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Ministry of Agriculture & Farmers Welfare
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FARM

Mechanization in India

The Custom Hiring Perspective

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Government of India
Ministry of Agriculture & Farmers' Welfare
Department of Agriculture, Cooperation
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MESSAGE

Farm Mechanization is a growing imperative for sustaining agricultural growth. There is a strong and positive correlation between farm power availability and agricultural productivity. Small and marginal farms (< 2 ha. of farm size) continue to remain at the center of Indian agriculture. However, mechanizing small and non-contiguous group of lands is against 'economies of scale', especially in operations like land preparation and harvesting. With continued reduction in average farm size, individual ownership of agricultural machinery will be progressively uneconomical. The challenge to policymakers will then involve the task of not only leveraging farm mechanization for enhancing agricultural productivity, but also how to include the large community of small and marginal farmers into the fold of mechanized farming.

Government of India is providing assistance under Sub-Mission on Agricultural Mechanization for establishment of Farm Machinery banks and creation of high-tech productive equipment hub for custom hiring.

I wish to express my sincere congratulations to FICCI, German Agribusiness Alliance and Yes Bank for bringing out this publication.


(S.K. Pattanayak)

Date: June 23, 2016

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Message

Engineering and technological inputs in agriculture have made significant contribution in increasing production and productivity through timely farm operations, accurate metering and better placements of inputs, conserving soil and water resources, increasing irrigation potential and efficiencies, reducing losses of produce by providing improved storage structures and technologies, and value addition. In recent past, due to high degree of weather aberrations, the timeliness of agricultural operations has come into sharp focus. It is often seen that the ideal conditions for an agricultural operation such as sowing or intercultural operation exist for a short period of time. If the farmer fails to complete the operation within the ideal frame, he will have to compromise with the output. This problem can be tackled by employing appropriate agricultural implements to carry out the operations.

Use of high capacity and energy farm implements are more important in changing climate scenario. The efficiency and timeliness of agricultural operations can be increased many fold even on small farms by using agricultural machinery. But the cost of such machinery is increasingly become unaffordable by smallholders in many cases. By sharing of the cost of implements by innovative arrangements, the cost required to be invested by farm holders can be made affordable. In the recent past, custom hiring of agricultural machinery is seen as such arrangement which can promote mechanization of agricultural operations on small farms. To make the cost of machinery affordable and to make them available to all farmers, Govt. of India is providing assistance under SMAM for establishment of farm machinery banks and hi-tech high productive equipment hub for custom hiring.

*I congratulate the FICCI along with German Agribusiness Alliance and Yes Bank, for bringing the publication of this book **Farm Mechanisation of India – the Custom Hiring Perspective** possible.*


Ashwani Kumar
Joint Secretary

25.06.2016

FOREWORD



Agriculture, as a significant contributor to employment and livelihood creation, continues to be the mainstay of India's rural economy. The sector remains crucial for the economy, in order to create a ripple effect on the services and manufacturing sectors of the economy, to meet food and nutritional requirements of our population and to contribute to macroeconomic stability.

Despite its vital role, the sector suffers from major hindrances and roadblocks in production, intermediaries and water scarcity, which have restrained growth. With increasing population leading to rapidly growing food demand, it is critical to build *efficiencies in agriculture* to achieve food security for the Nation. Hence, it is imperative to focus on increase in *production, productivity and profitability in agriculture* by improving the intensity of farm mechanization in the country.

Though farm mechanization has improved the state of agriculture in certain parts of the country, it is crucial to take concrete steps to propel farmers in large numbers towards adoption of efficient, cost effective and scalable mechanization technologies. With the right focus from various stakeholders, farm mechanization has the potential to play a significant role in decreasing labor drudgery and intensiveness and increasing efficiency in farm operations.

Implementation of the *Sub-Mission on Agricultural Mechanization (SMAM)* program by the Ministry of Agriculture is a positive step towards increasing farm productivity across the country. The program will be a catalyst for inclusive growth of agricultural mechanization in India by ensuring last mile reach of farm mechanization to small and marginal farmers.

Globally, the concept of Custom Hiring encompasses sowing operations and all mechanization interventions in the crop cycle till harvest; while India is yet to see intermediate custom hiring interventions. Business models in India are still evolving and will see exponential growth once stakeholders start getting returns on their investments. Early entrants into the sector are therefore covering new geographies, crops and also diverse models, including custom hiring services.

The concept of custom hiring has potential provided there is integration of all operations viz. provision of agri inputs like seeds, fertilizers and equipment, through partnerships with various partners in the ecosystem. With appropriate policy support for adoption, development and promotion of farm mechanization technologies through training, demonstration and use of ICT, the true potential of custom hiring can be harnessed.

I am confident that this YES BANK-GAA/OAV-FICCI report '*Farm Mechanization in India – The Custom Hiring Perspective*', which highlights challenges and the potential of custom hiring in India, will act as a useful reference for all stakeholders, including policy makers, corporates, farmers, and equipment suppliers in the farm mechanization sector in the country as well as globally, and contribute significantly to overall development of the agriculture sector.

Thank You.
Sincerely,



Rana Kapoor

Managing Director & CEO 

Chairman 

FOREWORD



Making farming a business proposition: Farm mechanization can elevate the agricultural economy and raise farmers' incomes

Following the Green Revolution, India witnessed a remarkable development: India today is the largest producer of milk, pulses and tea and it is the second largest producer of wheat, rice, fruits and vegetables. The country today is largely self-sufficient in food grains – and it has also become a net exporter of food items. Furthermore, India is fast emerging as a sourcing hub of processed food. Against the background of a growing middle class with rising incomes and a high population density, the potential for the development of the sector is enormous. It is therefore expected that the near future will see increasing investment in cold storages, modern processing units and packaging machinery, transport and logistics as well as storage capacities. But a strong food processing sector in India needs to be based on an efficient and sustainable Indian agriculture: All areas of the food processing sector depend on high quality agricultural produce, be it dairy, fruits and vegetables, grain, meat and poultry or fisheries.

However, Indian agriculture still faces major challenges: effects of global climate change, the need to develop strategies for a sustainable productivity enhancement with the main objective to significantly raise quantity and quality of food, an average low income of farmers, wastage of agri produce during the food supply chain, and lack of financial inclusion. A sustainable productivity enhancement and the achievement of the targeted 4 % growth in agriculture can therefore not be imagined without significant improvement in soil health, water management and irrigation, improved seed varieties and hybrids, and integrated pest management, credit financing and – farm mechanization. Innovative technological solutions at all stages of the value chain are the key to a modern, efficient and sustainable agricultural production in India.

German companies have to offer a lot in this regard. Many have been successfully doing business in India for several decades, be it in seeds, fertilizers,

plant protection, food processing or agricultural machinery. And especially machinery companies can contribute to making farming a business proposition. Some 50 years ago, a German farmer could only feed 10 people. Today, a farmer can feed 142 people. This could only be reached through the mechanization of agriculture and through a strong partnership between farmers and companies, who not only offer the technology but also provide knowledge and training. However, to facilitate the transfer and implementation of new innovative technologies, proper and predictable policy interventions are absolutely required. Already a number of important measures have been initiated by the Central and State governments to drive productivity, to encourage investment and to cease the limitation of the current Agri-Marketing System. The support of different measures to make machinery and equipment accessible and at the same time affordable for Indian farmers is surely a very important one. At the same time, the deployment of modern equipment can allow the efficient and sustainable use of inputs. We believe that India and Germany can join hands in contributing to agricultural development in India, by building a technology partnership and by building a knowledge and skill partnership. A strong collaboration between German and Indian stakeholders forms an important basis for sharing experience and information and for working together towards developing the sector. We therefore very much welcome the initiative of this joint publication.

Agriculture continues to remain a major sector of the Indian economy, it contributes to 60 % of employment and continues to be the primary source of living for 70 % of the population. Hence, by making farming a profitable business proposition, economic, social and ecological development of the country can be achieved.



Dr. Arnd Nenstiel

Chairman of the German Agribusiness Alliance
OAV German Asia-Pacific Business Association



Dr A. Didar Singh
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Foreword

Farm mechanization is essential for sustaining agricultural growth especially in the context of diminishing agricultural labour. However, large communities of small and marginal farmers are still not in a position to take full benefit of farm mechanization because of adverse economies of scale especially in operations like land preparation and harvesting.

With continued shrinkage in average farm size, more and more farms will fall into the adverse category thereby making individual ownership of agricultural machinery progressively more uneconomical. Therefore, time has come to seriously consider scaling different approaches of providing farm equipment in India.

One such approach which is prevalent in India for some of the agriculture machinery is "Custom hiring". It is important to intensify custom hiring model in the country which works on value driven approach and does not end with one time service to the customers. The Government of India recognizes the importance of farm machinery and has included custom hiring as important component under Sub- Mission on Agricultural Mechanization. There is emergent need for creating congenial policy framework that would incentivize establishment of custom hiring centers on business model in the country.

FICCI along with German Agribusiness Alliance and Yes Bank sincerely hopes that the information provided in this report will be useful to stimulate new ideas and help in opening up another facet to the emergent knowledge base of the farm machinery sector.

A. Didar Singh



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1. Executive Summary



1. Executive Summary

Farm mechanization in India is still in its nascent stages and during the last two decades has been able to achieve a meager growth of less than 5%. The sector faces critical challenges in terms of large share of small and marginal farmers, declining land holding sizes, high cost of farm machinery and equipment, inappropriate technology, undeveloped markets, complex operations, maze of legislation and insufficient policy framework. Land size, cropping pattern, market price of crops including Minimum Support Price (MSP), availability of labour and cost of labour are the major factors deciding the growth of agricultural mechanization in India. Unlike other agricultural sectors, farm mechanization sector in India has a far more complex structural composition. With continued decrease in average farm size, more farms will fall into the adverse category thereby making individual ownership of agricultural machinery increasingly uneconomical.

Custom Hiring envisages promoting establishment of farm machinery banks for hiring by way of providing financial assistance to self-help groups or farmers' co-operatives since the prohibitive cost of hi-tech and high productive equipments renders it difficult for individual ownership. The Custom Hiring Centres (CHCs) offer farm equipments and machineries on rental basis to farmers who cannot afford to purchase high-end agricultural machineries and equipments. The CHCs play a pivotal role in introducing high technology agricultural machinery to even small farmers with the objective to boost crop production, improve quality, timeliness and efficiency of agriculture operations. It is also amply clear that the current dispensation of the Custom Hiring sector in India is in two interventions predominantly:

- a) Pre-harvest: nursery preparation, transplanting, seed bed preparation, puddling etc.
- b) During harvest of crops like wheat, sugarcane etc.

As the small/marginal holdings constitute 80% of total land holdings in India, the potential for CHCs which will cater to the farm machinery requirement of such a vast area, is quite huge. Government of India, in recognition of this potential had envisaged increase of farm power availability from the present level of 0.93 kW/ha to 2 kW/ha during the 12th plan period (2012-2017). "Sub-Mission on Agricultural Mechanization (SMAM)" is one such initiative towards achieving this objective. Custom Hiring facilities for agricultural machinery is one of the major components of this mission. State governments of Karnataka, Andhra Pradesh, Madhya Pradesh and Punjab have been promoting Custom Hiring on Public Private Partnership (PPP) basis through training, demonstration and financial incentives.

Private sector participation in promoting farm mechanization in India through establishment of CHCs is gradually evolving with unique business models. EM3, a leading Custom Hiring company, is creating a pan India network of farm service centres – “Samadhan Kendras” which are the specialized centres started as CHCs equipped with various kind of modern agro machinery used for all field practices. Zamindara Farm Solutions uses a combination of library model and radio taxi model to provide farm equipment services. For better backward linkages, corporates like OLAM, a leading global agricultural commodity company, have been running CHCs for sugarcane harvesting in Madhya Pradesh through a tie up with the local agri tech service providers.

As majority of Indian farmers belong to small and marginal category, purchase of farm equipment is a significant investment for them. Reasonable financing norms are a must for making farm equipments and machineries available at affordable price and enhance farm mechanization. An issue that has been persistent in financing is the purchase of standalone implements. This adds to the “tractor-isation” trend that is visible in the industry and doesn’t add to overall mechanization. Industry stakeholders feel that commercial banks must be encouraged to provide adequate financing various farm equipments. This is seen by many industry sources as the biggest impediment to growth. Banks can finance the custom service units managed by individuals, institutions or organizations who maintain a fleet of tractors, bulldozers, well-boring equipment, threshers, combines, etc., and undertake farm work for farmers on contract basis, under Priority Sector Lending (PSL) policy of Reserve Bank of India (RBI).

Custom Hiring in India faces constraints like high initial cost of equipments, lack of knowledge in the aspects of operation, maintenance and repair of equipment, repair and maintenance under individual ownership coupled with lack of space for shelter, orientation towards the use of tractors and allied equipments, sub-optimal asset capacity utilization on account of crop specific requirements. To overcome this, virtual or real consolidation of the widely fragmented and scattered land holdings in many parts of the country, extension of benefits of mechanization to all cropping systems including horticultural crops, enhancement of the average farm power availability to minimum 2.5 kW/ha to assure timeliness and quality in field operations and use of precision and efficient equipments to improve the quality of operations is required.

The Custom Hiring model holds the potential to be the best way to introduce capital intensive, high quality and efficient farm mechanization to the small farming structures prevalent in India. The Custom Hiring model enables new machines to be used at their maximum capacity and enables farmers to gain access to latest technology they would otherwise not be able to afford. Custom Hiring can significantly facilitate diversification in agriculture specifically from wheat and paddy to other crops. However, Custom Hiring through private entrepreneurs or co-operatives will help to increase annual use of these equipments thereby making them viable.

Custom Hiring is the evolving concept in India and holds an immense potential to change the farm mechanization landscape of India. With increased participation of stakeholders across the agri supply chain and handholding farmers by supplying all equipments for entire life cycle of a crop sequentially, Custom Hiring concept can be successful. There is a need to study and replicate successful business models along with incentivisation and policy support for the adoption, capacity building and skill enhancement, development and promotion of farm mechanization technologies. Innovation in Custom Hiring model by institutionalization for high cost farm machinery such as combine harvester, sugarcane harvester, potato combine, paddy transplanter, laser guided land leveler, rotavator etc. is critical.

This report – **“Farm Mechanization in India: The Custom Hiring Perspective”** jointly prepared by YES BANK-GAA-FICCI would not have been possible without the support of leading stakeholders of farm equipment companies and Custom Hiring players. We acknowledge herewith the contribution of all to present their perspective on the nascent sector.



2.

Global Overview of Farm Mechanization Sector



2. Global Overview of Farm Mechanization Sector

The global agriculture and farm machinery market was valued at US \$ 144.10 billion in 2014 and is forecasted to grow at a compounded annual growth rate (CAGR) of 8.7% from 2015 to 2022 as per global syndicated reports published in 2015. Increasing demand for farm tractors and harvesting machinery is expected to spur the overall market growth. The growth of harvesting machinery is most prominent in the Asia-Pacific region where this product is receiving high demand from China and India. The demand can be attributed to the increasing food consumption owing to rising population in this region. The segments plowing and cultivating machinery, and planting and fertilizing machinery are also expected to register moderate growth in the coming years.

Based on geographic regions, the agriculture and farm machinery market is segmented into North America, Europe, Asia-Pacific, Middle East and Africa and Latin America. In terms of regional adoption, Europe, Asia-Pacific and North America were the key contributors to the global agriculture and farm machinery market in 2014 with Europe leading the market with around 36% share. The growth of farm machinery is significantly low in the Middle East and Africa region; however, Latin America is poised to grow considerably. Brazil holds the maximum share in the agriculture and farm machinery market in Latin America at present.

