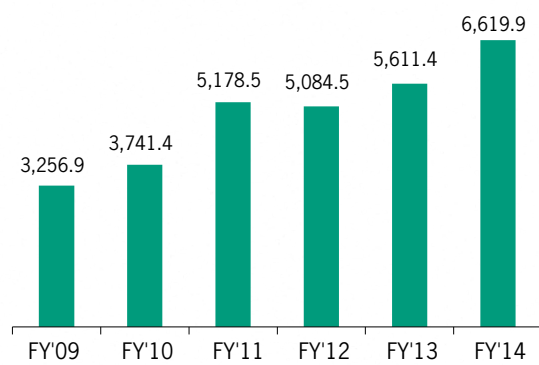
**Figure 16: Tractor sales by segment, FY'11 and FY'15**

Source: ICRA Research Services, June 2015 report

The tractor market has grown at a CAGR of 15.2 percent till FY'14. However, there was a sharp downturn seen in FY'15. This has been attributed to a reduction in farm incomes due to the decline in production of major crops as well as softening commodity prices with lower procurements by the government on account of adequate buffer reserves. In the same time period, the tiller market grew at 10 percent.

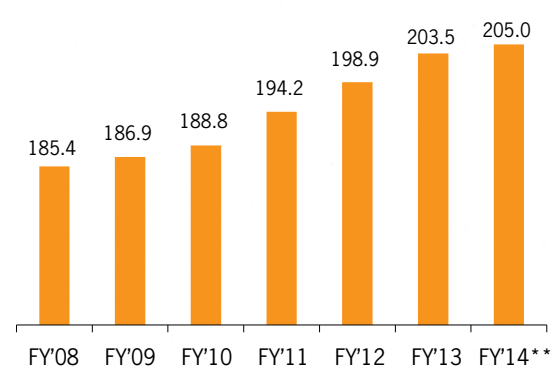
Between FY'08 and FY'13, the thresher and rotavator markets grew at 2.0 and 21.0 percent respectively.

**Tractor market (US\$ millions)**



Source: Ministry of Agriculture, November 2014, Market value estimated based on average price US\$ 9,500 per tractor as per Trends of Agricultural Mechanisation in India CSAM Policy Brief'

**Thresher market (US\$ millions)**

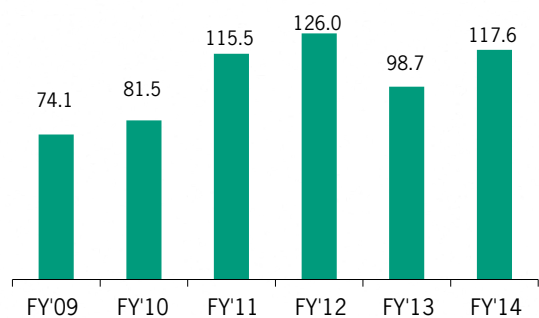


Source: Asia pacific agricultural equipment industry outlook to 2018, August 2014 report, Ken Research

**Figure 17: Tractor and thresher market**

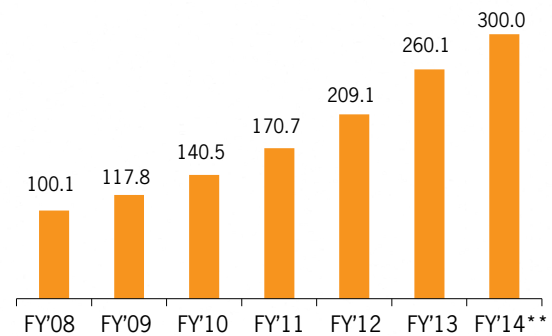
\*\* Estimated based on projected annual market size and average price as indicated in 'Trends of Agricultural Mechanisation in India CSAM Policy Brief'

**Power tiller market (US\$ millions)**



Source: Ministry of Agriculture, November 2014, Market value estimated based on average price US\$ 9,500 per tractor as per Trends of Agricultural Mechanisation in India CSAM Policy Brief'

**Rotavator market (US\$ millions)**



Source: Asia pacific agricultural equipment industry outlook to 2018, August 2014 report, Ken Research

**Figure 18: Power tiller and rotavator market sizes**

\*\* Estimated based on projected annual market size and average price and projected growth rates as indicated in 'Trends of Agricultural Mechanisation in India CSAM Policy Brief'

# 4.3 Farm machinery trade

Globally BRICS nations (Brazil, Russia, India, China and South Africa) with Japan and Turkey are joining the ranks of heavy weight agricultural machinery markets. India is too involved in the international trade of a number of different farm equipment.

### Tractor trade (units):

India is considered to be the largest tractor market in the world. While the country produces a large volume of tractors, it also exports tractor units to other countries across the world. On an average, the country exports an average of 60,000 tractors annually. India's tractor export markets primarily include African countries and ASEAN countries where soil and agro-climatic conditions are similar to India. In FY' 2009, India exported 38,198 units of tractors to 62,890 in FY' 2013 growing at a CAGR of 13 percent.

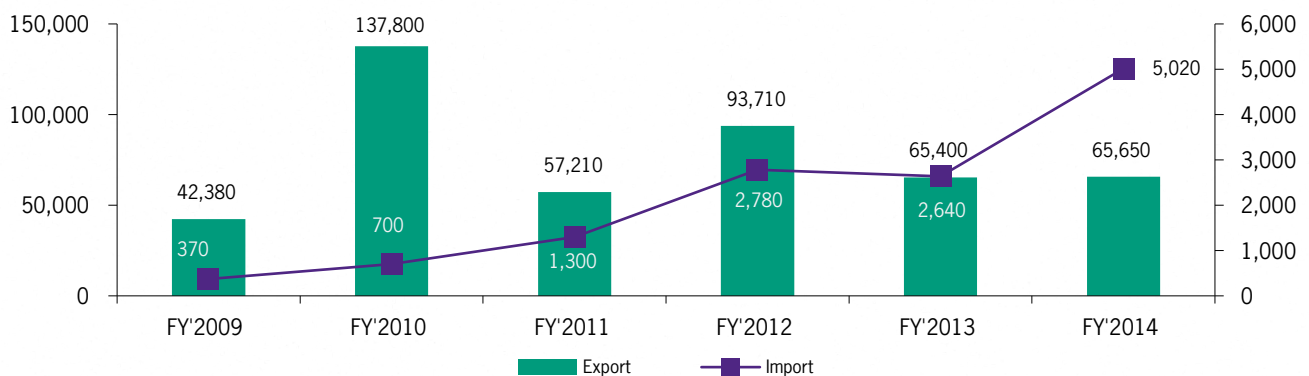


Figure 19: Tractor trade

India's tractor export markets majorly include African countries and ASEAN countries where soil and agro-climatic conditions are similar to India. In FY' 2009, India exported 42,380 units of tractors to 65,650 in FY' 2014 growing at a CAGR of 9.1 percent.