Agricultural mechanization using efficient machines improves the utilization efficiency of inputs like fertilizers and agro-chemicals and reduces negative impact on environment. Similarly, the use of micro-irrigation techniques not only improves water use efficiency significantly but also reduces deep percolation of water with which fertilizers like nitrates leach and pollute ground water. Application of fertilizer with drip irrigation (fertigation) improves fertilizer use efficiency and thus reduces amount of fertilizer needed to be applied, again reducing the negative chemical impact on the environment. The use of conservation tillage and minimum tillage methods improves soil health, reduces soil erosion and reduces costs. Thus, the appropriate and sustainable agricultural mechanization plays a major role in making agriculture sustainable. Depending on the size of farms, availability of farm

labor, mechanization of farm operations, the agricultural mechanization varies across the globe as given in Table 1 below:

Table 1: Features of Farm Mechanization across the Globe

Country	Features of Farm Mechanization
Europe	The continent has high numbers of machines per ha reflecting over-mechanization with great variety of farm structures ranging from small farms in higher altitudes to fairly large size farms with crops under plantation and fruit orchards. However there is a tendency for fewer but higher powered machines ranging from high power tractors and tractor mounted implements to long swathe boom sprayers for orchards.
USA	USA has distinctly completely mechanized farms and reveals trends towards larger and higher horsepower equipment. Further technical progress tends towards automation of farms and of late, the thrust is towards Internet of Agriculture Things (IoT in Agri).
Japan	The sector is highly mechanized with about 500 tractors and 250 harvesters per 1,000 ha. Japanese agriculture comprises mainly small, sophisticated and specialized machines and further technical progress tends towards more automation. Japanese agri machinery is a strong industry with export to whole Asia and other regions of the world including small farm machinery.
Sub-Saharan Africa	80% of agricultural area is cultivated by human power, only 5% with tractors. 70% of all tractors are in South Africa and Nigeria. Increasing imports from India and China.
North Africa/ Middle East	The level of mechanization is significantly higher than in Sub-Saharan Africa. The average number of tractors per 1,000 ha is 11. Large disparities can be observed in the region, for example in Morocco, the average of tractors per 1,000 ha is 6 while in Egypt it is 31 tractors per 1,000 ha.

Source: YES BANK Analysis, 2014

The world is in a flux currently with unprecedented climatic changes, lowering availability of food reserves and a growing population especially in third world countries. Given this scenario, small holders are under continuous pressure to increase production and overall returns from their production output. New technologies, while available are out of reach of small holders, who cannot afford to purchase agri equipments and machinery. In this scenario, Custom Hiring represents an important mechanism through which most small holders can access services of agricultural machinery. It is one option that can ensure the use of improved farm machinery, even to small and marginal farmers. Custom Hiring offers prospects for facilitating rapid mechanization of agricultural systems in the region. Custom Hiring services enhance technical and economic efficiency across the whole spectrum of agri-food value chains covering input supply, production, post-harvest, distribution, and retailing.



3. Geographical Spread of Farm Implement Manufacturers in India



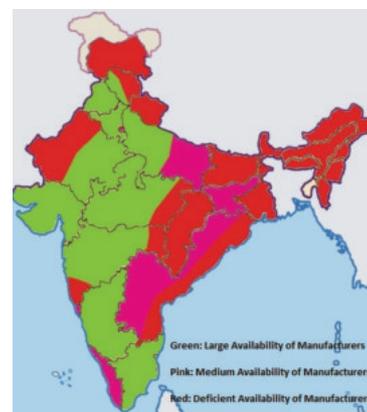
3. Geographical Spread of Farm Implement Manufacturers in India

The adoption of mechanization technology depends upon the local manufacture and after sales-services besides credit and financial incentive provided by the government. The manufacture of agricultural machinery in India is quite complex comprising from village artisans, tiny units, small scale industries to State Agro Industrial Development Corporations and organized tractor, engine and processing equipment industries. Traditional hand tools and bullock drawn implements are largely fabricated by village craftsmen and small scale industries. Organized sectors manufacture sophisticated machinery such as tractors, engines, mills and dairying equipment. The small-scale industries seldom have Research and Development (R &D) facilities and they depend upon public institutions for technological support. They require not only drawings but also prototypes and technical guidance to manufacture the equipment. These industries however, upgrade the technology with experience. As per Agricultural Machinery Manufacturers Association (AMMA) of India, there are approximately 250 medium to large scale units, 2,500 small scale industries, 15,000 tiny industries and 100,000 village level artisans.

3.1 Village craftsmen

Village artisans are the main source of supply, repair and maintenance of hand tools and traditional implements. These include implements and tools like spade, sickle, local ploughs, sowing devices, yokes, leveler, grinding wheels, hand mills, hand operated milk churning tools, winnowing devices, sieves, wooden storage structures, bullock carts, manual water lifting devices etc. If village artisans are properly trained, they can accelerate the adoption of mechanization inputs due to their proximity with farmers.

Exhibit 1: Availability of Farm Equipment Manufacturers in India



Source: Presentation by Dr. Kanchan K. Singh, ADG (Engg.) ICAR in 2nd Regional Forum on Sustainable Agricultural Mechanization at Serpong, Indonesia 9-11 September 2014

3.2 Tiny and small-scale industries

The tiny and small scale units fabricate the bulk of improved agricultural machinery such as ploughs, cultivators, disc ploughs and harrows, seed drills, planters, plant protection equipment, reaper harvesters, combine harvesters, threshers, cleaners, graders, mills, crushers, oil expellers, diesel engines, irrigation pumps, dairy machinery etc.

Some of these units also fabricate implements and equipment for tractor and power tiller manufacturers. They may lack good machine tools and heat treatment facilities. Some of them are more organized and have better fabrication toolings and thus are able to manufacture better quality machinery. The bulk of the farm machinery is made by the small scale industries. They use materials from mild steel to medium carbon steel. Heat treatment practices are generally inadequate except in few industries manufacturing knife and tillage tools. Equipment manufactured by the small scale industry (SSI) units includes soil working tools, seeding and planting equipments, hand hoes, sprayers and dusters, harvesting and threshing equipments, like reapers, threshers, combines, maize shellers, decorticators, cleaners, graders, mills, oil expellers etc.

3.3 Organized farm machinery industries

The medium scale and large scale industries manufacture diesel engines, electric motors, irrigation pumps, sprayers and dusters, land development machinery, tractors, power tillers, post harvest and processing machinery and dairy equipment. There are 22 tractor, 5 power tiller, 200 diesel engine, 600 irrigation pump, 48 combine and 188 earthmoving machinery manufacturers as given in Table 2 below. The marketing of agricultural machinery by these industries is through their network of dealerships and, therefore, these manufacturers are able to provide effective after-sales service. These industries upgrade their product and process technologies through their own R&D efforts, in addition to technological support from external agencies.

Major farm machinery used in India includes tractors, threshers and power tillers. Among these, the biggest market in terms of annual sales is that of tractors (around 6 lakh units annually), threshers (around 1 lakh units annually) and power tillers (around 56,000 units annually). Among farm machinery, tractors are most widely used by domestic farmers with the total market size estimated at around ₹ 34,000 crores annually.

Table 2: Major Farm Machinery Used in India

Name of Machinery	Market Size Annually (units)	Annual Industry Size (₹ crores)
Tractors	600,000	34,200
Power Tillers	56,000	706
Combined Harvesters	4,000 - 5,000	770
Threshers	100,000	1,230
Rotavators	60,000 - 80,000	693
Rice Transplanters	1,500 -1,600	62
Self-propelled Reapers	4,000 - 5,000	45
Zero Till Seed Drills	25,000 - 30,000	132
Multi-Crop Planters	1,000 - 2,000	8
Laser Land Levellers	3,000 - 4,000	129
Weeders	25,000	1,275

Source: Trends of Agriculture Mechanization in India, CSAM Policy Brief, June 2014

Today, India is recognized as a leading country in the world for the development and manufacture of agricultural implements and equipments. The range of equipment includes tractors, harvesting and threshing equipment, plant protection machines, irrigation and drainage pumps, sprinkler systems, land development machinery, dairy and agro-processing equipment etc. India is exporting increasing volumes of these to various countries including USA, Africa and Asia.

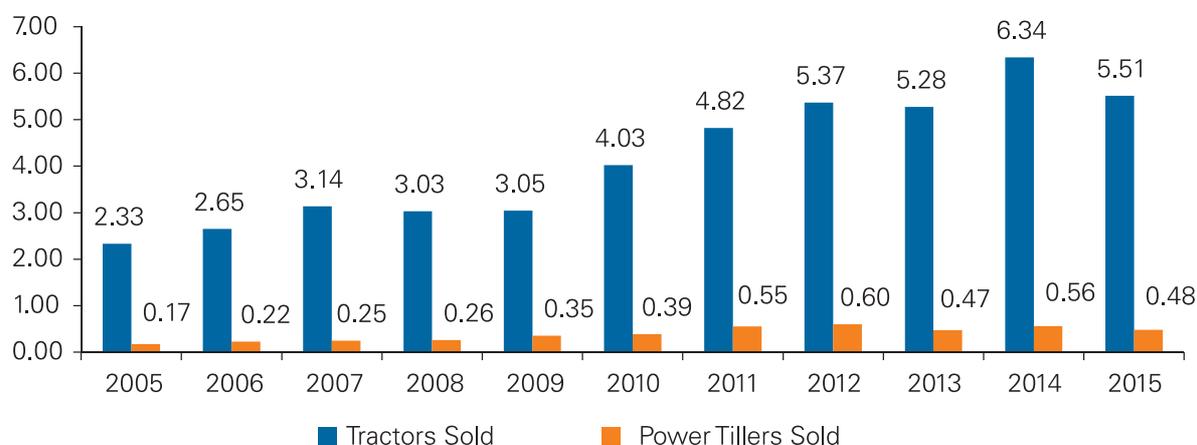
Table 3: Status of Farm Mechanization Industry in India

Equipment manufacturers	Number of units
Agricultural tractors	22
Power Tillers	5
Irrigation Pumps	600
Plant Protection Equipments	300
Combine Harvesters	48
Reapers	60
Threshers	6,000
Seed Drills and Planters	2,500
Diesel Oil Engines	200
Plough, Cultivators, Harrows	5,000
Chaff Cutters	50
Rural Artisans	>1 Mn

Source: Presentation by Dr. Kanchan K. Singh, ADG (Engg.) ICAR in 2nd Regional Forum on Sustainable Agricultural Mechanization at Serpong, Indonesia 9-11 September 2014

Tractors and power tillers have been driving the farm mechanization in India. Tractor sales have grown at a CAGR of 9.0 % in Financial Year (FY) 05-15 to around 5.5 lakh tractors in FY15 (around 2.3 lakh in FY05) whereas sales of power tillers have grown at a CAGR of 10.6% in FY05-15 to 48,000 power tillers in FY15 (17,841 in FY05). The same is represented in Exhibit 2 below.

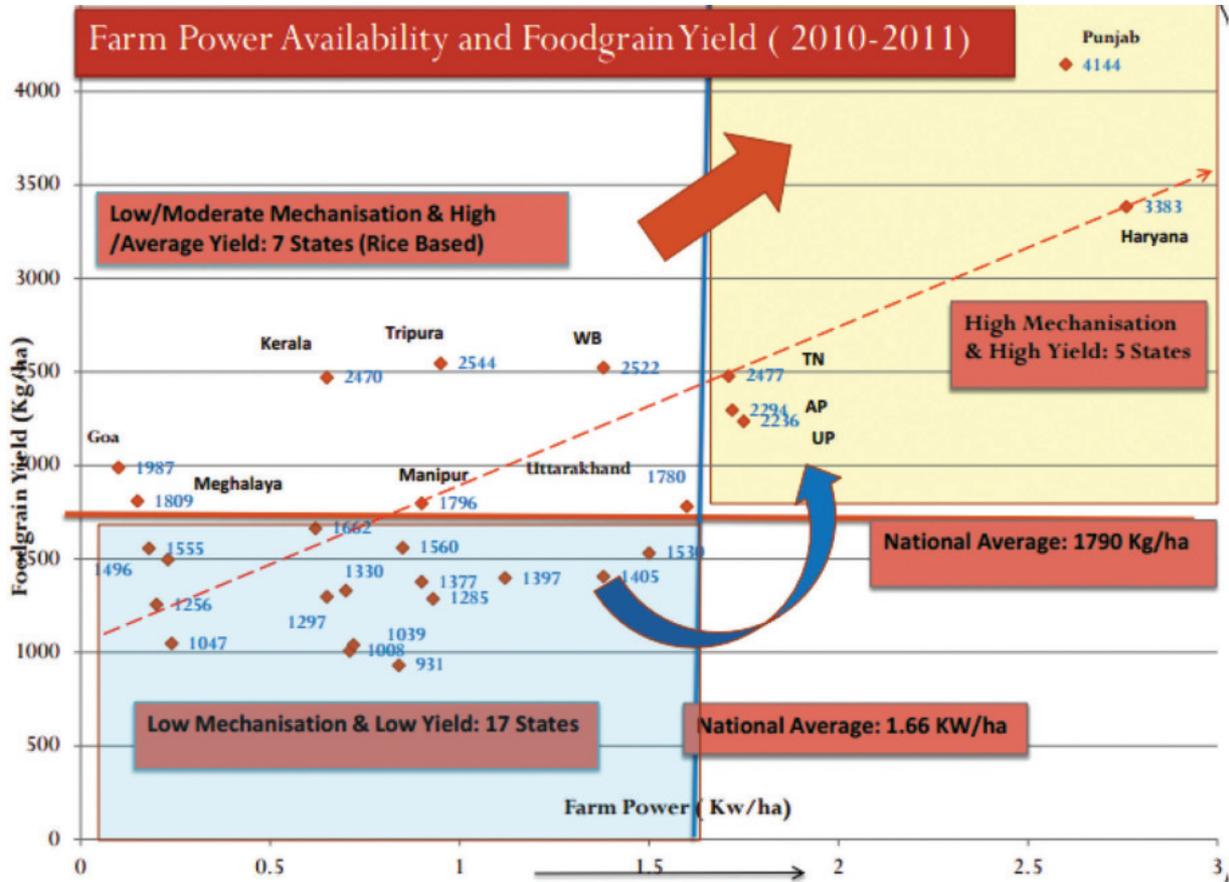
Exhibit 2: Tractors and Power Tillers Sold in India



CRISIL, Ministry of Agriculture, YES BANK Analysis, 2014-15

Penetration of tractors is tilted towards northern states like Punjab and Haryana whereas the penetration of power tillers is higher in southern and eastern India. The same is graphically represented in Exhibit 3.

Exhibit 3: Farm Power Availability and Food Grain Yield



Source: Ministry of Agriculture, Government of India, 2010-11



Farm Mechanization has immense potential in India. Table 4 shows the farm mechanization opportunities across the plains and hilly regions.

Table 4 : Opportunities in Farm Mechanization in India

Operation	Plains			Hilly Region			Precision Farming Machines
	Manual	Animal Drawn	Tractor/ Power Tiller/Self Propelled/ Power Operated	Manual	Animal Drawn	Tractor/ Power Tiller/Self Propelled/ Power Operated	
Prime Mover	Manual	Animal Drawn	Tractor/ Power Tiller/Self Propelled/ Power Operated	Manual	Animal Drawn	Tractor/ Power Tiller/Self Propelled/ Power Operated	Power Operated
Seed Bed Preparation	Green	Green	Green	Green	Green	Green	Green
Sowing/Planting/ Transplanting/Fertilizer Application	Orange	Green	Orange	Orange	Blue	Blue	Red
Irrigation and Drainage	Blue	Red	Orange	Green	Blue	Blue	Red
Weeding/Herbicide Application/Intercultural	Green	Blue	Orange	Green	Blue	Blue	Red
Fertilizer/Manure/Agro Chemical Application	Green	Blue	Orange	Green	Blue	Blue	Red
Spraying	Green	Red	Orange	Green	Blue	Blue	Red
Harvesting	Blue	Blue	Orange	Blue	Blue	Blue	Red
Threshing	Blue	Blue	Orange	Blue	Blue	Blue	Red
Special Package of Equipment	Blue	Red	Red	Blue	Red	Red	Blue
Other Machines/ Equipment	Red	Red	Red	Red	Red	Red	Red
LEGENDS							
Green	Available, possibility on improvement, needs to be demonstrated						
Blue	Normally, the operation is done using conventional tools or the power source is not used for this operation/ system or not applicable						
Orange	Available for some crop or in some parts of country, needs refinement, feasibility trials in other parts/crops						
Red	Needs development/refinement						

Source: Presentation by Dr. Kanchan K. Singh, ADG (Engg.) ICAR in 2nd Regional Forum on Sustainable Agricultural Mechanization at Serpong, Indonesia 9-11 September 2014



4. Sources of Farm Power in Indian Agriculture

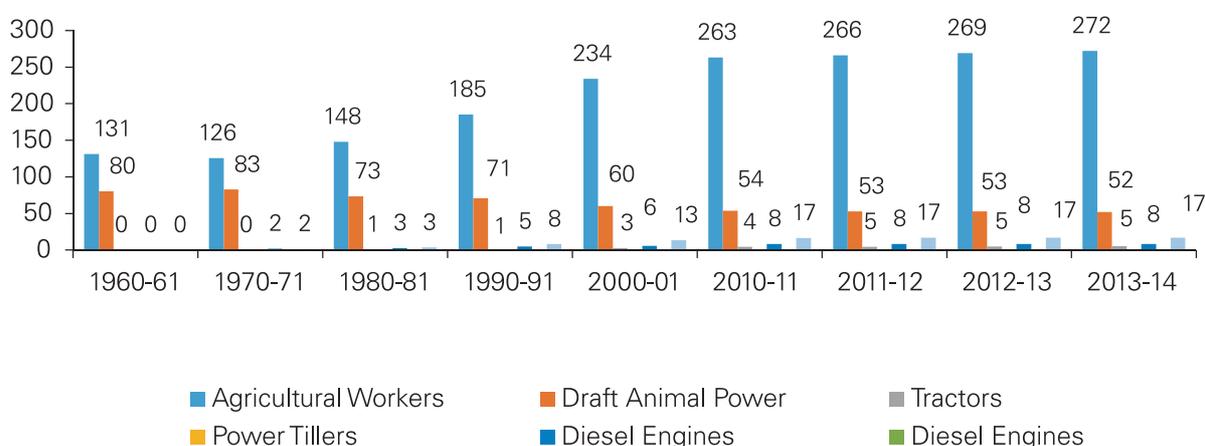


4. Sources of Farm Power in Indian Agriculture

India witnessed unprecedented growth in agriculture that helped the country to graduate from import dependence to self-sufficiency in food grains by increasing the food grain productivity from 0.64 MT/ha in year 1965-66 to 2.10 MT/ha in 2013-14 resulting in export. This growth was mainly attributed to adoption of the agricultural technology during green revolution supported by positive governmental policies, liberal public funding for agricultural research and development and untiring work of farmers and manufacturers of agricultural machinery.

The different sources of power available on the Indian farm for doing various mobile and stationary operations are mobile power viz. human, draught animals (bullocks, buffaloes, camels, horses and ponies, mules and donkeys), tractors, power tillers and self-propelled machines (combines, dozers, reapers, sprayers etc.) and stationary power i.e. diesel/oil engines (for pump sets, threshers, sprayers and other stationary operations) and electric motors (for pump sets, threshers, sprayers and other stationary operations). The time series data (1960-61 to 2013-14) of population of farm power sources and power availability from various farm power sources are presented in Exhibits 4 and 5 given below.

Exhibit 4: Population of Farm Power Sources in India (in million)



CAGR (%)						
	Agricultural Workers	Draft Animal Power	Tractors	Power Tillers	Diesel Engines	Electric Motors
1960-61 to 1990-91	1.16	-0.42	12.27	6.25	10.66	13.12
1991-92 to 2013-14	1.54	-1.33	6.65	12.03	2.50	3.29
1960-61 to 2013-14	1.38	-0.82	9.79	9.30	7.04	8.74

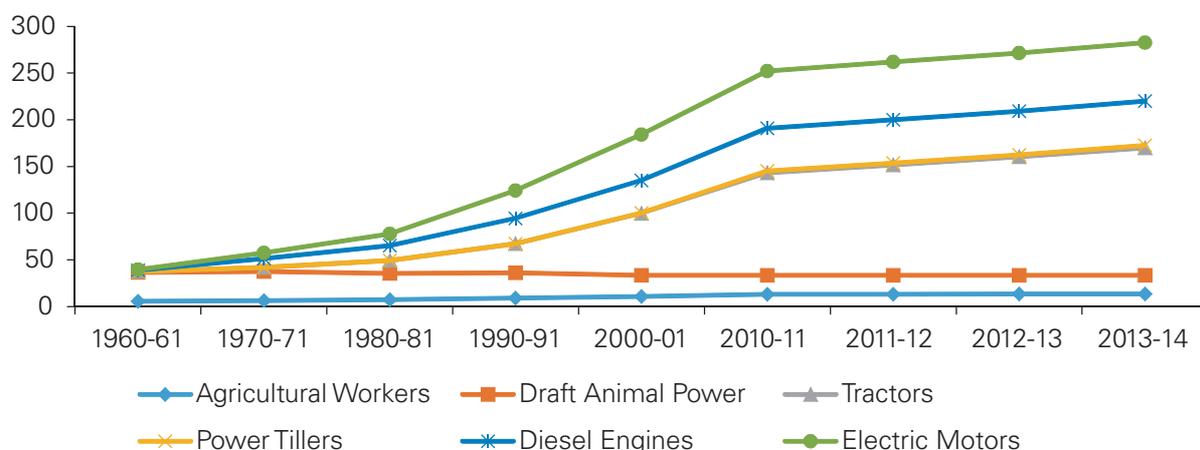
(ACGR = Annual Compound Growth Rate)

Source: Singh (2013); Singh et al. (2010); Singh et al. (2009); Live Stock Census, 2012, 2007, 2002
Tractor Manufacturers' Association (TMA); Power Tiller Manufacturers' Association (PTMA)

While the population of agricultural workers as percentage of rural population has gone down from about 69.4% in 1951 to about 55% in 2012 but in absolute terms, due to increase in overall population, the number of agricultural workers available in rural areas has increased from 131 million in 1960-61 to 272 million in 2013-14 and thereby registered an annual compound growth rate of 1.38% during the last 53 years.

During last 50 years the average farm power availability in India has increased from about 0.30 kW/ha in 1960-61 to about 1.78 kW/ha in 2011-12 as per CIAE, Bhopal

Exhibit 5 : Trends in Power Availability from Different Sources in India (in million Kw)



Note: 1 Human = 0.05 kW; draught animal = 0.38 kW; tractor = 26.1 kW; Power tiller = 5.6 kW;

Electric motor = 3.7 kW; Diesel Engine = 5.6 kW

Source: Singh (2013); Singh et al. (2010); Singh et al. (2009)

Human power availability for agriculture was 0.043 kW/ha in 1960-61 and reached to 0.096 kW/ha in 2013-14 registering the compound annual growth rate of 1.53%. Share of agricultural workers in total power availability in 1960-61 was 14.7% which has been reduced to 4.66% in 2013-14.

The declining trend of draught power was more visible especially in those states where the demand of tractors and power tillers has gone high. Draught animal power availability in India decreased from 0.229 to 0.224 kW/ha between 1960 and 1970. The power availability further reduced to 0.200 kW/ha in 1980, 0.162 kW/ha in 2000 and 0.14 kW/ha by 2013-14. Share of draught animal power was 78% of the total farm power in 1960-61 which has been reduced to 7% in 2013-14.

For meeting the increased demand of mobile power for timely farm operations and increased intensity of cropping, additional power is available mainly from tractors and power tillers. Self-propelled reapers and combines also provide mobile power specially for harvesting operations. India presently is the largest manufacturer of tractors in the world. There are more than 20 manufacturers of tractors in the country producing about 60 models of tractors in different horsepower ranges. Tractor dissemination in India has grown from 0.04 million units in 1960-61 to 5.2 million units in the year 2013-14 witnessing a compounded annual growth rate of about 10 per cent during the last 53 years. Farm power availability from tractor has consequently increased from 0.007 kW/ha in 1960 to 0.218 kW/ha in 1990 at an annual compound growth rate of 12.1%.

Stationary power sources in agriculture comprise of diesel engines and electric motors used for irrigation equipment, operating threshers and other stationary machines. Diesel engines and electric motors are widely used by the farmers mainly for lifting irrigation water, apart from operating stationary farm machines like threshers and chaff cutters. The populations of these prime movers have increased tremendously since the green revolution. Farm power from diesel engines increased from 0.009 kW/ha in 1960-61 to 0.247 kW/ha in 2000-01 and 0.335 kW/ha in 2013-14, registered the compound annual growth rate of about 7% during the last 53 years.

For adoption of higher level of technology to perform complex operations within time constraints and with comfort and dignity to the operators, mechanical power becomes essential. Thus, the extent use of mechanical power serves as an indicator of acceptance of higher level of technology on farms. Over the years the shift has been towards the use of mechanical and electrical sources of power, while in 1960-61 about 92.30% farm power was coming from animate sources.

It is apparent that the cropping intensity is increasing with increase in per unit power availability. It was 114% with power availability of 0.32 kW/ha during 1965-66 that increased to about 142 % with increase in power availability of 2.02 kW/ha in 2013-14. Net sown area per tractor shows the reverse trend during the same period, which observed 2162 ha/tractor in 1965-66 reduced to 27 ha/tractor in 2013-14.

Table 5 : Cropping Intensity and Power Availability on Indian Farms

Year	Cropping Intensity (%)	Food Grain Productivity (t/ha)	Power Available (kW/ha)	Power per Unit Production (kW/t)	Net Sown Area per Tractor (ha)
1965-66	114.00	0.64	0.32	0.50	2,162
1975-76	120.30	0.94	0.48	0.51	487
1985-86	126.80	1.18	0.73	0.62	174
1995-96	130.80	1.50	1.05	0.70	82
2005-06	135.90	1.72	1.49	0.87	45
2010-11	140.50	1.93	1.78	0.92	34
2011-12	141.50	2.08	1.87	0.90	31
2012-13	140.90	2.12	1.94	0.91	29
2013-14	142.00	2.11	2.02	0.96	27

Source: De et al. (2000); Agricultural Statistics at a Glance, Agricultural Census; Singh and Garg (2002)



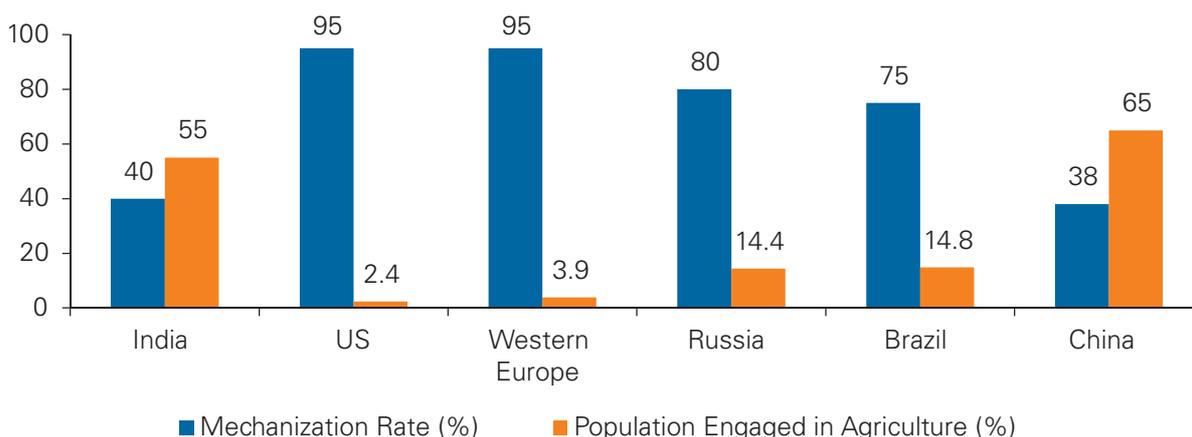
5. Mechanization in India vis-à-vis Other Countries



5. Mechanization in India vis-à-vis Other Countries

Farm Mechanization in India has been in its nascent stages during the last two decades and has been able to achieve a meager growth of less than 5 %. Even though, higher share of labour (55 %) with lesser contribution to Gross Domestic Product (GDP) (14 %) with overall mechanization level of 40-45 % makes farming in India less remunerative. The level of mechanization in India is still lower than in the United States (95 %), Western Europe (95 %), Russia (80 %), Brazil (75 %) and China (57 %).

Exhibit 6: Mechanization Rate vs Population Engaged in Agriculture, 2011



Source: Ministry of Agriculture, Government of India, 2011

The average farm power availability in the country is still at a low level as compared to other developing countries like China, Korea and Japan. Unlike other agricultural sectors, farm mechanization sector in India has a far more complex structural composition. It is facing various challenges related to farm machinery and equipment, technology, markets, operations, legislations, policy framework and other related areas. Land size, cropping pattern, market price of crops including Minimum Support Price (MSP), availability and

costs of labour are the major factors deciding the growth of agricultural mechanization. The production and productivity in Indian agriculture cannot be enhanced by primitive and traditional practices of farming.

In Asia-Pacific, India has remained one of the primary nations which fuelled the growth of the agricultural equipment market. The tractors, power tillers, combine harvesters, rotavators, threshers and rice transplanters are some of the equipments for which a surge in demand has been witnessed over the past few years. The table below gives a comparison of existing mechanization and penetration of farm mechanization in identified regions ranging from predominantly manual hand labour to highly sophisticated automation in farms. The same has been classified into 12 levels as given below:

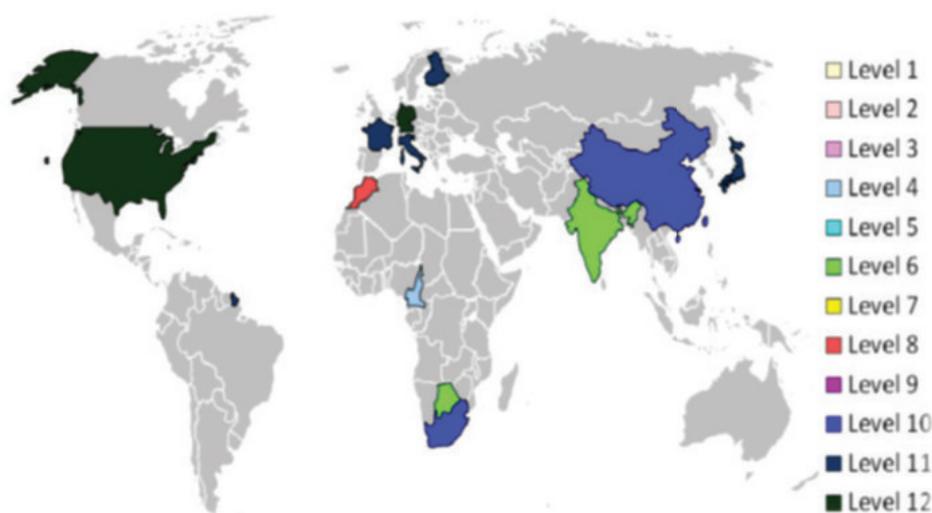
Table 6 : Agri Mechanization Comparison

Level	Farm Power Characteristics	Hand	Draught Animal	Tractors
1	Predominantly Hand Power	> 80%	<=20	<=5
2	Significant Draught Animals	46-80	21-39	<=10
3	Higher Tractor Usage	15-45	>=40	<=19
4	Largely Tractors	20-50	15-30	20-49
5	Fully Motorized Level 1	<=25	<=25	50-75
6	Fully Motorized Level 2	<=10	<=10	>75
7	Fully Motorized Level 3	-	-	-
8	Fully Motorized Level 4	-	-	-
9	Fully Motorized Level 5	-	-	-
10	Fully Motorized Level 6	-	-	-
11	Moderate Automation	-	-	-
12	Full Automation	-	-	-

Source: CECE-CEMA 2013 survey on Agricultural Development and Mechanization

The above table is plotted to leading continents and countries to describe the projected levels of farm power use from draught animals use to significant levels of automation.

Exhibit 7: Level of Automation in India vs Other Countries



Source: CECE-CEMA 2013 survey on Agricultural Development and Mechanization



6.

Key Drivers, Challenges and their Impact on the Agricultural Machinery Market in India



6. Key Drivers, Challenges and their Impact on the Agricultural Machinery Market in India

Given the domestic growing population and increasing disposable incomes, there is strong demand for food grains including cereals, fruits and vegetables. An increasing crop yield is the only solution to this problem since there is very limited opportunity to increase land under sowing. Among methods of increasing farm productivity domestically, farm mechanisation is the most sought after solution apart from increasing usage of agro-chemicals, correcting the composition of fertilizers (N:P:K ratio), increasing usage of hybrid seeds and better irrigation facilities. Farm mechanisation is also essential in augmenting the earning capacity of rural farmers and consequent progress of Indian society, as a whole. Growth in agri GDP is a prerequisite to achieve an overall national GDP growth target of 8% and above in the long term, going forward. Therefore, given the current emphasis of the central government on augmenting the share of manufacturing in total GDP and shortage of farm labour, farm mechanization is the way forward for Indian agriculture. The only perennial risk is adverse weather conditions.

6.2 Key Drivers of Agricultural Mechanization in India

The key drivers of the agricultural mechanization in India are as follows:

1. Labour shortage is being experienced at peak seasons due to the enactment of the National Rural Employment Guarantee Act and huge demand from the construction sector in cities. Labour is available at a higher cost per hectare and this would increase the demand for mechanization. It has been observed that the percentage of agricultural workers to total workers in India has been gradually declining from 59.1% in 1991 (total agricultural workers at 185.3 million vs total workers at 313.7 million) to 54.6% in 2011 (total agricultural workers at 263 million vs total workers at 481.7 million). It is expected to further decline to 25.7% by 2050 leading to severe farm labour shortage.