### India combine harvesters trade (units):

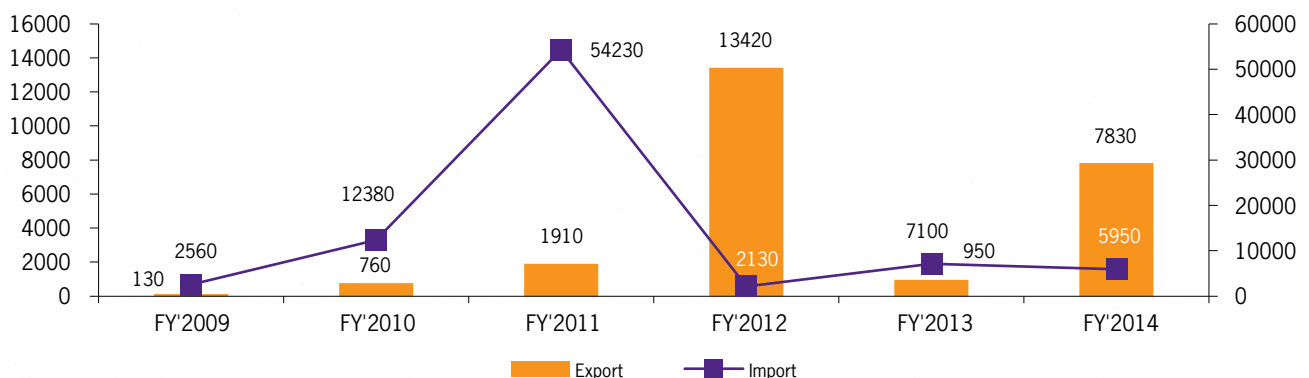


Figure 20: India combine harvesters trade

Source: Ministry of Commerce and Industry, Government of India

While domestic companies cover major part of the market, foreign players are gradually picking up. Import has increased with a CAGR of 15.1 percent between FY'09 and FY'14 while export has declined by 4.5 percent annually. Iran, Sri Lanka and Nepal are among the countries that generally import combine harvesters from India.

### Seeders, planters and transplanters trade (units):

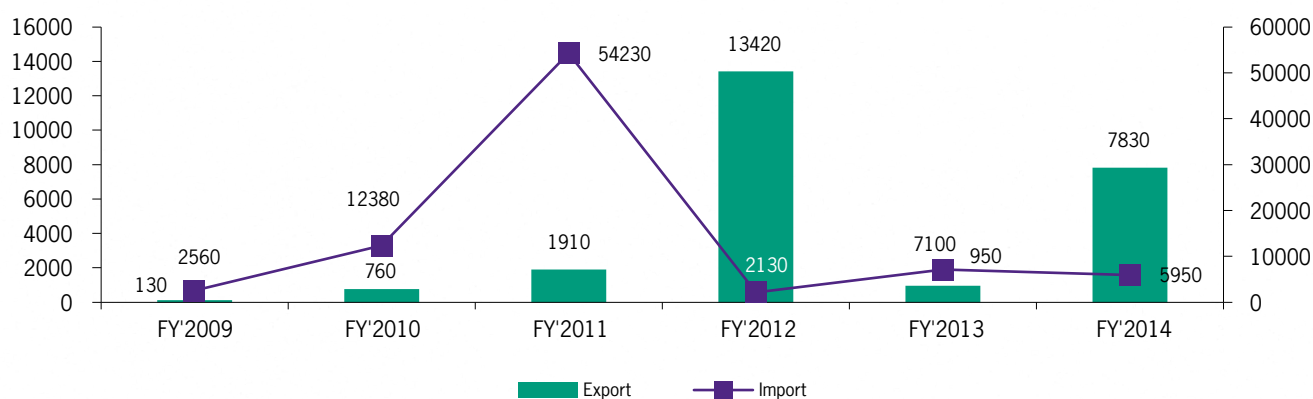


Figure 21: Seeders, planters and transplanters trade  
Source: Ministry of Commerce and Industry, Government of India

India majorly relies on imported machinery in this segment. Imports of the machinery grew at impressive CAGR 18.4 percent whereas; the exports saw a growth of CAGR of over 100 percent over the period from FY'09 to FY'14.



### Factors affecting trade

Limited farm labour, easy credit availability and fund access, moderate penetration and shortening replacement cycle have been some factors encouraging demand for tractors and farm equipment in the country.

Today a number of loan schemes, low interest rate plans and easy instalment breakdowns linked with the crop cycle have been made available to facilitate the generation of funds for farmers. As a result of this incentivisation, a large section of the farming community is now willing to embrace mechanisation rather than scouting for cheap farm labour.

On the pricing front, the minimum support price (MSP) rates decided by the government of India indirectly affect the farm equipment and tractor industry. Lower MSPs leave farmers with little or no money to spend on mechanisation.



## 4.4 Growth drivers

There are a number of factors that can contribute to the growth in farm mechanisation. In order to meet the demand in future and achieve the target of an average farm power availability level of 2.5 kW/ha, country needs to the intended level of mechanisation.



### Contract farming:

Business establishments provide farmers with specialised farm equipment and various amenities to improve crop yield through the adoption of latest agricultural technologies. Many companies in the country have participated in such practices before. The continuation and growth of contract farming with more entities getting involved provides future opportunities for the expansion of the industry.

### Low penetration of farm equipment:

Penetration of farm equipment in India provides a strong growth opportunity. As mentioned above, only about 40-45 percent of agriculture in India is mechanised. In 2012-13, it was estimated that the penetration of tractors was about 20 per 1,000 hectares. The penetration is lower with the small and marginal farmers who own land less than 5 hectares. This segment forms over 80 percent of the land holdings in the country. Thus, there is a lot of potential for increasing the penetration and therefore growing the market size.

### Credit availability:

Agricultural sector requires adequate financing with such a large portion of land holdings falling into the category of small and marginal farmers. With a greater focus on meeting the future production demand, various national and commercial banks have devised special plans to support the farmers through different schemes. There are several wrinkles in the procedure but a combine effort between the government and the institutions, dialogues for which are already underway, provides a good indication for the future of the industry. The government has also taken a keen interest in the industry and has provided special budget allocations under the 12th five-year plan.

# 4.5 Competitive landscape

The competitive landscape in each of the four major segments of focus shows a few, very large players dominate the market. Other smaller-manufacturers have lesser market share.

## Tractor Market:

The largest tractor manufacturers not only cater to the Indian market, but are also major exporters of tractors to regions such as the US, China, Australia, Latin America, the Middle East and South Asia.

### Tractor industry market share

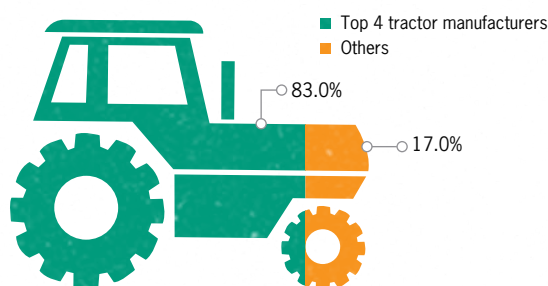


Figure 22: Tractor industry landscape

## Rotavator Market:

The Indian rotavator market is also dominated by a number of smaller firms. The top four rotavator manufacturers hold more than 80 percent of the market.