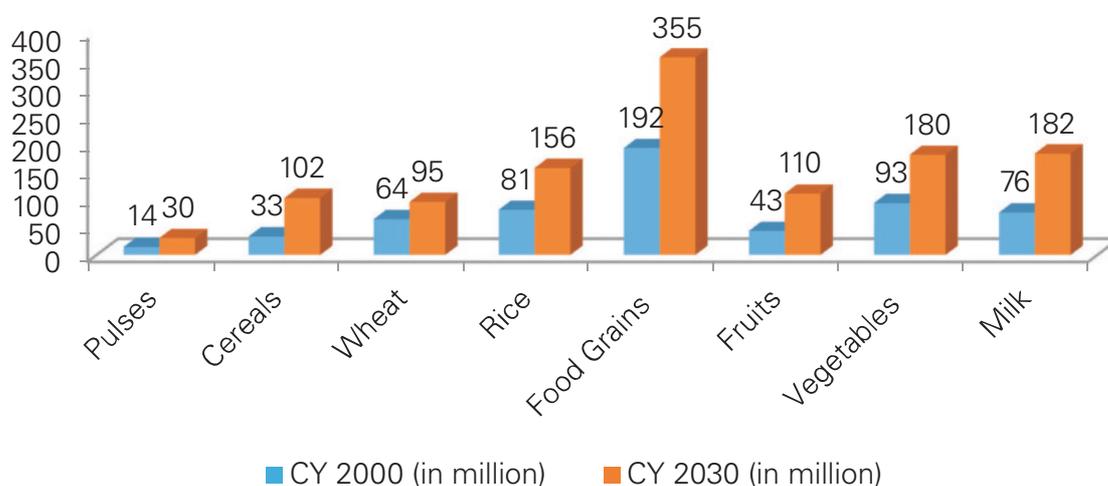
Table 7: Population Dynamics of Indian Workers and Farm Labour Shortage

Population Dynamics of Indian Agricultural Workers (No in Million)					
Particulars	1991	2001	2011	2020	2050
Country's Population	846.4	1,028.7	1,210.7	1,323	1,612
Total Number of Workers	313.7	402.2	481.7	566	787
Workers' Percentage of Population	37.1%	39.1%	39.8%	42.8%	48.8%
Number of Agricultural Workers	185.3	234.1	263	230	202
Including: Cultivators	110.7	127.3	118.7	110	
Including: Agricultural Laborers	74.6	106.8	144.3	120	
Agricultural Workers' percentage of Total Number of Workers	59.1%	58.2%	54.6%	40.6%	25.7%

Source: Vision 2050 Document of Central Institute of Agricultural Engineering, Bhopal, 2015

- As per the Vision 2030 document by Indian Council of Agricultural Research, domestic demand for food grains is expected to increase at around 2% CAGR in Calendar Year (CY) 00-30. Food grains demand is expected to reach 355 MT in CY30 vis-à-vis 192 MT in CY10. Fruits and Vegetables demand is expected to reach 290 MT in CY30 vis-à-vis 136 MT in CY10. However, given the limitations in land use and in increasing cropping intensity over a certain period, increasing the yield from the same land is an urgent requirement to meet the needs of a growing domestic population.

Exhibit 8: Demand of Food Grains, Fruits and Vegetables and Milk



Source: "Indian Council of Agricultural Research- Vision 2030"; 2014

- Yield improvement in food grains has improved from 522 kg/ha in 1950-51 to 1930 kg/ha in 2010-11 with a CAGR of around 2.2 %. In case of paddy, domestic yields were at 3591 kg/ha versus the global average of 4394 kg/ha. In case of maize, India's yield was mere 2512 kg/ha vs global average of 4944 kg/ha.
- Increased participation of corporates through corporate farming has become very popular. Companies are entering into agreements with farmers through contract farming thereby requiring mechanization.

6.3 Key Challenges in Agricultural Mechanization in India

The key challenges faced by farm mechanization in India (Mehta and Pajnoo, 2013) are as follows:

1. The average farm size in India is small (less than 2 ha) as compared to the European Union (14 ha) and the United States (170 ha). Therefore, there will be little mechanization unless machines appropriate for small holdings are made available or substantial farm amalgamation takes place. Due to small size of land holdings, it is difficult for the farmers to own machinery. As a result, the benefits of mechanization are enjoyed by only a section of the farmers who have large farm holdings.

Table 8: Farm Holdings Break Up in India

	Number of Holding (Million Number)			Area (Million Hectare)		
	2000-01	2005-06	2010-11	2000-01	2005-06	2010-11
Category of Holdings						
Marginal (<1 Hectare)	75.4	83.7	92.4	29.8	32	35.4
Small (1-2 Hectare)	22.7	23.9	24.7	32.1	33.1	35.1
Semi-Medium (2-4 Hectare)	14	14.1	13.8	38.2	37.9	37.5
Medium (4-10 Hectare)	6.6	6.4	5.9	38.2	36.6	33.7
Large (>10 Hectare)	1.2	1.1	1	21.1	18.7	17.4
All Holdings	119.9	129.2	137.8	159.4	158.3	159.1
Hectare /Holding				1.33	1.23	1.15
Holdings (%)	81.8%	83.3%	85.0%			

Source: Ministry of Agriculture, Government of India, 2014

2. Mechanizing small and non-contiguous group of small farms is against economies of scale especially in operations like land preparation and harvesting. With continued shrinkage in average farm size, more farms will fall into the adverse category thereby making individual ownership of agricultural machinery progressively more uneconomical.
3. The major constraint of increasing agricultural production and productivity is the inadequacy of farm power and machinery with the farmers. The average farm power availability needs to be increased to minimum 2 kW/ha to assure timeliness and quality in field operations, undertake heavy field operations like sub-soiling, chiseling, deep ploughing and summer ploughing.
4. There is an urgent need to design, develop and adopt machinery especially suitable to Indian farming conditions such as dry land farming, paddy transplanting, sugarcane harvesting, potato combining and cotton picking.
5. The quality and after-sales service of farm machinery are the other concerns in India as the majority of farmers are cost conscious. There are inadequate service centres for proper up-keep of the machinery. In addition, the inability of local low cost manufacturers to come up to the levels of standard designs of equipment also poses a big challenge to farm mechanization.
6. Almost 90% of tractors are sold in India with the assistance of some financial institutions. Sale of farm machinery is driven by factors like financial support, limit of funding (in terms of percentage of the cost), funding/financing institution and the applicant's profile (deciding the credibility of the loanee).

7. High cost and energy efficient farm machinery are capital intensive and majority of Indian farmers are not able to acquire these assets due to shortage of capital with them. Therefore, an arrangement to provide custom hiring service facility for these farm machineries to the farmers by engaging unemployed rural youth will go a long way in meeting the requirements.
8. Cropping pattern decides the extent of mechanization required for timely operations and achieving optimum results. The scope of mechanization increases with intensive cropping pattern. Price realized by the crop is also an important factor, as it indicates the cash in hand for the farmer.
9. Matching equipment for tractors, power tillers and other prime movers are either not available or farmers make inappropriate selection in the absence of proper guidance, resulting in fuel wastage and high cost of production.
10. Hill agriculture, which covers about 20% of cultivated land, has little access to mechanization. This situation has to be improved by developing and promoting a package of technology for mechanization of hill agriculture to achieve higher productivity.



7.

Overview on Existing Approaches of Providing Machinery and Farm Equipments in India



7. Overview on Existing Approaches of Providing Machinery and Farm Equipments in India

7.1 Custom Hiring

7.1.1 Introduction

Organized move to promote multi farm use of agricultural machinery was made in mid 1960's when Agro Industries Corporations (AICs) were established in the states. AIC in most states set up Agricultural Machinery Service Centres to provide Custom Hiring and servicing facilities to the farmers as no such facility was available. These centres were run on no profit no loss basis. From 1967, these centres also supplied pump sets, tractors, power threshers and power tiller on hire purchase basis rather than on Custom Hiring. These centres suffered huge losses on account of difficulties involved in recovery of loans from the farmers. The AICs had to curtail this project and finally these centres were closed. In the meantime, private entrepreneurs entered the field of custom operations of farm equipment. Owners of tractors and threshers started providing custom service to other fellow farmers for tillage, threshing, transport, etc. This brought additional income to custom operators and gave access to mechanization for all groups of farmers irrespective of the size of their holdings. Custom Hiring of farm machinery got further boost when the Government of India, in 1971, launched a scheme to set up Agro-Service Centres all over the country. The main aim of this scheme was to provide employment to the unemployed engineers and graduates in agriculture. The Government of India even paid subsidy on the interest on the capital. As a result of this scheme, Agro Service Centres in the northern states of Punjab, Haryana and Rajasthan were established to provide Custom Hiring services for use of tractor operated machinery, to sell farm equipment and other agricultural inputs and to provide servicing facilities for agricultural machinery. Custom Hiring services, in a limited way were started in 1990s under National Schemes spread over India, under National Agriculture Technology Project (NATP) and National Agricultural Innovation Project (NAIP). Accordingly, it had limited success because they were tried in limited spaces with extremely less number of staff i.e. concentrated to small pockets of India. In 2010, under National Institute on Climate Resilient Agriculture (NICRA), by bringing in 100 agri extension centres spread over drought/flood/hill area and other difficult terrains of agriculture, the man power utilization and technical expertise of agri extension centres was harnessed to popularize Custom Hiring services.

Custom Hiring envisages promoting establishment of farm machinery banks for hiring by way of providing financial assistance to self-help groups or farmers' co-operatives since the prohibitive cost of hi-tech and

high productive equipments renders it difficult for individual ownership. The CHCs give farm machinery on rental basis to farmers who cannot afford to purchase high-end agricultural machinery and equipments apart from servicing old machinery. The centres play a pivotal role in introducing high technology agriculture machinery to even ordinary farmers with the objective to boost crop production and improve quality of agriculture operations.

Due to India's archaic Land Ceiling Act, the total land under agriculture for an average Indian farmer is shrinking, which is a mere 1.5 acre per farmer at present. With such small land holdings, a farmer faces difficulty in justifying ownership of any kind of agri-machinery. Hence, renting out farm machines becomes more viable. Out of 120 million strong farmer population in India, majority of them are incapable of buying machines. Moreover, the growing reality of labour shortage is making farmers more inclined towards mechanization to ensure faster work at a lower cost.

7.1.2 Objectives of Custom Hiring

1. To make available various farm machinery/equipments to small and marginal farmers
2. To offset the adverse economies of scale due to high cost of individual ownership
3. To improve mechanization in places with low farm power availability
4. To expand mechanized activities during cropping seasons in large areas especially in small and marginal holdings
5. To provide hiring services for various agricultural machinery/implements and high value crop specific machines applied for different operations

The farm power availability for small/marginal land holdings is the lowest. As the small/marginal holdings constitute 80% of total land holdings, the potential for CHCs which will cater to the farm machinery requirement of such a vast area, is quite huge. Government of India, in recognition of this potential had envisaged increase of farm power availability from the present level (0.93 kW/ha) to 2 kW/ha during the 12th plan period (2012-2017). SMAM was one such initiative towards the achieving the objective.

7.1.3 Farm Machinery Banks for Custom Hiring

This component of SMAM provides suitable financial assistance to establish farm machinery banks for Custom Hiring for appropriate locations and crops. The key objectives of Custom Hiring enterprises include:

1. To promote mechanization in districts with low farm power availability
2. To provide hiring services for various agricultural machinery/implements applied for different operations
3. To expand mechanized activities during cropping seasons in large areas especially in small and marginal holdings
4. To involve manufacturers/agri extension centres in operation and maintenance of machines in the CHCs
5. To introduce improved/newly developed agricultural implements and machines in crop production

CHCs will be established in the districts identified for implementation in the State Annual Action Plan. These would be established in villages having low farm power availability and large area under small and marginal holdings. Each CHC will have the capacity to cover minimum area of 10 ha/day and at least 300 ha in a cropping season. Machines can be hired for entire operations from land development to residue management. Each CHC will be set up on a specific crop based, cost based and cluster based approach. Each CHC will have small crop specific machinery suitable for local requirement for mechanized farming under small and marginal holdings.

The following parameters may be chosen for selection of village/town for setting up of CHCs:

1. Low ratio of farm power availability
2. Low number of tractor population
3. Small & marginal operational holdings
4. Less productivity of food grains but potential to enhance productivity

Entrepreneurs will select such machinery/implements appropriate for the crops grown in the identified districts. The capacity of the machines will be selected on the basis of area to be covered in a cropping season. The CHCs having the project cost more than ₹ 25 lakh will be established under the model of credit linked back ended financial assistance. The bank will lock the financial assistance released to them for a period of 4 years. The beneficiary will not be allowed to repay the complete bank loan within the period of less than 4 years. The beneficiary will not allow transferring/selling/mortgaging the CHC to anyone before the completion of 6 years.

7.1.4 Hi-Tech, High Productive Equipment Hub for Custom Hiring

This component of SMAM provides financial assistance to set up hi-tech machinery hubs for high value crops like sugarcane, cotton etc. The key objectives include:

1. To promote utilization of hi-tech, high value machines for higher productivity
2. To provide hiring services for various high value crop specific machines applied for different operations
3. To expand mechanized activities during cropping seasons to cover large areas
4. To involve manufacturers for setting up of such centres

Hubs are established in the districts identified for implementation in the State Annual Action Plan having larger area under cash and other value crops. Each hub will have the capacity to cover at least 500 ha in a cropping season. Machines are hired for crop specific operations. Larger area under cash crops/high value crops are the potential areas to set up CHCs.

Entrepreneurs/manufacturers select such machinery appropriate for the cash and other high value crops grown in the identified districts. The type and capacity of the machines will be selected on the basis of area to be covered in a cropping season. Hubs will be established under the model of credit linked back ended financial assistance. Banks will lock the financial assistance released to them as per the terms of repayment of loan. The Beneficiary will not be allowed for transferring/selling/mortgaging the hubs to anyone.

7.1.5 Government Initiatives in Promotion of Custom Hiring

Agriculture Ministry has proposed a programme for the 12th Five Year Plan (2012-17) that seeks to provide affordable farm machinery to small and marginal farmers and in areas where farm labour is scarce. SMAM aims at catalyzing an accelerated but inclusive growth of agricultural mechanization in India. Its focus is on increasing the reach of farm mechanization to small and marginal farmers and in regions where availability of farm power is low. The other major components in the sub-mission include promotion and strengthening of agricultural mechanization through training, testing and demonstration. It includes post-harvest technology and management (PHTM), financial assistance or procurement subsidy for agriculture machinery and equipments, establishment of farm machinery banks for Custom Hiring, enhancing hi-tech high productive equipment hub for Custom Hiring, among others. The programme also aims at enhancing farm productivity at village level by introducing appropriate farm mechanization in selected villages and creating ownership of appropriate farm equipments among small/marginal farmers in eastern/north eastern regions. Some of the state government initiatives in promoting custom hiring have been appended below:



7.1.5.1 Custom Hiring in Karnataka

In July 2014, the Government of Karnataka appointed two private entities to run 178 CHCs around the state for six years. Shri Kshethra Dharmasthala Rural Development Project, popularly known as SKDRDP, a charitable trust runs 161 centres. The Indian Society of Agribusiness Professionals (ISAP), New Delhi has been assigned to run the remaining 17 centres. Under the PPP model, each centre has been given a budget for ₹ 50 lakhs in the first year and ₹ 25 lakhs in the second year. The government has chipped in ₹ 37.5 lakhs for the first year and will fund another ₹ 12.5 lakhs in year two. The private partner has put in equity of ₹ 12.5 lakhs for the first year and will make equal contribution in the second year. From the third year onwards, the private entity will have to operate the centre with internal accruals for the remaining contract period.

The SKDRDP centres opened for business in February 2015. Equipment rentals are about 10% to 20% cheaper than the rate offered by private players. About 7,724 farmers in three districts have utilized the centres' services. Along with 16 medium-powered tractors and 11 mini tractors and other associated implements, the centres rent out hand-operated machineries such as weed cutters, harvesters, transplanters, battery-powered sprayers and irrigation pumps. The equipment has been stocked based on cropping pattern in each location.

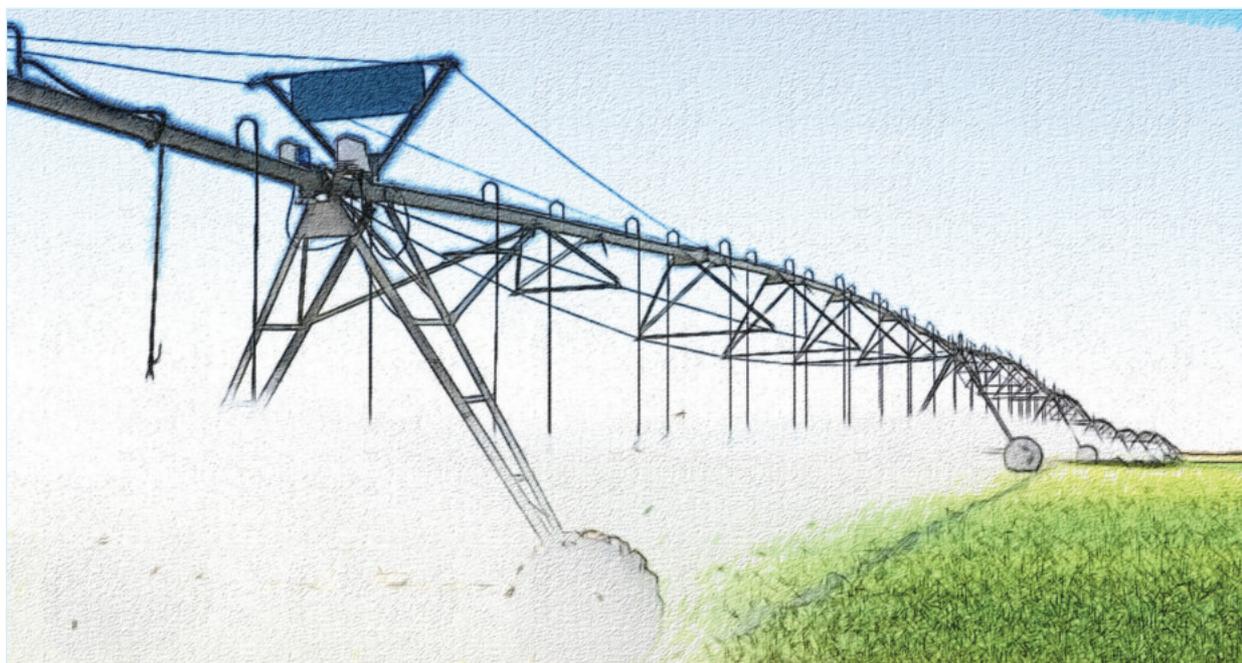
Karnataka has a large number of small farms with land holding of less than 2 hectares and very poor economic condition. Single farm ownership and use of tractors and machinery on these small farms is not economically viable. But through Custom Hiring of agricultural machinery even small farmers have been able to get the benefit of agricultural mechanization. In this view, Government of Karnataka also initiated establishment of Custom Hiring Service Centres (CHSCs) through Primary Agricultural Credit Co-Operative Societies (PACS) by supplying tractors and associated implements and equipments in the year 2010-11 under Rashtriya Krishi Vikas Yojana (RKVY) to fulfill the needs of the small and marginal farmers. Considering the agro-climatic conditions, cropping pattern, farm machinery density and demand for farm machineries, the type of machineries were distributed across CHSCs in Karnataka. As per one of the studies conducted to assess the performance of CHCs in Raichur district of Karnataka, it was found that though tractors were distributed for all the CHSCs, the associated machineries varies from region to region. However, economic utilization of machineries was lacking in most of the CHSCs. The main reasons for under-utilization of machineries are: lack of awareness about how to use and need does not arise for use especially for power weeder, electronic balance and winnowing fan. The poor quality and non-suitability of machinery for specific location was another reason for non-utilization of machinery like seed cum fertilizer drill, cultivator, leveller blade, blade harrow and rotavator.

7.1.5.2 Custom Hiring in Madhya Pradesh

The Government of Madhya Pradesh envisaged the establishments of professionally run CHCs in the state in order to facilitate easy availability of tractors and other hi-tech equipments for farmers on Custom Hiring basis. The Government of Madhya Pradesh provides assistance to establish Hi-Tech CHCs. The assistance to each centre is given to the tune of 50% of the cost of machineries and implements purchased for providing custom hiring services to farmers, up to maximum of ₹ 50 lakhs. The beneficiary has to establish CHC at a place offered by him. The beneficiary will need to maintain a fleet of at least 5 tractors and matching implements. The matching implements should cover all the agricultural operations starting from land preparation till threshing. Machines like combine harvester, straw reaper, reaper cum binder and other self propelled machines suited for local needs should also be made available to farmers on rental basis.

Each selected applicant can avail subsidy at 50% of the cost of agri machineries and implements purchased for Custom Hiring work, maximum up to ₹ 50 lakh. Successful applicant shall prepare a bank loan case for establishing a CHC with nationalized/scheduled banks. Subsidy will be provided only in bank loan case. Subsidy will be in the form of "Back Ended Subsidy". In this form subsidy is deposited with bank and adjusted at the end when the operator has repaid full loan amount. The bank will not take any interest, from the applicant, on amount equal to the subsidy amount. The successful applicant will have to establish the CHC within 4 months from the date of issue of work order. The departmental officers will monitor the progress and after physical verification the subsidy will be released to the bank.

The essential infrastructure i.e. shade for storage of implements and machineries, a workshop for repair and maintenance of implements will have to be created by the applicant either on his own land or on a leased land. Sufficient staff should be employed for operation and maintenance of machines. Hiring charges will



include charges for petroleum, oil and lubricant (POL), staff, maintenance, implement and administrative costs. No other charges shall be levied on farmers. The CHC is to be established with a view to provide facilities to farmers for a period of at least 6 years.

7.1.5.3 Yantradoot Scheme for Promotion of Farm Mechanization in Madhya Pradesh

To increase the rate of agricultural mechanization in the State of Madhya Pradesh, Yantradoot Village Scheme more popularly known as Yantradoot Yojana was implemented in 2009. Under the scheme, a village each has been taken as a mission village by agriculture officers in 25 districts across the state.

In this mission, villages also known as “Yantradoot Villages,” district level officers of the Department of Agriculture Engineering provide information related to the use of machines in agricultural operations to farmers, demonstrate the use of such machines and make the machines available for use by farmers at a nominal rate. The uniqueness of the Yantradoot Yojana lies in the fact that it has completely transformed the nature of farming in these model villages. Not only has the process of farming become time, cost and effort saving but there has also been large scale increase in agricultural productivity in these villages.

After the field demonstrations are held, CHCs are set-up in these model villages. Each centre is managed by a field coordinator, who hires drivers from among the village youth for operating certain equipments. All the equipments that are demonstrated on the field are parked in these camps and can be hired by farmers for usage on their agricultural lands by paying a nominal price. Farmers contact the field coordinator and book the equipments they require and the coordinator gives them a slot i.e. day and time when the equipment will be available for their use and informs them about the hiring price. For instance, a farmer can hire a deep ploughing tractor for an hour by paying a price of ₹ 325. This cost includes the cost of the driver as well the diesel cost. All the farmer has to do is to guide the driver to his land and supervise him while the driver conducts the deep ploughing process. Similarly, farmers can hire other implements for their agricultural operations.

The hiring rate at these CHCs is cheaper than the rate at which private companies provide this service. For instance, the tractor that is hired at ₹ 325 from the government CHC is given at the price of ₹ 450 to 500 by private companies. Thus, the CHCs under the Yantradoot Yojana are helping farmers cut down on agriculture input costs.

As much as 40% increase has been registered in the agricultural productivity due to the implementation of this scheme in the selected villages. It has made farming a compact activity in these villages with proper planning for each season. Farmers have been familiarized with time; cost and resource saving techniques of farming that are resulting in increasing yields. A case in point would be the huge rise in the production of soya bean crop in these Yantradoot Villages. While earlier only two to three quintals of soya bean was produced per acre, now the production has gone up to about fifteen to sixteen quintals per acre.

7.1.5.4 Primary Agriculture Credit Societies (PACS) in Punjab and Custom Hiring

Under-utilization of the costly machines has been noticed because of lack of Custom Hiring opportunities. It is therefore the need of the hour to promote efficient use of the large and costly farm implements. Primary Agriculture Credit Societies (PACS) and other state agencies and entrepreneurs may be encouraged to establish farm machinery banks and provide tractors and other implements on Custom Hiring.

To provide machinery on Custom Hiring basis to farmers on time and at reasonable rates, the establishment of Agro-Service Centres was suggested. A landmark step in this direction was the setting up of Agro-Service Centres in Punjab in the year 1972, with the twin objectives of providing self-employment to educated youth and Custom Hiring services to the resource-poor farmers in Punjab. But, over time, these got phased out due to farmers owning individually the small-powered machines. However, the new farm equipment, such as laser levelers, which are highly costly, has low annual use and requires high-power tractors have become the demand of the modern efficient agriculture. The Punjab State Farmers Commission took the initiative to strengthen the Primary Agricultural Cooperative Societies (PACS) by providing one-time capital assistance as subsidy to own the costly machines and equipment and work as Cooperative Agro-Service Centres (CASCs).

The model of evolving primary agriculture cooperative societies in villages into “Agricultural Machinery Custom Hiring Service Centres,” successfully demonstrated in several villages of Punjab has the potential to be replicated in other states. The model in Punjab focuses on reducing capital investment on machinery and making available latest machinery to small farmers through these centres. The hiring-in of machinery services from these centres has been found cheaper by 16% and 35% as compared to the hiring-in from private operators and self-owning of machinery, respectively.

7.1.5.5 Custom Hiring in Nagaland

The first Farm Machinery Bank for Custom Hiring was established at Niuland, Nagaland in 2015. Farm power availability is significantly low in North East Region which necessitates promotion of Farm Mechanization as a special mission such as SMAM. The bank was an entrepreneurial outcome considering the highest production and productivity in major crops in Niuland region.

The government's support to develop Custom Hiring is a bold step to aid entrepreneurs in the agricultural applications. By providing special subsidies to purchase a package of machines, the government is trying to encourage small and medium investors to start equipment hiring business. Farmers need not invest in expensive machines for limited use in own fields for small time windows of agricultural processes, such as sowing, transplanting and harvesting. They can get modern machines in good condition, operated by skilled operators that will reduce need for heavy investment and enhance productivity.

7.1.5.6 Custom Hiring in Tamil Nadu

Under SMAM scheme, the Agricultural Mechanisation Programme in Tamil Nadu was implemented during the year 2014-15 with the financial assistance from the centre and state government in the ratio of 75:25. The sharing pattern between central and state was changed to 50:50 from the year 2015-16. The main objectives of this scheme are increasing the reach of farm mechanisation to small and marginal farmers and to the regions where availability of farm power is low, offsetting adverse economies of scale and higher cost of ownership of high value farm equipment by promoting CHCs for agricultural machinery and passing on the benefit of hi-tech, high value and highly productive agricultural machinery to farmers through creating hubs for such farm equipment.

Under this scheme, subsidy assistance is provided to the farmers for the purchase of tractors, power tillers, rice transplanters, specialized self propelled machinery, manual/animal drawn equipments/implements/tools, plant protection equipments and other important agricultural implements/machinery. From the year 2014-15, this scheme is being implemented with a financial outlay of ₹ 1,080 lakhs for the components namely:

- 1) Farm Machinery Testing Centre at Agricultural Engineering College and Research Institute, Tamil Nadu Agricultural University, Kumulur, Trichy District for an amount of ₹ 135 lakhs
- 2) Financial assistance for procurement of tractors by the farmers for an amount of ₹ 295 lakhs
- 3) Establishment of farm machinery banks for Custom Hiring for an amount of ₹ 650 lakhs

7.1.6 Models of Custom Hiring

There are two prevailing models of Custom Hiring, namely

- Tractor centric model
- Operation specific model

The key characteristics of these models are given below:

The tractor centric model focuses on tractors along with range of equipments. This model offers only basic services like leveling, ploughing, harrowing, planting etc. Mostly local entrepreneurs with limited financial capability implement this model in focused territories.

The operation specific model entails one type of high ticket machinery (single/fleet) with operations in larger territory, even in multiple states for better utilization of the machine. This model offers services for operations like harvesting, transplanting etc. and is relatively better organized.

A very successful example of Custom Hiring is the model used in grains. Individual entrepreneurs travel all over India according to the season to hire out their machines and to maximize the machines potential, thus

earning income. First successes have also been shown in the use of sugar cane harvesters and also paddy transplanters.

A rental hirer/contractor business is different from a CHC model. The government terms it as a CHC because the farm mechanization was not happening at the pace it was desired. Initially, the CHC was formulated for various crops including pulses, soya etc. The plan was to provide subsidy which should go into rental channel, not ownership. For a CHC, as the subsidy is through government, the machinery is not chosen by the company or the NGO alone. It is a joint effort of NGO/company, local agriculture authority who decide the type of machineries according to crops in that area. Some of the models where the company is not taking any subsidy and runs it as profit centre, it should not be considered as a CHC. It is a rental hiring model. The company engages with NGOs for CHC. The company provides knowledge, technical assistance and financial education to these NGOs for running it efficiently.

7.1.7 Private Initiatives in Custom Hiring

7.1.7.1 Case Study – EM3

EM3 Agri Services provides farm mechanization services and the mission is to enhance the wealth of small and marginal farmers and increase farm productivity through the application of contemporary technology on an affordable “pay for use” basis. EM3 is creating a pan India network of farm service centres – “Samadhan Kendras”. Samadhan Centres are the specialized centres started as “Custom Hiring Centres” equipped with various kind of modern agro machinery used for all field practices starting from sowing to harvesting. These centres are located in the rural areas with rented premises where they keep all machinery. These centres are also used for farmer meeting/ enrollment desk/one point contact centre and other farmer services.

Each Kendra, managed through robust processes, Information Technology (IT) enabled systems, and manned by agronomy professionals, will be equipped to deliver the entire suite of basic and precision operations throughout the farming value chain. This includes topography, soil analysis, seedbed preparation, sowing, fertilizer application, weed/pest control, top dressing, harvesting and post harvest operations. The farmer engages the services on call on a “pay for use” basis obviating the need for owning or operating any of the equipment. Each Kendra also serves as a knowledge centre for farmers to learn and absorb new precision farming techniques. The economies of scale afforded by the centre enable EM3 to offer services at an affordable cost. Further, the farmers benefit from the use of precision farming techniques that further optimize costs and enhance farm productivity. To enable these services, EM3 has an arrangement with John Deere India, as well as joint venture with Trimble Inc. who supports EM3’s effort through their strengths in farming machinery and technology. At the market end, the company has formalized arrangements with ITC and Small Farmers’ Agribusiness Consortium (SFAC) that provide dense market (farmer) access. Because of these partnerships, the company has been able to cover over two million acres of farm land. The first phase of this initiative was rolled out in Central India in October 2014. It is EM3’s intention to rapidly replicate this to other crops and geographic locations and over the next 10 years, the enterprise plans to open thousands of Samadhan Kendras – either self owned or franchised to create a dense pan Indian presence.

Each Samadhan Centre currently costs ₹ 1.5 crore. Such a centre typically has 5-10 tractors and 25-30 equipment pieces and would take up to two years to operationally break even. All Samadhan Centres will be owned and operated by EM3. EM3 wants to “Uberise” farm services by imparting relevant global technologies and equipment to India, thereby making them accessible and affordable to Indian farmers with FAAS (farming-as-a-service) where they ‘pay per use’ (hours, days, operation or months depending on commercial terms).

7.1.7.2 Case Study – Zamindara Farm Solutions Pvt. Ltd. (ZFS)

The company is associated with more than 5,000 families for tractors and farm implements on rent. The farmers have also started high tech equipment like Reversible Mould Board (RMB) ploughs and sub soilers. In association with Bill & Melinda Gates Foundation, the company trained farmers for baling operations which not only increased their incomes but also helped in protecting the environment. Moreover, 800 village youth got employment on Custom Hiring of residue collection machines.

The three year program “Feed the Future” (FTF) of USA for Africa infact used the success story of ZFS and has tied up with them to build a cadre of African agricultural specialists trained in different aspects of development, mechanisation and commercialisation of the agriculture in Africa.

ZFS uses a combination of library model and radio taxi model. In the library model, all the machines are parked in the same place, farmers take the machine, use it and return it; while the radio taxi model works through a call centre. The farmers can reach them at their call centres and the company sends the requested services. The company also provides extension services. The company rents out a wide range of machines including tractor, trencher, fodder, direct paddy seeder, laser leveler, turbo happy seeder, sub soiler, rice transplanter, bed maker, gen set, front loader & back hoe, pit digger, precision and many others. Village based staffs and rural entrepreneurs provide all the services. The company’s junior partners organize the delivery to farmers.