### Rotavator industry market share

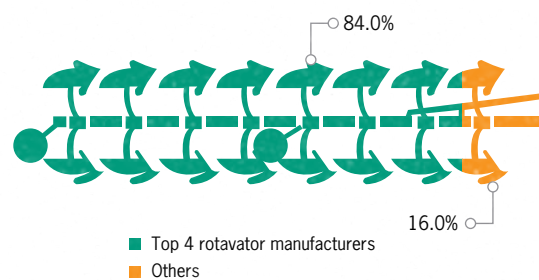


Figure 23: Rotavator market landscape

## Power Tiller Market:

This market is dominated by two Indian companies collectively catering to more than 65 percent of the market. The remaining market is catered to by small firms and primarily by those importing Chinese power tillers. The key Indian tiller manufacturers also cater to the export market, exporting to regions such as the Middle East, Russia, Turkey, the European markets and other parts of Asia.

### Tiller industry market share

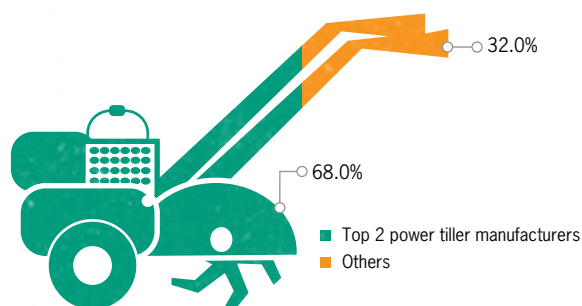


Figure 24: Power tiller market landscape

## Thresher Market:

The majority of the thresher market in India remains unorganised. Only one large manufacturer stands out and holds about a third of the market. The other is divided up into numerous smaller players.

### Thresher industry market share

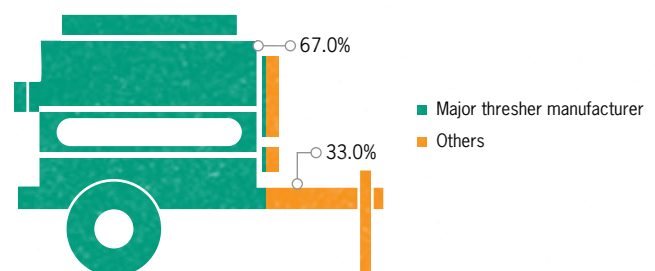
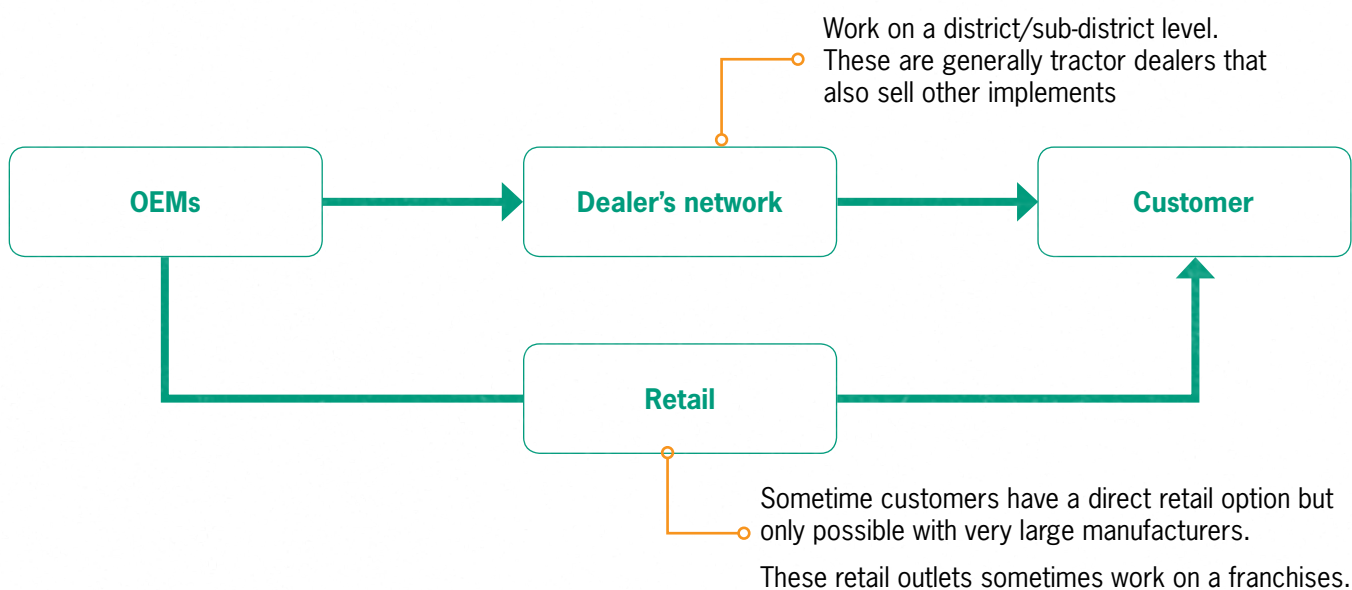


Figure 25: Thresher market landscape

## Distribution channels for farm equipment



## Financing options for acquiring farm machinery

Financing remains a key hurdle for farmers accessing the subsidies extended by the government. Even with subsidy support, farmers have limited options. Even some equipment manufacturers provide assistance to the farmers. For example, large tractor manufacturers provide assistance to farmers for purchase of tractors by giving out loans through their finance division.

Farmers also have the option of approaching cooperative agricultural banks such as National Bank for Agriculture and Rural Development (NABARD) for assistance. Agricultural loans are also available to farmers for a multitude of farming activities through public sectors banks in India. These include the State Bank of India as well as other nationalised banks that offer a variety of schemes to help farmers in purchase of farm equipment. Finally, farmers can also approach commercial banks for financing farm equipment.

Although farmers have a number of options for financing, a number of challenges continue to hinder credit flow within the beneficiaries. These include high collaterals, especially for loans of more than INR 1 lakh, high interest rates and relatively low repayment periods (5-7 years). Industry experts believe that easier financing norms and more financing from commercial banks are needed to promote farm mechanisation in the country.

# 4.6 Concept of Custom Hiring Centres (CHCs) for farm equipment

Custom hiring of farm machinery (CHCs) was introduced in Indian agriculture in as early as 1912. Organised move to promote multi-farm use of agricultural machinery was made in mid-1960 when Agro-Industries Corporations were established within the states.

CHCs are a unit comprising a set of farm machinery, implements and equipment for hiring by farmers. These centres give farm machinery on a rental basis to farmers who cannot afford to purchase high-end agricultural machinery and equipment, apart from servicing old machinery. Farm machineries/equipment available at CHCs include tractor, rotavator, multi-crop thresher, MB plough, cultivator, leveller blade, blade harrow, seed cum fertilizer drill, knapsack sprayer, power weeder, winnowing fan, electronic balance, repairing tools.

These units are generally located in close proximities to large and small land holdings, which supply machinery and equipment to villages close to it reducing transport cost and transportation time.

States such as Punjab, Haryana, Uttar Pradesh, Uttarakhand, Gujarat, Maharashtra, Karnataka and TN, which are highly mechanised, have maximum number of registered and unregistered CHCs catering to the machinery and equipment requirements of the farmers.