A pilot project has been launched in Punjab by Zamindara Farming Solutions to allow companies and individuals rent out their tractors and equipment to a registered user who can expect the services at rates cheaper than those offered by traditional companies. The pilot project has received an initial funding from NABARD as a loan of ₹ 22 lakh and ₹ 3 lakh as grant to carry out this innovative project called “Chaalak Bane Malik” based on popular taxi service like Ola. This initiative of “Chaalak Bane Malik” will provide services to about 3,000 farmers in the area under which tillers, farmers will be given loan at low rates. The amount of Equated Monthly Installments (EMI) will be deducted from the business they generate and eventually a farmer becomes the tractor/implement owner.

7.1.7.3 Case Study – OLAM India

OLAM is a leading commodity company in India with a pan-India footprint for ten key products. The company has sugar milling operations in India. To have better backward linkages, the company is running CHCs for sugarcane harvesting in Madhya Pradesh. OLAM India has tied up with agri tech service providers which are individual entrepreneurs at the village level. The equipments are purchased by the service providers with financial assistance from the company and the company also guarantees business to these service providers for a period of 5 years. The service providers also avail subsidy through state governments which in turn helps in better return on the capital employed. The focus has been on the maximum capacity utilization of the machinery and it has been able to achieve over 40% mechanical harvesting through this initiative. To provide technical assistance and after sales services to service providers, it has tied up with a tractor manufacturer which has setup local shops to assist. Some of the focus areas which the company feels are essential for a CHC include:

1. Multipurpose equipment
2. Local support for the equipments
3. Training of the service providers

7.1.7.4 Case Study – Indian Society for Agribusiness Professionals (ISAP)

ISAP was established in 2001 by a group of agriculture and management professionals, with the belief that capacity building of small and marginal farmers’ agricultural practices would help enhance their livelihoods and income, and thereby result in better quality of life for rural communities. The organization works in the areas of ICT in agriculture, women empowerment, water conservation and sustainable livelihoods. The organization is working with state governments and private sector for running CHCs.

- **Karnataka CHC:** The government provided subsidy for buying the machinery so that rentals for the farmers can be subsidized. The project will be supported for a period of six years by the state government. The Jai Kisan Souharda Multipurpose Cooperative in Bidar’s Bhalki region has 1,000 farmer-members, of whom only six own tractors. But their Farmer Producer Organization (FPO) has five tractors and matching implements — rotavator, mould board plough, subsoiler, seed-cum-fertilizer drill, rotary mulcher and multi-crop thresher. Thus, individual growers who cannot afford these machines are now able to custom hire them from the FPO. The focus crop is red gram and the rentals

vary as per machinery and the requirement. The ISAP’s work has been supported by Morocco’s Office Chérifien des Phosphates Group (OCP), the world’s largest phosphatic fertilizers maker. Since phosphorous is the most vital plant nutrient in pulses, it suits the OCP’s interests to fund extension activity among pulses farmers.

- **Rajasthan CHC:** ISAP helps companies in their Corporate Social Responsibility (CSR) programs for which the funds are allocated to CHC programs. ISAP runs these centres through FPOs. The machineries are purchased by ISAP which are transferred to the FPOs over a period of time. The machinery is transferred in the name of the FPO after the initial period. Primarily, the crops targeted are soya and mustard.

The table below shows the crops and area where ISAP is working on for Karnataka under OCPF, Sustainable Harvest Agriculture Resources and Environment (SHARE), National Food Security Mission (NFSM) and National Horticulture Mission (NHM) projects.

Table 9 : Crops and Coverage Area Undertaken by ISAP Projects

Crops	Area/Region
Red Gram	Gulbarga, Bidar, Raichur
Soya	Gulbarga, Bidar, Raichur
Jowar	Gulbarga
Bengal Gram	Gulbarga
Safflower	Gulbarga
Horticulture Crops, Including Fruits, Vegetables and Floriculture	Gulbarga, Bidar, Raichur, Gadag, Dharwad, Haveri, Hasan, Kodagu, Koppal, Yadgir and Bellary

Source: ISAP, 2015

7.1.7.5 Case Study – John Deere

John Deere has tried the Custom Hiring concept in Aligarh with Tata Kisan Sansar in initial stages. Later, the company successfully replicated the model in Gujarat with SMAM scheme which laid the confidence for nation-wide roll out. The company is actively collaborating with EM3 in the State of Madhya Pradesh with two locations: Jatara and Bijawar of Chatarpur. The company is responsible for sales of all agri equipments including tractors and other implements (from Green Corporation) to EM3. EM3 will set up hubs and spokes by FPOs or franchise; or by entrepreneurs or any all-under-one-roof kind of stores. The company is promoting Custom Hiring with two entrepreneurs in two separate locations: one at Badwani and another one with a company called “Fresh-O-Veg” which processes fresh tomatoes linked with various FPOs in Khargone in Madhya Pradesh.

7.1.7.6 Case Study – Tata Trusts

Tata Trusts has started working on Custom Hiring and first commercial venture will be unveiled shortly. The Custom Hiring is a tripartite venture of Tata Trusts + EM3 + two local FPOs. The project is being implemented in Jatara and Bijawar regions of Chatarpur in Madhya Pradesh for soybean crop. One hub each will be created in both these locations to store farm equipments. Farmers in these areas can’t afford even smaller implements; hence impact of such intervention is high. Tata Trusts will bring in with one time grant money to both FPOs for machine purchase. EM3 will chip in with matching money. EM3 will be responsible for maintaining the equipment and hiring staff to run the hubs. A small agri plot is being taken by the joint venture and the package of practices will be done as per research institutes directives including university

approved seed and advanced cultivation techniques. Both the FPOs grow their own soybean seed (after buying breeder seed from university) and also sell fertilizers and pesticides leading to the development of farmer touch points. Hence, these two FPOs were selected for functioning as hub for farm equipment. Currently the pricing for hiring of each equipment is under discussion and pricing will be made dynamic depending on farmer acceptance.

7.1.7.7 Case Study – Escorts

Escorts started the new division Crop Services to move from being a tractor manufacturer to a complete Farm Solutions provider to cater to small and marginal farmers' farm mechanization needs. The company ties up with 5-6 progressive and entrepreneurial farmers having 10-15 acres of land in a locality and forms Limited Liability Partnership (LLP) Company which acts as an independent unit and profit centre. Each centre covers initially 300 acres and will scale up to 1,000 acres in next 2-3 years. The farmers invest margin money and the company brings in equal amount of money to buy the equipments. Rest of the funding is through debt. The farmers are responsible for business development. The company imparts technical as well as business training to these entrepreneur farmers. On account of local management, the overhead costs to the company are considerably reduced. Hiring rates are determined by the local management. The company doesn't enforce to buy the machinery from Escorts. The machinery is decided mutually amongst all the partners of the company. The LLP provides end to end mechanization solutions for paddy cultivation starting from sowing till harvesting. With its cutting-edge technology and engineering skills, Escorts has introduced various equipments to make paddy cultivation mechanized and easy for farmers for better yield. Mechanized practices in paddy cultivation helps in saving time and fuel. It does a better job at pulverization of fields with precise leveling for even distribution of water in the field. This leads to even transplantation of seeds and better plant establishment and hence quality yield. Co-investment from the company in this model boosts the confidence among farmers. Paddy cultivation in India is at a large scale which helps the company in direct competition and helps in expansion easily. The company has five centres spread across states of Odisha and Telangana which they want to scale up to 25 centres in span of 1 year. The company wants to focus on paddy for next 2-3 years as large acreage is available under paddy. With strong Government push for establishing CHCs across states, custom hiring business presents huge scope for agri machinery suppliers to expand their base.

7.1.7.8 Case Study – Yanmar Coromandel

Yanmar Coromandel Agrisolutions Private Limited is a Joint Venture (JV) Agreement between Yanmar (40%), Coromandel (20%) and Mitsui (20%) for providing agri-solutions which includes manufacture, sales and after-sales service of rice transplanters and combine harvesters in the Indian market. The JV endeavors the promotion of rice transplanters as well as imparting know-how on rice planting techniques employed in Japan among farmers in South India to start off. This is with a view to significantly enhancing paddy field productivity by utilizing rice transplanters and combine harvesters, along with practices that best match local needs.

The JV has targeted small farmers, a segment in which Japanese manufacturer Yanmar has a strong presence. The rice transplanters, automatic seeding machines and power weeders will be sold and leased out to farmers through Coromandel International's Gromor chain of rural market outlets. Tamil Nadu is the first state for the intervention to be followed by Andhra Pradesh.

Paddy has been chosen since there are many interventions in package of practices from nursery bed preparation to puddling to main field preparation, seedling sowing etc. and further weeding operations amongst others. All these farm operations for the last 50 years in India have been labour intensive besides being time consuming. With labour wages moving south and monsoon being erratic, it was a felt need amongst the farmers that introduction of mechanisation will help them overcome labour shortages and timely sowing.

Paddy being cultivated as solo crop by most farmers in Kharif in South India, timely bundling of paddy seedlings and quick transplantation is of paramount importance. Hence, the JV has introduced implements to address the above concerns. Yanmar Coromandel is taking a dual mode of addressing the penetration of Custom Hiring of rice transplanters and other equipments. It is setting up exclusive outlets which will be selling the equipment besides acting as service centres and also providing training on the usage, maintenance and operations.

Separately, it is also selling the capital intensive machinery to the large acreage paddy farmers. It is expected that once the large farmers have completed the farm operations; they will encourage the renting of transplanters to other small acreage farmers for their operations. Some entrepreneurs have come forward to set up service centres which will be used in Custom Hiring concept for Yanmar Coromandel Agrisolutions.

The Agricultural Engineering Department of Tamil Nadu state government is providing subsidy schemes under Custom Hiring program under SMAM; and this scheme will help popularize Yanmar Coromandel products. Besides, V.S.Tillers in to an exclusive tie-up with M/s. Yanmar Coromandel Agrisolutions will also be marketing the rice transplanter in Tamil Nadu, Kerala and Odisha.

Exhibit 9: A Typical Yanmar Coromandel Agrisolutions Service Centre



Source: Yanmar Coromandel Agrisolutions

7.1.7.9 Case Study – TAFE

TAFE has products including tractors for land/seed preparation (across crops like rice, wheat, sugarcane, soya, maize, cotton and vegetables) and for harvesting (rice, wheat, maize and some horticultural crops). It has been experimenting with various options of Custom Hiring for various crops like paddy, sugarcane etc. around its factory premises at Madurai by:

1. Old agri equipment rentals versus brand new equipment for Custom Hiring/rentals
2. Tie-up with public sector banks like Punjab National Bank (PNB) to provide finance for financing new tractors, purchase of the old tractors and repair and renovation of tractors including a customized "PNB Dealer Suvridha Scheme". The scheme provides credit facilities to the tractor dealers for both sale and service of tractors and for providing Custom Hiring services (sowing, harvesting, threshing, etc.) to the farmers who cannot make one time investment on expensive agricultural implements.

7.1.7.10 Case Study – Mahindra & Mahindra (M & M)

M & M has set up a dedicated team for Custom Hiring called “Business Expansion” program and this will look at the service model of tractor by hiring/Custom Hiring/leasing/franchisees etc. for Mahindra tractors and other affiliated equipment. This is a focus area at Mahindra Group. The following entities in the group will be leveraged to grow the Custom Hiring business of the group:

1. EPC – the micro irrigation equipment arm
2. Mitsubishi Agriculture + Mahindra – lightweight small tractors, harvesters and transplanters for the Indian market for use in Custom Hiring.
3. Swaraj Mahindra tractors – most of the paddy machinery including puddlers, transplanters, other small farm equipment will be aggregated from this company
4. Trringo - organized rental business model for farm equipment to make tractor and implement rentals more accessible to farmers through a branded service. Trringo is a franchisee based model to ensure consistent quality of service and timely delivery. Trringo will use digital platform as an enabler to process orders and pass them to the nearest franchisee through location based mapping and will effectively bring in new age digital technology to the tractor rental business. This is expected to significantly increase the reach of farm mechanization and enable digital empowerment of the farmers of India. This venture would be set up as a new age startup company.

The first TRRINGO custom hiring centre has been inaugurated at ‘Hithnal Hobli’ in Koppal District as part of the MoU signed with the Government of Karnataka; since Karnataka is an important market for the company and going forward operations will be set up in key hubs in Gujarat, Maharashtra, Madhya Pradesh and Rajasthan. TRRINGO is a first-of-its-kind farm equipment aggregator service and allows the farmers to rent tractors and other mechanized farm equipment for completing their farming requirements without any investment. TRRINGO provides a unique business model based on franchisees where a rural businessman can invest in five tractors and equipment and set up a hub or a centre for operations. A call to the help line number ‘1800-266-2668’ will connect the farmer to the TRRINGO call center and immediate assistance through the nearest available tractor or equipment vendor will be provided.

5. Strategic partnership with ‘Sampo Rosenlew’ of Finland to focus on developing the combine harvester business in India, China, Africa and the Middle East.

It is expected that all the above companies will be leveraged by Mahindra Group to aggregate various farm equipments which will then be given under Custom Hiring to farmers or to franchisees.

In order to be in keeping with the multi utility use, multi person use for agri operations in custom hiring, Mahindra has now launched a new range of five Agri Specialist Tractors – “Mahindra YUVO” with advanced technology in the range of 30-45 horsepower. Yuvo range offers many features like 12F+3R gears, 1500 kg lift capacity, precision hydraulics and high engine power designed for over 30 different farming applications from land preparation to harvesting as well as post-harvesting operations.

Exhibit 10: Trringo Leaflet



Source: Website of Mahindra & Mahindra

Table 10: Comparison of Custom Hiring Initiatives

Company/Parameters	Geography of operations	Machinery & Equipments Range (Diverse/Specific)	Governmental Support	Operational Model	Captive Use	Rural Employment	Training and Development	Own Brand	Partnership with other Companies	Use of ICT	Crops
Zamindara Farm Solutions Pvt Ltd	Punjab and Haryana	Diverse	Yes	Library and Radio Taxi	No	Yes	Yes	Purchased	Yes	Yes	Multicrops
Olam India	Madhya Pradesh	Specific	Yes	Tie up with agri service providers	Yes	Yes	Yes	Purchased	No	No	Single
ISAP	Karnataka and Rajasthan	Diverse	Yes	Rental, Tie up with FPOs	No	Yes	Yes	Co-owned	No	Yes	Multicrops
John Deere	Madhya Pradesh	Diverse	Yes	Tie up with EM3, FPOs	No	Yes	Owned	Owned	Yes	No	Multicrops
TATA Trust	Madhya Pradesh	Diverse	No	Tie up with EM3, FPOs	No	Yes	Yes	Purchased	Yes	No	Single
Escorts	Odisha and Telangana	Diverse	No	LLP Company	No	Yes	Yes	Owned and Other brands	No	No	Single
Yanmar Coromandel	Tamil Nadu and Andhra Pradesh	Diverse	Yes	Rental model through outlets	Yes	No	Yes	Owned	Yes	No	Single
TAFE	Tamil Nadu	Diverse	No	Experimenting various options	Yes	No	No	Owned	No	No	Multicrops
M & M	Pan India	Diverse	No	Franchisee based model	Yes	Yes	Yes	Owned	Yes	Yes	Multicrops
EM3	Pan India	Diverse	Yes	Pay for use model	No	Yes	Yes	Purchased	Yes	Yes	Multicrops, esp. Sugarcane, Paddy, Wheat and Toordal

Source: YES BANK Analysis, 2016

7.1.8 Social, Economic and Environmental Benefits of Custom Hiring

Promotion of Custom Hiring services has the following economic, social and environmental benefits:

Economic and Social Impacts: Efficient labor, reduction of production costs, improved cultivation area, timely production, increased quality cultivation, increased yields, crop diversification, reduction of harvest and post-harvest losses, surplus income through hiring farm-power services to others, Reduction of drudgery and workloads particularly for women, Improved safety, Retention of farmers in rural areas along with improved livelihood are some of the economic and social impacts of Custom Hiring. To analyze the extent of use of combined harvesters in Papda and Rampura Kalan villages of Madhya Pradesh, to estimate costs and benefits of using combined harvesters and farmers' perceptions and to recommend options for their use among smallholder farmers, data on the use of combined harvesters was collected from secondary sources, farmers using these machines, entrepreneurs renting them out and other key stakeholders in selected villages of Madhya Pradesh, as a part of the Village Dynamics Studies in South Asia (VDSA). This study titled "Impact of MGNREGA on Rural Agricultural Wages in Semi-Arid Tropics India" was presented at National Symposium on "Dynamics of Rural Labor Markets: Implications for Agricultural Growth and Rural Transformation, 15-16 September 2014, New Delhi of Consultative Group on International Agricultural Research NGO (CGIAR). The following were the observations:

- The use of combined harvesters has led to the expansion of profitable monocrops. Soybean is now grown on 75% of the crop area in the rainy season. Wheat occupies 80% of the crop area in winter. Farmers were unable to attain this level of expansion earlier due to the shortage of labor during the peak season.
- Farmers who used the combined harvester took 45 minutes to harvest, thresh and pack wheat in an acre, which otherwise takes a week and 15 labor days.
- The shift of rural labor from farm to non-farm activities, their migration to cities and rising rural wages have served as incentives to increased adoption of combined harvesters in India. Custom Hiring and government subsidy have also supported its dissemination, allowing smallholder farmers to adopt and benefit from the combined harvesters.
- The use of the harvester has helped farmers cope better with and adapt to climate vagaries during the crop cultivation period.