Other states do have operational CHCs but farm mechanisation still remains a serious concern. Custom hiring centres, in order to work effectively and efficiently require a sound infrastructure setup for its operations, which include all weather roads, spatial distribution of machinery ownership and servicing network.

The government also recognises the value of these centres and the role they can play in mechanisation of farm operations. As a result, establishment of farm machinery banks for custom hiring is one of the core components of the Sub-Mission on Agricultural Mechanisation (SMAM) and government provides financial assistance for setting them up. However, there is a need for enhanced participation from the private sector in an endeavour of setting up CHCs and capacity building. Only then the subsequent upskilling and training can bring a sustainable and more inclusive growth.

## Global perspective: Custom hiring of agricultural machinery in China

The Government of China pays great attention to farm mechanisation, recognising and appreciating its importance. It has launched a number of policies in support of custom hiring of agricultural equipment. In 2004, congress adopted the 'Law on Promoting Agricultural Mechanisation of the People's Republic of China' and in 2010, released the 'Opinion on Promoting Sound and Fast Development of Agricultural Mechanisation and Agricultural Machinery Industry'.

Under these, the responsibilities of all levels of government and agricultural authorities were outlined with respect to promoting agricultural mechanisation in their respective regions and measures and requirements for promoting custom hiring of equipment were laid out.

China also has a subsidy policy for farmers, which has promoted farmers' willingness to purchase machinery, which in turn, has laid a solid foundation for custom hiring. There are number of steps the government took to help foster custom hiring and as a result. Statistics from the year 2013 show that China had 5.24 million machinery service-providing households, 168,000 organisations, 201,000 machinery maintenance plants and stops, and 7,000 intermediary service organisations. In particular, machinery cooperatives, specialised in cooperative use of machinery have seen strong growth. Custom hiring of farm machinery including leasing, cross-region operations, order placement and contract management, has met the diversified needs of the farmers.

# Key Innovations in the industry value chain for efficient farming



Innovation is intrinsic to agriculture. Ever since humans discovered the technique of multiplying wild seeds into food and other products, an unbreakable relationship between agriculture and creativity was born. India presents unique opportunities with its small land holdings, variety of climatic zones and different soil types across different regions. Thus, innovation is essential for Indian agriculture as a result of the above-stated factors. In order to adapt to these, furthering the innovative spirit among all stakeholders (individual farmers to large-scale manufacturers) is necessary.

Below are just some examples of innovations in agricultural equipment that came about to address specific but real issues farmers face on the farms on a daily basis:

## **Mobile groundnut thresher-cum-collector:<sup>8</sup>**

The machinery was invented on account of the farm labour scarcity. Non-availability of farm labour during peak season of sowing and harvesting delays the collection and ultimately results in yield losses. To overcome these problems, a tractor mounted PTO powered mobile thresher was developed. This has a separate chamber for collection of groundnut pods and stalk. The manufacturer of the machine was awarded at the 7th National Award Function of the National Innovation Foundation – India (NIF) in 2013.

The salient features of this innovation are:

- Provision of storage chambers and feeding mechanism making it suitable for threshing while moving around the field.
- It reduces time and labour cost.

Source 8: Information on innovations and images used are from the National Innovation Foundation – India (NIF)

### Groundnut digger:<sup>9</sup>

Labour scarcity also promoted the development of a groundnut digger. One of the major challenges faced by farmers is the shortage of labour for harvesting operations. The machine has a tractor-mounted, PTO-powered groundnut digger. The innovator was awarded at the 7th National Award Function of the National Innovation Foundation – India (NIF) in 2013.

The salient features of this innovation are:

- This machine not only mechanises the digging but also undertakes cleaning and drying.
  - Damage to the pods is much lesser than the alternatives currently available.
  - The machine can be used in different kinds of soil. On an average the machine can harvest about 0.4 acre per hour.
- 

### Sugarcane Bud Planter:<sup>10</sup>

Sowing of sugarcane buds in field is cumbersome.. Not maintaining uniform distances between the buds and varying the depth while sowing manually, may result in less productivity. As an attempt to address these issues, the Sugarcane Bud Planter was born, which is a tractor operated bud planter.

Using this planter the plantation cost is estimated to reduce to about INR 800/acre from about INR 6,000/acre using labour. The plant-to-plant sowing distance can also be adjusted according to the requirements. It can also be used for simultaneous application of fertilizer, pesticides or herbicides in the field. For this purpose, the machine is equipped with a sprayer pump. The machine can also be used for intercropping along with sowing of sugarcane buds. Pulses, wheat, and peanuts can be planted in between two rows of sugarcane. Apart from these, the machine can also be used for planting potatoes. The machine becomes helpful for those farmers, who face constant scarcity of farm workforce. The machine requires manpower only to fill the bud box whenever it gets empty. The innovator was awarded at the 8th National Award Function of the National Innovation foundation – India (NIF) in 2015.

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### Solar-powered water pumps:

These pumps use the abundant solar power available to pump water from the ground. These provide an energy-efficient way to farmers for irrigating their land.

These also have the potential of providing additional income to the farmer. The saved power on the farms can be sold back to the grid.

Taking a cue from countries such as Japan and China, both of which invest heavily in research and development for technological innovation in farming, India must also take more steps to promote and foster an innovative environment in agriculture. This can help the country in achieving higher penetration levels as well as a more productive labour force. #

Source 9,10: Information on innovations and images used are from the National Innovation Foundation – India (NIF)



Section V:  
Government's  
role in farm  
equipment sector

# 5.1 Overview of schemes and policies

The Government has implemented various farm mechanisation programmes in the country through schemes such as Rashtriya Krishi Vikas Yojna (RKVY), Mission for Integrated Development of Horticulture (MIDH), National Mission on Oilseeds and Oil Palm (NMOOP) and National Food Security Mission (NFSM). In addition to development of such schemes, the government has also implemented the National Mission on Agricultural Extension and Technology (NMAET) to strengthen the extension machinery and utilise the same for synergising the interventions under these schemes.

## **Mechanisation under the National Food Security Mission (NFSM):**

The National Development Council (NDC) adopted a resolution to launch a food security mission comprising of wheat, rice and pulses to increase production of wheat by 8 million tons and pulses by 2 million tons by the end of the XIth five-year plan. Accordingly, the National Food Security Mission (NFSM) was launched in October, 2007. The mission is being continued in the XIIth five-year plan with revised targets. The plan now targets additional production of food grains of up to 25 million tons (10 million tons of rice, 8 million tons of wheat, 4 million tons of pulses and 3 million tons of coarse cereals) by the end of the five-year plan. In accordance with that, the Mission makes provisions for assistance (up to 50 percent the cost of machinery) to be provided for adoption of farm machinery such as pump sets, tractor mounted sprayers, seed drills, zero till seed drill etc. to varying degrees.

## **Mechanisation under the Rashtriya Krishi Vikas Yojna (RKVY):**

To spur growth in agriculture and allied sectors, the Government of India, in consultation with the Planning Commission, Department of Agriculture and Cooperation, launched the RKVY in 2007-08. The main objectives of the schemes include:

- Incentivising states to increase investment in agriculture and allied sectors.
- Ensuring the preparation of agricultural plans for the districts and states based on agro-climatic conditions, availability of technology and natural resources.
- Achieving the goal of reducing the yield gaps in important crops, through focused interventions along with maximising returns to the farmers.
- Bringing about quantifiable changes in the production and productivity of various components of agriculture and allied sectors by addressing them in a holistic manner.

The scheme works through four main streams:

- RKVY Production growth – with 35 percent of the outlay.
- RKVY Infrastructure and assets – with 35 percent of the outlay.
- RKVY Special schemes – with 20 percent of the outlay.
- RKVY Flexi fund – with 10 percent of the outlay (States can undertake either production growth or infrastructure and assets projects with this allocation).



Agricultural mechanisation falls under the production growth stream of the scheme. Under this scheme, assistance can be provided to farmers for farm mechanisation efforts, as detailed in the state/ district agricultural plans, especially for improved and gender friendly tools, implements and machinery. However, assistance for large equipment (e.g. tractor, combine harvester, sugarcane harvester, cotton picker etc.) for which ownership may not be economically viable, assistance should only be provided for establishing custom hiring centres under RKVY (infrastructure and assets stream).

#### **Mechanisation under the Mission for Integrated Development of Horticulture (MIDH):**

MIDH is a centrally sponsored scheme for the overall growth of the horticulture sector covering fruits, vegetables, root and tuber crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew, cocoa and bamboo. The Central Government provides 85 percent of the assistance and the remaining 15 percent is provided by the states (except in the north-eastern and Himalayan states where the central government's contribution is 100 percent). One of the key interventions under the scheme is 'Horticulture Mechanisation' which aims to improve farm efficiency and reduce drudgery of the workforce. Assistance in this regard is provided for activities such as procurement of power operated machines and tools, besides import of new machines. Assistance is also available to grower associations, farmer groups, self-help groups, and women farmer groups etc. (with more than 10 members) that are engaged in cultivation of horticulture crops. 60 percent of the cost of machines will be borne by such groups.

#### **National Mission on Agricultural Extension and Technology (NMAET):**

Agricultural technology, including the adoption/ promotion of critical inputs and improved agronomic practices, was being disseminated under 17 different schemes of the Department of Agriculture and Cooperation during the 11th plan. The Modified Extension Reforms Scheme was introduced in 2010 with an objective to strengthen the extension machinery and utilise it for synergising the interventions under these schemes under the umbrella of Agriculture Technology Management Agency (ATMA).

NMAET was envisaged as the next step towards this objective through the amalgamation of these schemes. It includes four sub-missions:

- Sub-Mission on Agriculture Extension (SMAE)
- Sub-Mission on Seed and Planting Material (SMSP)
- Sub-Mission on Agricultural Mechanisation (SMAM)
- Sub-Mission on Plant Protection and Plant Quarantine (SMPP)

These sub-missions are inextricably linked to each other. The common thread running across all four sub-missions is 'Extension and Technology'.

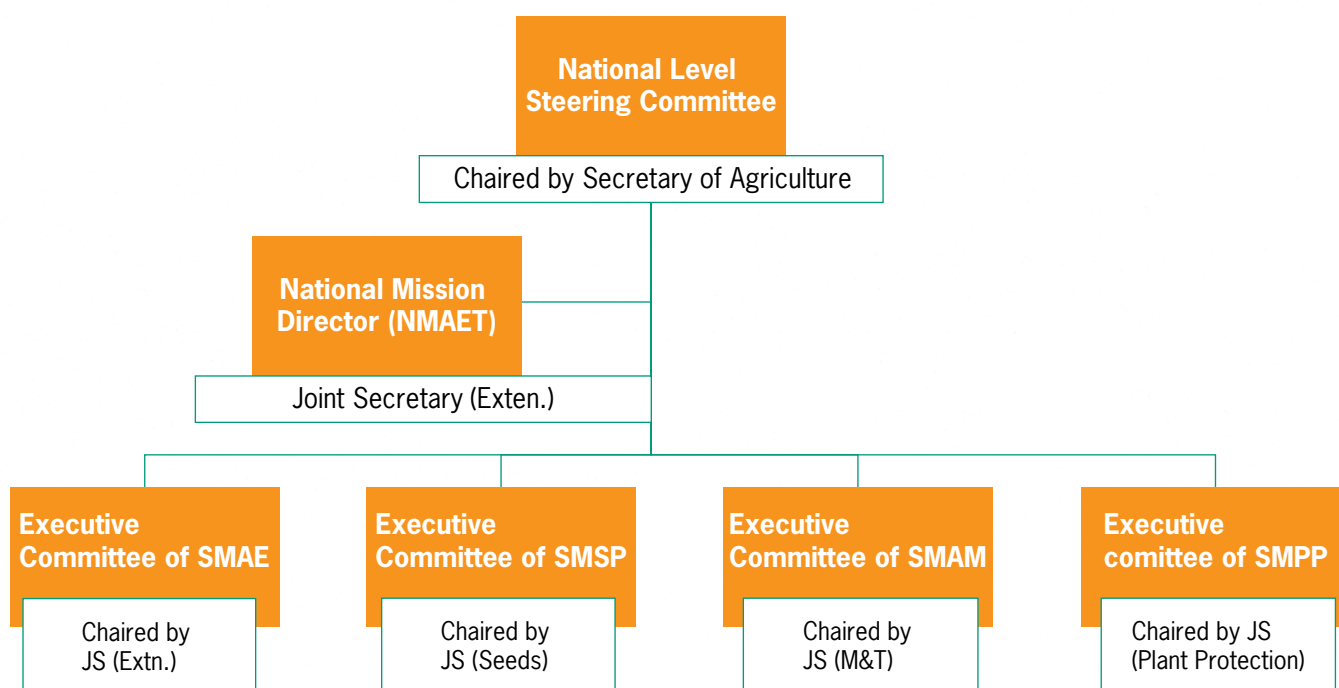
The objectives of this Scheme can be achieved through a judicious mix of extensive physical dissemination, use of ICT, popularisation of modern and appropriate technologies, capacity building and institutional strengthening to promote mechanisation, availability of quality seeds, plant protection and also encouragement of aggregation of farmers interest groups (FIGs) to form Farmer Producer Organisations (FPOs).

### Structure of the mission:

For effective implementation of the national mission, a steering committee was constituted and notified. The committee is the policy making body, giving overall directions and guidance to the mission. It acts as an empowered body and decides inter-component changes among the sub-missions. The committee also reviews the performance of the NMAET at least once a year.

Mission director for the NMAET is the joint secretary (extension) who ensures effective and expeditious implementation and convergence among the sub-missions. The overall in-charge of each sub-mission is the joint secretary of the respective elements covered under the scheme.

### Implementation process of the NMAET:



Source: Department of Agriculture, Grant Thornton analysis

However, convergence of farmer centric extension related activities is overseen by the Extension Division through the instrumentality of SEWP (State Extension Work Plan). Mission Director also helps in bringing out synergies among various sub-missions.