Table 11 : A Partial Budget Analysis of the Use of Combined Harvesters for Wheat in Papda Village, Raisen District, Madhya Pradesh, India, 2013.

Benefits	US \$/ha	Costs	US \$/ha
ADDED RETURNS		ADDED COSTS	
		Rental Charge of Combined Harvesters	41
REDUCED COSTS		REDUCED RETURNS	
Reduced cost of labor for harvesting, threshing, etc.	140	Loss of straw using harvester (opportunity cost)	62
		Grain losses (5%)	23
TOTAL ADDED BENEFIT	140	TOTAL ADDED COST	126
Net Benefit per ha = US \$ 140-US\$ 126 = US \$ 14			

Source: Whether combine harvester is speeding up rural transformation in India, a poster presentation by International Crops Research Institute for the Semi-Arid Tropics, India (ICRISAT), 2013

Environmental benefits: use of water conservation technologies such as laser leveling, use of baler instead of burning crop residues. Also, as in case of Zero Tillage (ZT) allows direct planting of wheat without plowing, sowing seeds directly into residues of the previous crop on the soil surface, thus saving irrigation water, increasing soil organic matter and suppressing weeds. ZT users reap substantial benefits, and this technology could help close the growing yield gap between production and consumption of wheat in Bihar. However, with low ownership of tractors and ZT drills, large-scale adoption of ZT in eastern India hinges on an expansion of the network of service providers, who can custom hire these kinds of services to smallholder farmers. With public and private sector partners, the International Maize and Wheat Improvement Centre (CIMMYT) led Cereal Systems Initiative for South Asia (CSISA) has supported the development of ZT service providers among tractor owners by facilitating the purchase of ZT drills and providing technical trainings and know-how since 2009. Consequently, the number of ZT service providers in Bihar increased from 17 in 2011 to 1,624 in 2014, servicing a total of approximately 44,700 acres.

7.1.9 Scope of Custom Hiring in Dairy Industry

The Custom Hiring concept can be very well extended to Indian dairy industry specifically during milk production stage by small milk producers who are not able to invest in modern milking machines due to high cost. Community milking is a method of collecting milk through a conveniently located milking machine (often called as milking parlors) from those cattle farmers having lesser number of cattle and thus finding it difficult to afford the milking machines. The milk producers in the vicinity bring their animals to these parlors which enables fast and hygienic milking. This milk is then supplied to the Milk Coolers immediately. The benefits of community milking parlors to the farmers include improved herd productivity by extension and education, improved quality and quantity of milk, reduction of incidence of mastitis and provision of comfortable milking facility. Private dairies can establish these centres which would enable them to procure clean and hygienic milk within the shortest possible time and to provide the facility to small milk farmers with fewer animals and those who are not able to purchase costly milking machines.

Stellapps Technologies Private Limited (Stellapps) has developed India's first 8 – point community milking parlor for Kolar Milk Union Limited (KOMUL). This includes milk line based automated milking systems, ranging from a simple three station parlor to large herring bone parlors bundled with cow identification, automated milk meters, cluster retrieval and milk sampling – enabling Udder-to-Cup clean milk production protocols.

The concept of Custom Hiring is at a very nascent stage in the dairy industry but can be applied successfully at milk production level like milking parlors, spreading slurry, harvesting of grass and corn for silage, milking machines etc. Perishable nature of commodity with quality concerns and lack of professionalism in dairy farming management are considered to be key reasons for limited penetration of Custom Hiring in the dairy sector.

7.2 Technical/Agriculture Service Providers

The national agricultural policy of the government of India accords a very high priority to application of frontier sciences like bio-technology, pre and post harvest technologies, adequate and timely supply of quality inputs, such as seeds, fertilizers, plant protection chemicals, bio-pesticides and control agents and agricultural machinery, strengthening of research and extension linkages and broad basing extension system. To accelerate the diffusion of agricultural technology to the farmers and develop models of cropping systems, research in association with Indian Council of Agricultural Research (ICAR), National Agricultural Technology Project with World Bank assistance has already started functioning. Lack of adequate manpower and equipment, the declining utility and effectiveness of Training and Visit (T & V) System and lack of professionalism have, however, affected extension services in the country.



There is a large reservoir of graduates in new and emerging areas in the agricultural sector which awaits to be tapped for providing support services to farmers through Agri - Clinics and or Agri-Business Centres, supplementing the efforts of Government and public sector agencies, and filling critical gaps therein. It was felt that around 10,000 fresh graduates, besides other graduates, who are already working, might prefer to make it their profession to provide paid services to the farmers, if opportunities are available for providing technical services support in agriculture related ventures. Agriclincs and agribusiness centres are such ventures to gainfully utilize the services and skills of agricultural graduates for supporting agriculture and allied activities and to complement governmental efforts. It was felt that such deployment of trained and educated professionals as technical service providers would supplement and enhance the quality of the government development efforts.

The objective of Agro Service Centre - Farm Machinery is to enable farmers who cannot afford bullocks or other farm machinery to hire services of agro service centre for farm operations, to make available various farm machineries for custom hire at one place - single window, to make available services of agro service centre for repair and maintenance of farm machinery owned by farmers. The objective of Agro Service Centre - Farm Machinery & Primary Processing is to provide custom hire services facilities to the farmers, to improve timeliness in agricultural operations, to improve production and productivity of Indian agriculture, to improve post harvest processing facilities and profitability of farmers.

7.3 IT as an Enabler for Demand Aggregation

When it comes to improve the decision making process of farmers, the access to and sharing of experiences and knowledge among them is a key practice for success, and ICT is an essential enabler. A very innovative example in case is Gujarat based agriculture entrepreneur Dinesh Tilva who has turned popular social media app WhatsApp into a classifieds marketplace that allows farmers to trade goods such as grains, vegetables, seeds, irrigation equipment and tractors, among others. He moderates all the ads and broadcasts them to nearly 1,500 contacts in his smartphone. Most of these contacts are farmers, while some are traders of fertilizers, seeds, farm equipment, while a few are agents dealing in land and property. Farmers from across Gujarat, mostly from Saurashtra and central parts, find the system beneficial for them. Similarly, a group of farmers from Madhya Pradesh's Khargone are making use of social media network to practice modern farming, ensure best prices for their produce, and also prevent crop failure. The group – comprising more than 50 farmers – uses WhatsApp and Facebook to not only stay connected, but also to keep members up to date about topics ranging from mandi prices to outbreak of diseases and trade inquires from exporters. One of the members is an expert in mechanized agriculture and has a range of advanced agriculture equipment

that is available on hourly rental basis. The group's members also share the latest technical updates and make efficient use of transport facilities to ensure that perishable produce of all the members are shipped on time. They have also formed a "hi-tech vegetable and fruit production group" that uses modern farming methods, machinery for packaging material, grading to enhance the shelf life of the produce.

ISAP has been effectively using ICT in its various agriculture extension programs. ISAP has developed mobile application to reach to large numbers of farmers with accurate, timely and appropriate information. ISAP has created an applet called e-Krishak Sahyogi to help extension agents/farmers in diagnosing problems of disease or pest infestations in their fields. This applet is benefitting 9,600 farmers in Rajasthan. In addition, more than 1,000 farmers take benefit of ISAP advisory through Whatsapp messenger services. These farmers are sent animation videos on proven cropping technique through Whatsapp group on weekly basis. ISAP Facebook group witnesses several posts from farmers seeking solutions for their farm-specific problems, which are duly responded by subject experts/scientists from various agricultural institutes.

The application being created by ISAP not only provides information and advisory but also acts as a data capture and business management tool for individual farmers and farmer organizations like FPOs. It covers all aspects of farming and business like input sourcing, output sales etc.

Besides the above, some entrepreneurs are also making use of innovative ideas like Whatsapp groups, websites and other IT tools to aggregate farm mechanisation and custom hiring demand as follows:

1. The Agri Hub – This website is promoting farm mechanisation by selling modern equipment for presowing till post harvest practices. http://www.theagrihub.com/category/Farm%20tools%20&%20Equipments_56
2. Kheti Gaadi – It is an Android based application which is selling new as well as second sales of tractors, farm equipment besides also promoting equipment rentals - <http://khetigaadi.com/>
3. Kisan Manch – It is an android based application which is selling farm equipment and also promoting service centres- http://kisanmanch.com/Home/Service_Centres/NTQ=
4. Gold Farm, Coimbatore – Using this Android based application, previously known as AK Surya Power Magic farmer can rent farm equipment predominantly paddy harvestors. It matches the free available harvestor hours from owners with users who will need harvestors on rent and then uses this marketplace to meet supply and demand- <http://www.suryapowermagic.com/gold-farm.html>
5. Oxen Farm Solutions, Pune – This company evaluates options available in the international market and then brings the best fitting to farms on a pay per use model. The farmers pay for the hours used and don't have to worry about buying and maintaining the machines especially focussed on inter-cultivation operations machines like multi utility weeders, rotary tillers, mouldboard ploughs, ridgers, seeders etc. - <http://www.oxenindia.com/>
6. Padgilwar Corporation, Yavatmal - This company is starting a hub and spoke model of Custom Hiring Centres with a smart card enabled "Farm Machinery Bank Card" which will track the usage of machinery by farmers - <http://padgilwar.com/>
7. FarMart: is an on-demand agtech startup, connecting farmers who own machinery with those who don't; through a mobile app or call centre – www.farmart.co
8. RAVGO: This is an agri-equipment rental marketplace launched in May 2016 by Vikas Goyal and aims to bring access to modern technology for small farmers who cannot afford ownership of expensive machinery. Through Ravgo, farmers can access agriculture services, superior farming technologies and latest equipment at affordable costs without the hassle of ownership. The objective is to enhance productivity through farm mechanisation and thereby increase the income of farmers. The platform leverages Internet technology to provide benefits of mechanical technology to small and marginal

farmers. RAVGO follows a commission-based model in which it charges a certain percentage from vendors in lieu of the business it brings to them. An hour of service fetches as high as Rs 1,000. This rental economy has proved to be a boon for both vendors (agri-equipment owning farmers) and consumers (farmers). The former gets a regular source of income on his investment (equipment) and the latter saves lakhs of rupees on purchase of new tools and gets the service for as less as a few thousand rupees. Ravgo launched operations in Faridkot district of Punjab by enrolling vendors who own agri-equipment. It has on-boarded 50 vendors in one month and claims to have offered its services to more than 200 farmers. It plans to launch operations across Punjab in the next rabi season. (<https://ravgo.com/>)

Besides, Vikas had also launched Agroman in 2014 which is an integrated, online agriculture portal providing agro-services to farmers and acts as a product and price discovery platform.

7.4 Farmer Credit Programmes

Purchase of farm equipment is a significant investment for most of the farmers in India. Hence, reasonable financing norms are a must for ensuring mechanization. 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 'tractorisation' trend that is visible in the industry and doesn't add to overall mechanization. Industry stakeholders also feel that commercial banks must be encouraged to provide adequate financing for various farm equipments. 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.

Popularity of farm equipments, such as laser leveller, paddy transplanter and harvester, among farmers has opened a plethora of opportunities for bankers. With the increasing need for precision implements and machinery other than tractor, there is an immense potential for enhanced credit flow in the sector. The introduction and use of other farm equipment, such as power tillers, tractor drawn implements, reapers, threshers, cleaners/graders, zero-till seed-cum-fertilizer drill, raised bed planters, reapers and rotavators, have also increased significantly over the past few years, making it an attractive sector for the banks. The emerging areas that need attention include mechanization of labour-intensive operations like paddy transplanter, cotton picking, sugarcane harvesting and introduction of crop residue management and propagation of water conservation technologies through the use of suitable equipment.

Priority Sector refers to those sectors of the economy which may not get timely and adequate credit in the absence of this special dispensation. Priority Sector Lending (PSL) is an important role given by the Reserve Bank of India (RBI) to the banks for providing a specified portion of the bank lending to few specific sectors like agriculture and allied activities, micro and small enterprises, poor people for housing, students for education and other low income groups and weaker sections. This is essentially meant for an all round development of the economy as opposed to focusing only on the financial sector. Lending to the agricultural sector has been defined to include (i) farm credit (which will include short-term crop loans and medium/long-term credit to farmers) (ii) agriculture infrastructure and (iii) ancillary activities. Under ancillary activities, loans to Custom Service Units managed by individuals, institutions or organizations who maintain a fleet of tractors, bulldozers, well-boring equipment, threshers, combines, etc., and undertake farm work for farmers on contract basis are eligible under PSL.

Though institutions like primary agricultural credit societies, multipurpose societies, marketing societies etc., and line departments have machinery for Custom Hiring, a vast area still remains uncovered. Informal hiring systems are also prevalent in rural areas, however, timely availability is not assured. Therefore there is

a need to encourage individuals like progressive farmers, rural unemployed youth, agri graduates etc., and also village level institutions like Water Users Association, Watershed Committee, SHG Federations etc., to set up CHCs.

NABARD scheme of agricultural machinery CHCs is essentially suited for areas where paddy is cultivated predominantly. The CHC may comprise the following machinery:

- 35 HP tractors - for tillage operations, traction source and transport
- Power tillers – for tillage operations in small farms, traction source for small equipment and agri input transport for short distance.
- Multi crop power threshers
- Winnower
- Self-propelled reaper
- Sprayers
- Repairing tools

Ideally, the CHC shall be located in a place where large small land holdings are located within a radius of 5 to 7 kms. This will reduce the transportation cost and time of transport of agricultural machinery. In other terms, one CHC is expected to cater to 4/5 villages and therefore a common place equidistant from the villages catered is advisable. The cost of the unit works out to ₹ 15.50 lakh, which includes cost of construction of a workshed of 500 sq. ft. The land cost which is not considered in the project may however, be treated as margin. While the major income is generated out of Custom Hiring, recurring cost involved are fuel/lubricant cost for the machinery, driver charges, repair maintenance charges, labor, interest on bank loan and insurance.



8. Supporting Schemes by the Government



8. Supporting Schemes by the Government

8.1 National Mission on Agricultural Mechanization (NMAM)

As an integral component of the effort of Department of Agriculture, Cooperation and Farmers Welfare to restructure and streamline all Agriculture Development Schemes in the 12th plan, it was envisaged to have one integrated national mission on agricultural mechanization that would aim at catalyzing an accelerated but inclusive growth of agricultural mechanization in India. The mission provisions for continuation of following three ongoing 11th plan interventions which include:

1. Promotion and strengthening of agricultural mechanization through training, testing and demonstration
2. Post harvest technology and management
3. Financial assistance or procurement subsidy for agricultural machinery and equipments

Besides, NMAM proposed to include the following additional interventions that are already identified under the Mission document on National Mission for Sustainable Agriculture (NMSA):

1. Establishment of farm machinery banks for Custom Hiring
2. Establishing Hi-Tech, High Productive Equipment Centres
3. Enhancing farm productivity at village level by introducing appropriate farm mechanization in selected villages
4. Creating ownership of appropriate farm equipment among small/marginal farmers in eastern/north eastern region

The proposed outlay for this mission during 12th plan shall be ₹ 3,500 crores.

8.2 Sub-Mission on Agricultural Mechanization (SMAM)

Among the states, farm power availability in Punjab, Haryana, Western Uttar Pradesh and western part of Rajasthan is higher than the national average of 1.73 kW/ha. In rest of the country, especially in eastern and north-east regions, it is significantly lower which requires the promotion of farm mechanization as a special



mission. SMAM scheme will be implemented in all the states, to promote the usage of farm mechanization and increase the ratio of farm power to cultivable unit area up to 2 kW/ha. The mission comes under the ambit of National Mission on Agricultural Extension & Technology.

8.2.1 Objectives

The mission endeavors to fulfill the following objectives:

1. Increasing the reach of farm mechanization to small and marginal farmers and to the regions where availability of farm power is low, especially in Eastern and North Eastern regions.
2. Offsetting adverse economies of scale and higher cost of ownership of high value farm equipment by promoting CHC for agricultural machinery.
3. Passing on the benefit of hi-tech, high value and hi-productive agricultural machinery to farmers through creating hubs for such farm equipment.
4. Promoting farm mechanization by creating awareness among stakeholders through demonstration and capacity building activities.
5. Ensuring quality control of newly developed agricultural machinery through performance evaluation of newly developed agricultural machinery and equipment and certifying them at designated testing centres located all over the country.