An expanded IDWG headed by the APC or Principal Secretary (Agriculture) at state level (after including all sub-missions related officers) and ATMA Governing Board at district level, monitors and is accountable for the effective implementation of the mission.

### Sub-Mission on Agricultural Mechanisation (SMAM):

The Sub-Mission is part of the National Mission on Agricultural Extension and Technology, and is implemented

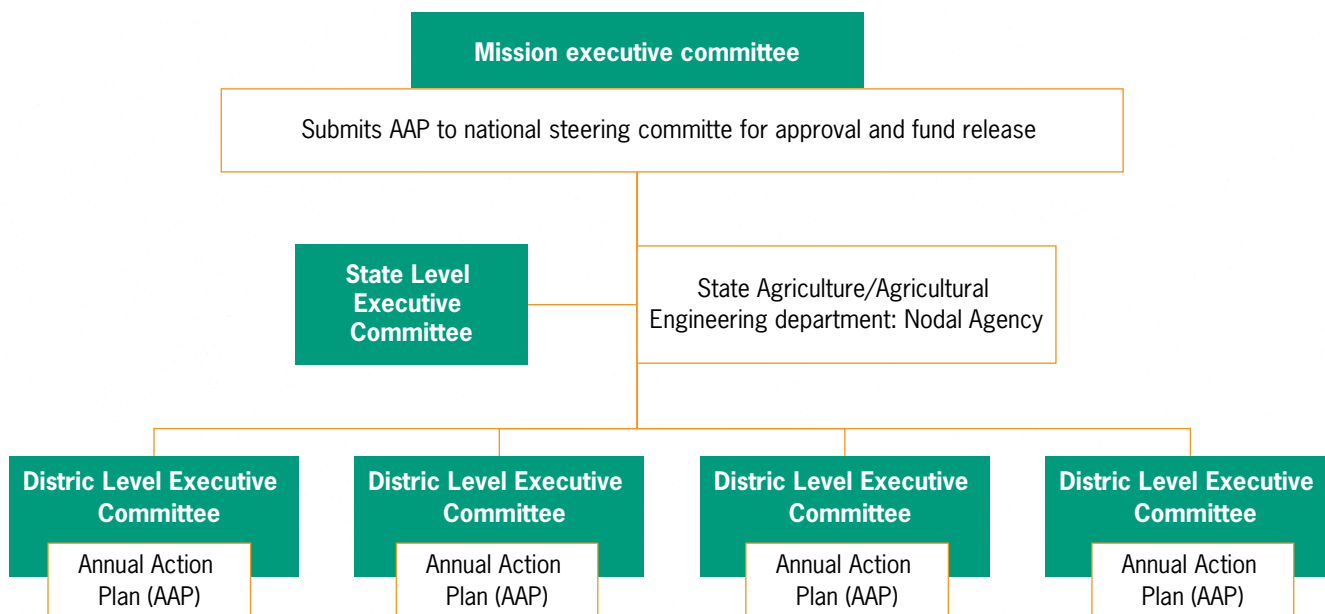
in all the states to promote the usage of farm equipment and to increase the ratio of farm power to cultivable unit area up to 2kW/ha. Mission's objectives are:

- Increasing the reach of farm mechanisation to small and marginal farmers and to regions where availability of farm power is low.
- Promoting 'Custom Hiring Centres' to offset the adverse economies of scale arising due to small landholding and high cost of individual ownership.
- Creating hubs for hi-tech and high value farm equipment.
- Creating awareness among the stakeholders through demonstration and capacity building activities.
- Ensuring performance testing and certification at designated testing centres located all over the country.

To achieve these objectives, the mission has the following components:

- Promotion and strengthening of agricultural mechanisation through training, testing and demonstration [Central Sector Scheme/ Component].
- Demonstration, training and distribution of Post-Harvest Technology and Management (PHTM) [Central Sector Scheme/ Component].
- Financial assistance for procurement of agricultural machinery and equipment.
- Establishment of farm machinery banks for custom hiring.
- Establishment of hi-tech and productive equipment hub for custom hiring.
- Financial assistance for promotion of mechanised operations/ hectare carried out through custom hiring centre.
- Promotion of farm machinery and equipment in north-east region.

**Implementation process of the SMAM:**



Source: Department of Agriculture, Grant Thornton analysis

The district level annual plans are submitted to the nodal agency, which are the state agricultural departments or agricultural engineering departments. These agencies then prepare the state annual plans in consonance with the mission’s goals and objectives, taking into account the tentative outlay of the state as outlined by the Department of Agriculture, Cooperation and Farmer Welfare (DAC & FW). The nodal agencies also ensure suitable integration of AAP with other schemes such as the RKVY, NFSM, and MIDH. The state annual plans are then submitted to the State Level Executive Committee (SLEC) for approval and thereafter to the executive committee. Upon approval of the plans, the nodal agencies receive the funds from the DAC & FW for the implementing agencies and oversee, monitor and review implementation of the programmes.

**Monitoring:**

The mission envisages a coordinated approach for monitoring and evaluation with active involvement of the implementing agencies, beneficiaries and other stakeholders. A combination of periodic desk review, field visits and web-based mechanism has been adopted for releasing funds, monitoring physical and financial progress and monitoring the progress of the other mission interventions at the national level by Mechanisation & Technology (M&T) division at the DAC & FW.

## 5.2 What schemes and policies mean?

Subsidies to the tune of 25 to 50 percent are made available to farmers by the Government to ensure the machinery/equipment is available at a better price. However, ceiling limits are available to all category of farmers for the purchase of various agricultural equipment's under varied schemes of the Department of Agriculture and Cooperation such as Macro Management of Agriculture, National Food Security Mission (NFSM), Rashtriya Krishi Vikas Yojana (RKVY), National Horticulture Mission etc.

Preliminary targets under the NFSM for the Twelfth Plan were enhancing production by additional 25 million tonnes of food grains, which includes 10 million tonnes of rice, 10 million tonnes of wheat, 3 million tonnes of pulses and 2 million tonnes of millet. Also, the scheme aims to expand fodder production to meet the demand both of green and dry fodder. The Union Budget 2013-14 had allocated US\$ 339.5 million (INR 2,250 crore) to the mission.

New farm practices were encouraged through 5.79 lakh demonstrations of improved package of practices on rice, wheat and pulses. About 100.70 lakh ha area had been treated with soil ameliorants (gypsum/ lime/ micro nutrients etc.) to restore soil fertility for higher productivity. Whereas, an area of about 39.42 lakh ha was treated under Integrated Pest Management (IPM).

Nearly 30.16 lakh improved farm machineries including water saving devices are distributed. Capacity building of farmers has been encouraged through arranging 43,656 farmers' field schools (FFS) at the farm level so far. All the targets were less than what actually was achieved during the Eleventh Plan and are consistent with demand forecasts. This would amount to targeting 2–2.5 percent increase in food grains production in the Twelfth Plan.

Two programmes were started as RKVY sub-components in the Eleventh Plan by the government namely, the 60,000 pulses village programme and the intensive millets production programme were shifted into NFSM.