8.2.2 Approach

The mission objectives would be achieved by adopting multi-pronged approach by:

1. Conducting performance testing for various farm machineries and equipments at the four Farm Machinery Training and Testing Institutes (FMTTI), designated State Agricultural Universities (SAUs) and ICAR institutions.
2. Promoting farm mechanization among stakeholders by way of on-field and off-field training and demonstrations.
3. Providing financial assistance to farmers for procurement of farm machinery and implements.
4. Establishing CHCs of location and crop specific farm machinery and implements.

5. Providing financial assistance to small and marginal farmers for hiring machinery and implements in low mechanized regions.

8.2.3 Components

The mission would have following eight components:

1. Promotion and strengthening of agricultural mechanization through training, testing and demonstration: This component aims to ensure performance testing of agricultural machinery and equipment, capacity building of farmers and end users and promoting farm mechanization through demonstrations.
2. Demonstration, training and distribution of post harvest technology and management (PHTM): This part aims at popularizing the technology for primary processing, value addition, low cost scientific storage/transport and the crop by-product management through demonstrations, capacity building of farmers and end users. Provides financial assistance for establishing PHT units.
3. Financial assistance for procurement of agriculture machinery and equipment: This would promote ownership of various agricultural machinery & equipments as per norms of assistance.
4. Establish farm machinery banks for Custom Hiring: This would provide suitable financial assistance to establish farm machinery banks for Custom Hiring for appropriate locations and crops.
5. Establish hi-tech, high productive equipment Hub for Custom Hiring: This would provide financial assistance to set up hi-tech machinery hubs for high value crops like sugarcane, cotton etc.
6. Promotion of farm mechanization in selected villages: This component provides financial assistance to promote appropriate technologies and to set up farm machinery banks in identified villages in low mechanized states.
7. Financial assistance for promotion of mechanized operations/hectare carried out through CHCs: aims to provide financial assistance on per hectare basis to the beneficiaries hiring machinery/equipments from custom hiring centres in low mechanized areas.
8. Promotion of farm machinery and equipment in north eastern region: extends financial assistance to beneficiaries in high-potential but low mechanized states of north-east.

8.2.4 Coverage

Although this mission will be operational throughout the country, some components will have a location specific approach for creating more inclusiveness. The component providing adequate financial assistance to individuals, group of farmers, cooperatives, self help groups (SHGs) for creating ownership of appropriate low cost, light weight but multi-utility farm machinery and implements shall be implemented in those potential villages where level of mechanization is poor but the potential can be harnessed for higher production and/or multi-cropping. Similarly, the nucleus for Custom Hiring Centre can be a cluster of villages or blocks having a catchment area of 5,000-10,000 ha. On the other hand, hi-tech, hi-productive agriculture machinery hub that needs minimum infrastructure and service support for operation and maintenance will be established at sub division/district level. This hi-tech hub, being primarily comprising of self-propelled equipment will be able to cover a greater catchment area. The advice of State SAUs, Krishi Vigyan Kendras (KVKs), Agriculture Technology Management Agency (ATMA) and reputed NGOs may be taken in identifying the appropriate equipment for implementation and also the source of supplies.

8.2.5 Cost Norms and Pattern of Financial Assistance for Custom Hiring under SMAM during 12th Plan Period

Component No. 4: Establish Farm Machinery Banks for Custom Hiring

Table 12: Cost Norms and Pattern of Financial Assistance for establishing Farm Machinery Banks for Custom Hiring

Item	Maximum Permissible Project Cost	Pattern of Assistance
Procurement Subsidy for Establishment of Custom Hiring Centre upto 10 lakh	₹ 4 lakh	40 %
Procurement Subsidy for Establishment of Custom Hiring Centre upto 25 lakh	₹ 10 lakh	40 %
Procurement Subsidy for Establishment of Custom Hiring Centre upto 40 lakh	₹ 16 lakh	40 %
Procurement Subsidy for Establishment of Custom Hiring Centre upto 60 lakh	₹ 24 lakh	40 %

Source: Ministry of Agriculture, Government of India, 2014

Component No. 5: Establish Hi-Tech, High Productive Equipment Hub for Custom Hiring

Table 13: Cost Norms and Pattern of Financial Assistance for establishing Hi-tech, High Productive Equipment Hub for Custom Hiring

Item	Maximum Permissible Project Cost	Pattern of Assistance
Procurement Subsidy for Establishment of Custom Hiring Centre upto 100 lakh	₹ 40 lakh	40 %
Procurement Subsidy for Establishment of Custom Hiring Centre upto 150 lakh	₹ 60 lakh	40 %
Procurement Subsidy for Establishment of Custom Hiring Centre upto 200 lakh	₹ 80 lakh	40 %
Procurement Subsidy for Establishment of Custom Hiring Centre upto 250 lakh	₹ 100 lakh	40 %

Source: Ministry of Agriculture, Government of India, 2014

Component No. 6: Financial Assistance for promotion of Mechanized operations/hectare carried out through CHCs

Table 14: Cost Norms and Pattern of Financial Assistance for promoting mechanized operations/hectare carried out through CHCs:

Item	Maximum Permissible Project Cost	Pattern of Assistance
(a) Hiring Charges to farmer members of Farm Machinery Banks set up under component (6)	₹ 2,000/ha/farmers/year	50% of the cost of operation/ha
(b) Field Demo by CHCs	Minimum 120 ha/season per CHC	₹ 4,000/ha

Source: Ministry of Agriculture, Government of India, 2014

8.2.6 State Wise Allocation of Funds under SMAM during 2015-16:

The state wise allocation of funds under SMAM during 2015-16 is tabulated below:

Table 15: State Wise Allocation of Funds under SMAM during 2015-16

State	Allocation of Funds (in ₹ lakh)
Uttar Pradesh	1,710.3
Maharashtra	1,596.2
Rajasthan	1,241.4
Madhya Pradesh	1,127.4
Karnataka	920.4
Andhra Pradesh	758.4
Gujarat	725.2
Assam	692.0
Bihar	691.6
Tamil Nadu	661.1
West Bengal	620.4
Orissa	576.6
Telangana	549.2
Chhattisgarh	400.2
Meghalaya	362.6
Jharkhand	281.4
Tripura	257.2
Nagaland	225.9
Haryana	211.6
Mizoram	202.9
Kerala	192.2
Manipur	191.1
Arunachal Pradesh	188.3
Punjab	186.5
Sikkim	129.8
Jammu and Kashmir	98.9
Uttarakhand	79.7
Himachal Pradesh	77.9
Goa	9.2

Source: Press Information Bureau, Government of India, August 2015



9. Constraints and Challenges



9. Constraints and Challenges

The farm mechanization sector is plagued by various challenges related to product, technology, markets, operations, legislation, policy framework and other related areas which pose a serious impediment to the growth of the industry. The key challenges faced by the farm mechanization industry in India are discussed below:

Research, development and testing of India-specific farm machinery and equipment: Land tillers and tractors serve the basic function but there is an urgent need to develop a machinery especially suitable to Indian farming conditions such as small farms, dry farming, and for the operations such as paddy transplanting, sugarcane planting, potato digging, cotton picking etc.

Standardization and quality control: As the majority of customers are cost conscious, quality of the product takes a major hit. In addition, the inability of local low cost manufacturers to come up to the levels of standard designs of equipment also poses a big challenge to farm mechanization.

Education, training and popularization of farm equipment: Knowledge about selection of machinery is insufficient. The farmers as well as artisans lack adequate training for efficient usage of the machinery. There are inadequate service centres for proper upkeep of the machinery and the market lacks regulations on Custom Hiring services.

Issues in farm mechanization: The major issues in farm mechanization are discussed below:

- Highly diverse farm size and soil types resulting in the need for customized farm machinery and equipment for different regions of the country.
- Skewed and seasonal usage resulting in low economic viability which calls for innovative solutions for scaling up usage.
- Best results from mechanization can be obtained if the usage is coupled with sufficient irrigation.
- Increased mechanization results in surplus draught cattle and their upkeep is a concern for the farmers.
- Education and training for efficient usage of farm equipment is required to be imparted along with knowledge about selection of appropriate machinery.
- Small and marginal farmers have cyclic nature of revenue streams resulting in limited capital availability.

The constraints in Custom Hiring of improved machinery as follows

1. High initial cost often prohibits individual ownership especially for small and medium farm holds.
2. Lack of knowledge in the aspects of operation, maintenance and repair of equipment restricts the use of farm machinery.
3. Repair and maintenance under individual ownership coupled with lack of space for shelter also constraints the use.
4. Tractorization being the prime mover in India, farm mechanization is more oriented towards use of tractors and allied equipments.
5. PPP in Custom Hiring has been a limited success. Government has adequate funds, but private players are not inclined to invest on account of scattered land holdings, longer maintenance period of equipments, success rates etc.
6. Sub-optimal asset capacity utilization on account of crop specific requirements and uniform spread of Custom Hiring to all the farmers who need it.
7. Lack of awareness amongst farmers on the merits of Custom Hiring.

The key challenges in Custom Hiring include:

1. Virtual or real consolidation of the widely fragmented and scattered land holdings in many regions of the country.
2. Extend benefit of mechanization to all cropping systems including rice and horticultural crops.
3. To achieve higher production levels, the quality of operations like seedbed preparation, sowing, application of fertilizer, chemicals and irrigation water, weeding, harvesting and threshing will have to be improved by using precision and efficient equipment.
4. The main challenge is the lack of Custom Hiring in the potato sector. The standardization of the growing of potato is a major challenge that needs to be addressed to increase the potential of Custom Hiring. Buy-in from the farmers and most importantly, the processors higher up the value chain is critical to promote the Custom Hiring.



10. Way Forward and Conclusion



10. Way Forward and Conclusion

Though mechanization has improved the state of agriculture in certain parts of the country, it is still a bottom of the pyramid story and it will remain so unless concrete measures are taken to propel farmers towards adoption of efficient farm mechanization practices. Custom Hiring is the only practical way to introduce capital intensive, high quality mechanization to the small farming structures prevalent in India. The Custom Hiring model enables new machines to be used at their maximum capacity and enables farmers to gain access to technology they would otherwise not be able to afford. The increased demand from processors have implied that the quality standards of the agri produce are continuously being driven higher, thus creating a need for higher performance and more precise mechanization.

Custom Hiring can significantly facilitate diversification in agriculture specifically from wheat and paddy to other crops. Machinery required for operations like sowing, planting, transplanting, plant protection, harvesting and product recovery is highly crop specific. Thus, diversification would require use of a vast variety of additional equipment for these operations on limited area in the initial stages, making it highly uneconomical on ownership basis. However, Custom Hiring through private entrepreneurs or co-operatives will help to increase annual use of these equipments thereby making them viable.

Under-utilization of the costly machines has been noticed because of lack of custom hiring opportunities. It is therefore the need of the hour to promote efficient use of the large and costly farm implements. PACS and other state agencies and entrepreneurs may be encouraged to establish farm machinery banks and provide tractors and other implements on custom hiring.

The majority of Indian farmers do not benefit from mechanization because of the shortage of capital consequential to the purchase of needed equipment. Therefore, an arrangement to provide Custom Hiring service facility for farm machinery to farmers by engaging unemployed agricultural graduates is the most appropriate approach in meeting the requirements. In the past years, the government made an attempt to promote ASCs, but many of those units failed in view of the absence of a regular source of income. Nowadays, these units could be attached to primary farm-processing to ensure regular source of income. These units will also have a better scope for manpower utilization round the year, better productivity and income generation per unit of manpower deployment. This will give the added incentive to the agricultural graduates to not leave the units even if other job opportunities are available.

While Custom Hiring is prevalent in India for some of the agriculture machineries, it is highly unorganized and sporadic. Severe labor shortages in crops such as sugarcane necessitates for the use of machines such as sugarcane harvesters and planters. However, the cost of these equipments makes them unviable even for large farmers in India. Further, they need a minimum number of 1200 to 1800 operating hours annually to be financially viable. Promotion of the concept of organized Custom Hiring through farm service centres is the potential channel to address these constraints. Custom Hiring is the evolving concept in India and holds an immense potential to change the farm mechanization landscape of India.

Following are the key interventions required across the value chain to enable the wide spread adoption of this model:

1. With increased participation of stakeholders across the agri supply chain and handholding farmers by supplying all equipments for entire life cycle of a crop sequentially, the Custom Hiring concept can be made successful. e.g. EM3 is handholding farmers by sequencing the use of implements in farmers' fields' right from use of hand weeders to fertilizer spray pumps to bund makers to seed drillers to rotavators to harvesters.
2. Partnership is crucial for any company to enter into Custom Hiring space. Concept of Custom Hiring holds good potential provided there is an integration of all the operations viz provision of agri inputs like seeds, fertilizers, implements etc through partnerships with various companies.
3. There is a need for incentives and policy support for the adoption, development and promotion of farm mechanization technologies particularly suitable for dry land farming, horticulture and orchards, hill agriculture, sugarcane harvesting, cotton picking, rice production etc.
4. Commercial banks and financial institutions need to develop hassle free loan origination and disbursement process for tractors and farm machinery on individual ownership basis or Custom Hiring basis. A higher rate of refinance needs to be extended to loans lent by banks in regions with low mechanization so as to increase the interest of banks to lend to this sector.
5. Training and farmer workshops to show and identify the benefits of new technologies as well as intensive communication with the value chain is the key. The standardization of growing only happens once the results are proven to be more efficient and consistent.
6. KVKs and extension wings of universities need to play a very key role in sensitizing the farmers on Custom Hiring adoption. Infact, recently , keeping the high skills required for handling modern farm equipment, The Deen Dayal Upadhyay Kaushal Kendra of Gandhigram Rural University (<http://www.ruraluniv.ac.in/>) based at Gandhigram, Dindigul, Tamilnadu has started a Bachelors in Vocational Studies (B.Voc) in Farm Equipment's Operation and Maintenance (http://www.ruraluniv.ac.in/bo_php/pdf/bvoc_info.pdf)
7. Manufacturing units that are set-up in areas with lower mechanization needs to be supported by extending tax and duty sops. This would result in easier reach of the equipment to farmers in those areas. Simultaneously, the government needs to design easier financing schemes for such farmers.
8. Combined harvesters which are capital intensive are the potential components for Custom Hiring. 90 % of these machines are owned by non-farmers which are predominantly transport operators which can be encouraged to promote Custom Hiring.
9. There is a need to innovate Custom Hiring model by institutionalization for high cost farm machinery such as combine harvester, sugarcane harvester, potato combine, paddy transplanter, laser guided land leveler, rotavator etc.
10. Indigenization of many specialized machineries by the private players which are otherwise imported thereby bringing down the cost.
11. Promotion of the formation of farm cooperatives including FPOs which eventually increases the scope of use of bigger farm machinery and result in minimum wastage of resources.

12. Improvement in irrigation facilities will enable the farmer to go for multiple cropping and hence there will be need of more machines.
13. **Seed coating/treatment:** Currently seed treatment is US \$ 150 million market in India, manually driven, hand mixing and predominantly focused on soybean, paddy, corn, cotton etc besides other commercial crops. Major states of focus are Madhya Pradesh, Andhra Pradesh, Tamil Nadu etc. and leading players in seed treatment are BASF, Bayer, Rallis, UPL etc. Globally, seed treatment is a mechanized operation whereas in India, immediately before sowing, most of the seed is treated manually with chemicals. Custom Hiring companies can import large sized seed treatment–cum–mixing machines for use here, e.g. Cimbria and Momesso seed coating machinery companies from Brazil.
14. Mapping the farm operations for key focus crops in India and major mechanized interventions needed:
 - a. **Cotton** – Cotton picking by imported machinery will reduce the Go-to-Market lint besides machinery for baling the cotton. If this machinery is available, the picked cotton will be protected from vagaries of unseasonal monsoon, quicker storage resulting in better quality.
 - b. **Corn** – Corn deshelling is a manual and very time consuming process. A mechanized intervention is needed for quicker storage; thereby preventing moisture loss and improving quality.
 - c. **Soybean** – Seed is bulky. Most of sown seed is treated. Custom Hiring mode will help farmers as currently this is a manual chore at farm level.
 - d. **Paddy**- Seed is treated manually with chemicals and since paddy occupies a very large acreage, using Custom Hiring seed treatment machines will be a good intervention.



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13. Discussions with Stakeholders of leading farm machinery companies on various Custom Hiring models

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