Funds allocated under government's initiative RKVY and its sub-schemes for 2015-16 are US\$ 559.4 million (INR 3,707.16 crores). Whereas, for the year 2014-15 the funds released by the government for the scheme across all states were US\$ 1,262.20 million (INR 8,363.89 crores) and the expenditure made for the same year was US\$ 826.35 million (INR 5,475.85 crores).



## Agriculture Equipment Industry: SWOT analysis

A SWOT analysis to promote mechanisation of Indian Agriculture

### Strengths

- Large infrastructure of over 20,000 manufacturers in small scale industry; vast network of academic and R&D institutions including AICRPs under NARS for human resource development and R&D.
- Trained manpower for R&D in agricultural engineering.
- Over 100 cooperating centres of AICRPs in the area of agricultural engineering.
- Computer aided design adopted by the institutes for high pace of R&D.

### Weaknesses

- Unreliable after sales service of agricultural equipment.
- Poor liaison with industries for R&D and commercialisation.
- Non effective feedback system.
- Absence of non-land economic activities.
- Non-systematic marketing of agricultural equipment.

### Opportunities

- Development of entrepreneurship for custom hiring of farm machinery and agro-processing equipment.
- Post-harvest loss reduction and value addition at the production catchments through rural level agro-processing centres.
- Establishment of value chain for commercial supply, transport and marketing of agricultural produce.
- Opportunity to increase the irrigated area by introducing micro-irrigation.
- Reducing yield gaps and increasing productivity through precision farming technologies.

### Threats

- Migration of farmers from agriculture to other industries.
- Fragmentation and continuous reduction of operational holdings.
- Slow pace of R&D and commercialisation.
- Inadequate infrastructure back up, for after sales support of farming equipment.
- Renewable energy technology is still subsidy dependent.

S W O T





Section VI:  
Challenges faced  
by the industry

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There are a number of obstacles in achieving the target level of 2.5 Kw/ha farm power availability. It is imperative that all stakeholders in farm equipment sector have a clear understanding of these challenges and can collaborate to overcome these issues.

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### Small and scattered land holdings:

Average farm size in India is less than 2 hectares, which is far lower than regions like European Union (14 hectare) and the US (170 hectare). Large farm machineries are difficult to operate on such land holdings, which in some cases are completely unsuitable.

Another factor to consider is mechanising small and non-contiguous group of small farms is against economies of scale, especially in operations such as land preparation and harvesting. As land holdings get smaller, more and more farmers fall into the adverse category and therefore make ownership of machinery lesser economical.

### Equipment cost, quality and after-sale service:

Farm equipment, especially the energy-efficient options, are capital intensive and are a major investment for most of the farmers in India. A majority of them belong to the low-income bracket. This is evidenced by the fact that almost 90 percent of the tractors sold in India are done so with the assistance of some financial institution.

The quality and after-sales service of farm equipment is another concern, since agriculture is largely carried out in rural parts of India and there is still an inadequacy of service-centres for proper maintenance.

### 'Tractor-isation' and not mechanisation:

Tractors have an annual market of 600,000-700,000 units in India whereas, threshers, the next largest segment, has an annual market of just 100,000 units. The penetration of tractors has grown from one per 150 hectares to one per 30 hectares on agricultural land.

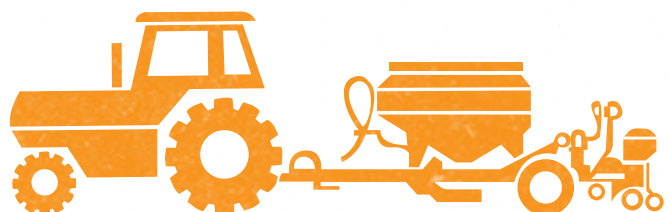
However, such a growth in penetration has not been seen in other agricultural implements. This phenomenon has been dubbed as 'tractor-isation' by many industry stakeholders. It is to be noted that for a sustainable agricultural future, other farm implements, and not just tractors, need to be advanced to farmers in the country.

### Tendering process:

There are various inefficiencies in the tendering process, especially with regard to the time and length of the process. In some states, the tendering process goes through the months of August and September (even October in some cases), due to which a time lag crops up. By this time the main season has already ended. Hence, farmers are unable to draw the optimal benefit of the available machinery. The tiller market is especially impacted by this, as virtually all the tillers sold in the country are done so on subsidy (since subsidy applies to imported tillers as well). Therefore, ensuring timely completion of the tendering process (before the beginning of April) is paramount to safeguard the interests of the farmers.

### Procurement process for the farmer:

The entire process of acquiring farm equipment is very tedious and cumbersome for a farmer. A farmer has to go through various levels/ departments to get his land records verified. Post clearance, he has to go through further checks from the District Agriculture Officer in order to obtain approval and clearance for the purchase. This process itself becomes a big hindrance and discomfort to the farmer.



### **Financing of farm equipment:**

Purchase of farm equipment is a significant investment for most of the farmers in India. Hence, reasonable financing norms are a must for ensuring mechanisation.

An issue that has been persistent in financing is the purchase of standalone implements. The only exception is seen in case of tractors where the required details of the equipment e.g. engine number, chassis number etc. are available. Hence, institutions insist on purchase of the tractor along with other farm implements. This seems to discourage farmers from investing at large, as they need to shell out a huge amount. This adds to the ‘tractor-isation’ trend that is visible in the industry and doesn’t add to overall mechanisation.

Industry stakeholders also feel that commercial banks must be encouraged to provide adequate financing for various farm equipment. This is seen by many industry sources as the biggest impediment to growth. Industry believes that commercial banks are reluctant to provide financing for agricultural equipment, owing to the risk it poses.

### **Redundancies and inefficiencies in the equipment testing process:**

One of the strategies laid out in the Sub-Mission on Agricultural Mechanisation (SMAM) is conducting performance testing for various farm equipment at the four Farm Machinery Training and Testing Institutes (FMTTI), designated State Agricultural Universities (SAUs) and ICAR institutions. This ensures that a farmer can trust the technology being purchased. However, the number of institutions that can provide these FMTTI certificates is low and causes many logistical issues for the manufacturers. The redundancies in the process of testing further contributes to the logistical issues faced by manufacturers.

### **Pricing of equipment:**

The government has allocated a substantial subsidy for farm equipment of about US\$ 300 million (INR 2,000 crore), under the SMAM. However, the government also feels that the pricing of the equipment needs to be addressed with equal importance. The prices of equipment under subsidy are seen to be higher than the market price of these equipment. This poses a challenge for the government as well as the farmers.

In order to ensure optimal use of the subsidy being provided, ensuring fair prices for the equipment is essential. The government suggests the ‘pricing cartel’ issue to be resolved through hosting the list of manufacturers and the equipment price on a central portal, which can then be communicated to the states.

### **Other challenges the industry faces:**

A host of other challenges are faced by the industry and impacts proper functioning of the system.

- There is a lack of proper mandatory safety standards for use of machinery as well as absence of standardised norms to ensure quality of the equipment. As a result, there is no premium for the higher quality products, which leads to lesser incentives for manufacturers to invest in quality and also to invest in new and cutting-edge technologies.
- Another problem the industry faces is the lack of data/information. Also, there is a clear absence of farm machinery management data regarding use-patterns, annual-use, breakdown-frequency, repair and management cost, reliability, granular information on the extent/penetration of mechanisation etc. In absence of data, requirements of the scope of market growth remains unclear and are often targets are missed.
- Some manufacturers also face issues of excise duties that need to be paid on intermediate parts such as higher-quality gear-boxes that are imported and used in assembling the final product. Therefore, even if parts are imported and assembled and used in the country, the manufacturers have to bear the cost.





Section VII:  
Way forward

# 7.1 Innovative measures

Based on our interviews with various stakeholders, industry advisors, operators and manufacturers, various measures are recommended. These measures have been divided into two broad categories: Innovative measures and administrative measures. Innovative measures are new initiatives that can be taken into consideration in the future and administrative steps are those that will remove the inefficiencies and redundancies that exist in the current system

## A. Custom Hiring Centres (CHC) for various purposes:

Promoting establishment of more CHCs is essential for future of the industry. But these centres could play more than the traditional role. These centres can be used as central hub for a number of activities:

- Ensuring availability of crop and local-condition specific equipment for use.
- Promoting the idea of cooperative farming among small and marginal farmers so that these 'cooperatives' can together fund farm equipment and use concurrently.
- Act as a point-of-sale for second-hand equipment as well as hubs for after-sale service. CHCs could establish linkages with OEMs and dealers to make themselves the centre of all these different activities.
- These centres could be established on a 'hub-and-spoke' model wherein last-mile outreach is established by having smaller outlets at the village level, which can also provide support for farming practices.

"It will make impact on the items that are imported by saving on custom duties. For example, laser land levellers and paddy transplanters. But the impact would be immense. Low HP tractors manufacturing should be encouraged"

## B. Creating an institutionalised framework for custom hiring in the country:

While custom hiring is prevalent in India for some of the agriculture machinery, it is highly unorganised and sporadic in present situation. This is on account of the following factors -

- Custom hiring centres need a minimum scale for efficient operation as the activity is capital intensive. They also have a longer gestation period due to lower asset utilisation on account of the seasonal nature of agriculture machinery demand.
- There is significant entry barrier for small entrepreneurs to establish these centres. Small entrepreneurs are neither creditworthy nor there are any special policy incentives for promoting them.
- Credit policies of the banks need to be evaluated. Generally, the banks insist on collateral guarantees apart from hypothecation of farm equipments for giving loans and as a result, the response from entrepreneurs is decreasing. Therefore, there is a need for stakeholders to devise an institutional framework for custom hiring in the country.

## C. 'Make in India' support for farm implements:

The 'Make in India' initiative launched by the Government could be used to support the manufacture of inputs and farm implements currently being imported. This would help in reducing the overall capital cost.

#### D. Alternate route for the subsidy:

The subsidy amount could be re-routed to ensure that the interest rate on financing the farmers produce is brought to a much lower rate and that farmers can get longer payback periods as well as longer moratoriums (few years without interest). This would also apply to the financial assistance provided for setting up CHCs. Commercial banks could be brought into the fold to ensure greater participation on their part.

“Commercial banks need to be encouraged to provide financing for equipment. Commercial banks’ not willing to finance these machines is the biggest impediment in the industry”

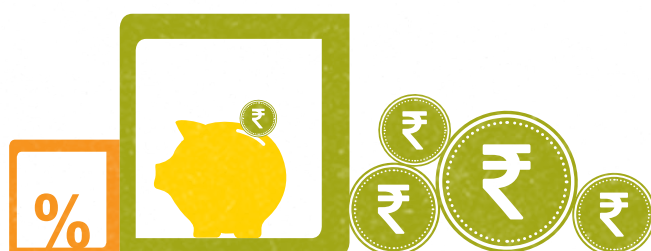
“The subsidy needs to be re-visited. The farmers need better rate of interest for mechanisation to increase”

#### E. CSR funds with a purpose:

In accordance with Section 135 of the Companies Act of 2013, eligible firms are required to spend at least two percent of their average net profit in the preceding three financial years, towards CSR. These funds could be used in a few innovative ways for the benefit of the industry.

- Companies that are directly involved in the agriculture equipment industry and are unable to invest in to corporate social activities in line of their business, could use the funds for initiatives such as ‘Adopt a Village’ and promote, through capacity building, practices such as precision agriculture, skill development and micro irrigation. This would ensure that the agricultural ecosystem is built in a sustainable manner.
- Companies in this industry could approach others not directly involved in farm machinery and pitch the idea of investing their CSR funds into promoting farm mechanisation through capacity building initiatives as well as infrastructure creation in order to help in skill development and establish custom hiring centres.

“Yes, this would help the farmers a lot and get their morale up”



## 7.2 Administrative measures

- **Tendering process:** The tendering process in states must be completed before the sowing season. The states should be encouraged to ensure that before April all the tendering processes are completed so that subsidies are in place for farmers, in case tendering processes are continued.
- Re-visit of the Regional Comprehensive Economic Partnership (RCEP) agreement by the Government so as to include farm equipment as a product line in the trade agreement, to ensure that the industry doesn't absorb custom costs and gets the benefit of free-trade agreements (FTAs)
- The government, in association with ICAR, should establish standardised quality norms for equipment and farm implements.
- Stakeholders to drive to further research and development efforts into crop-specific implements that are suitable for the Indian conditions.
- Testing of implements to be done at the class-level and not variations. For example only one of the 5-foot, 6-foot and 7-foot rotavators needs to be tested. This will help reduce redundancies in the testing procedures, saving time and costs.
- As an endeavour, the government should try to accelerate the setting up of more certification centres to ensure that testing of the equipment can be done more quickly.
- **Equipment inputs in the GST bill:** A mechanism for distinguishing the implements used in automotive and agriculture sector (e.g. gearbox is used in both cars and tractors), can be included as a part of the GST bill, so that implements used as part of farm equipment are not burdened with additional tax.
- Equipment manufacturers should publish/ share with the government, the list of machinery and market prices, which can then be put into a central portal. This will act as a ready-reckoner for all stakeholders and can help in doing away with the tendering process.
- A re-visit of the subsidy slabs is required, so that the large pool of small and marginal farmers actually benefit from these programmes.
- Promoting use of renewable energy in farm equipment segment such as solar-powered pumps, tapping the immense potential in India for solar-power and creating alternate source of revenue for the farmer by selling the additional power general back to the grid.
- **Credit Guarantee Fund:** It is pertinent to devise framework that would strengthen the credit policy for farm machinery in India. Credit guarantee fund is in operation for facilitating loans for micro, small and medium enterprises (MSMEs). Similar models should be devised for farm machinery sector as well.

These initiatives would help in accelerating mechanisation of Indian farms and therefore, help the country reach the goal of a sustainable agricultural production.

“The tendering process needs to be looked at again and if it must exist, it must be completed by April”

“There has been growth in tractors but other latest technologies are not reaching to the farmer”

“Leave the choice to the farmer. If he wants to buy a luxury car or an economy car, he should be able to”

“We need to have standardised norms for quality”

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