

Labour scarcity and its implication for farm mechanization in India

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1. Introduction:

In India agriculture is the main sector which has employed a major portion of its total workforce since a long time ago. But the structural changes in the national and state economies, large scale migration of labour from agriculture and operation of the rural development and poverty alleviation programmes have systematically reduced the relative importance of agriculture in labour allocation decisions of rural households. Consequently, there has been considerable reduction in labour supply to agriculture. On the contrary, the spread of advanced farm technology, increase in cropping intensity, growing importance of timely farming operations, and a remarkable shift in agriculture from a family-labour based way of life kind of activity to a business enterprise have significantly increased the demand for farm labour. In such view of things agriculture is facing acute labour shortage and the notions of surplus rural labour and zero marginal product and opportunity cost of labour have become misnomers. Its impact on agriculture can be seen in terms of reduction in crop yield, reduction in cropping intensity and changes in traditional cropping pattern. It has impacted the whole economy also by increasing the wage rates thereby high cost of cultivation which is directly reflected in higher output prices resulting in the food inflation.

In 2011-12 out of the total workforce of 467 million, agriculture sector has constituted 228.3 million (48.9%). In agriculture labour has remained very less productive as compared to other sectors. Worker's productivity in agriculture is growing at only 2.9%, while in industry it is growing at comparatively higher growth rate of 6.7% and in services at 5.3% (Chand and Srivastava, 2014). Goldman Sachs (2014) has also calculated that labour is 4 times more productive in industry and 6 times more productive in services compared to agriculture in India.

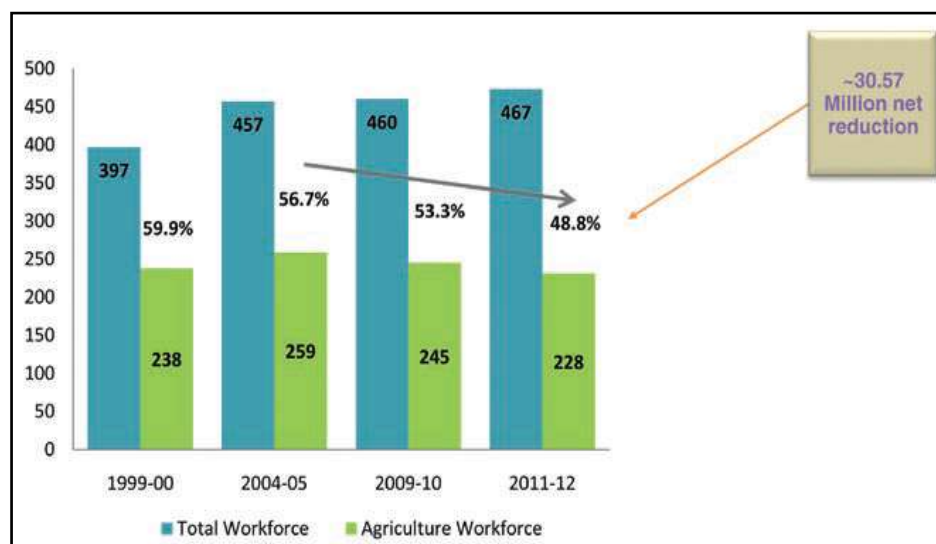
Usually as an economy matures there is a movement of excess agricultural workers from low productivity agricultural sector to higher productivity sectors. Higher productivity implies higher wages in other sectors. So natural movement of workers take place away from agriculture. Such shift should be coupled with technological advancement in the primary sector means adoption of lower labour intensive or higher capital intensive technology; otherwise agriculture productivity will be affected.

2. Trend in the agricultural workforce:

India is experiencing not only declining share of agriculture in total employment (from 56.7% in 2004-05 to 48.8% in 2011-12) but also a significant decline in absolute number of people employed in the agricultural sector (from 259 million in 2004-05 to 228 million in 2011-12 thus 30.57 million net reduction over this period). This brings to the fore that fewer people are

being added to the workforce in agriculture and highlights the net migration to other sectors (Figure 1).

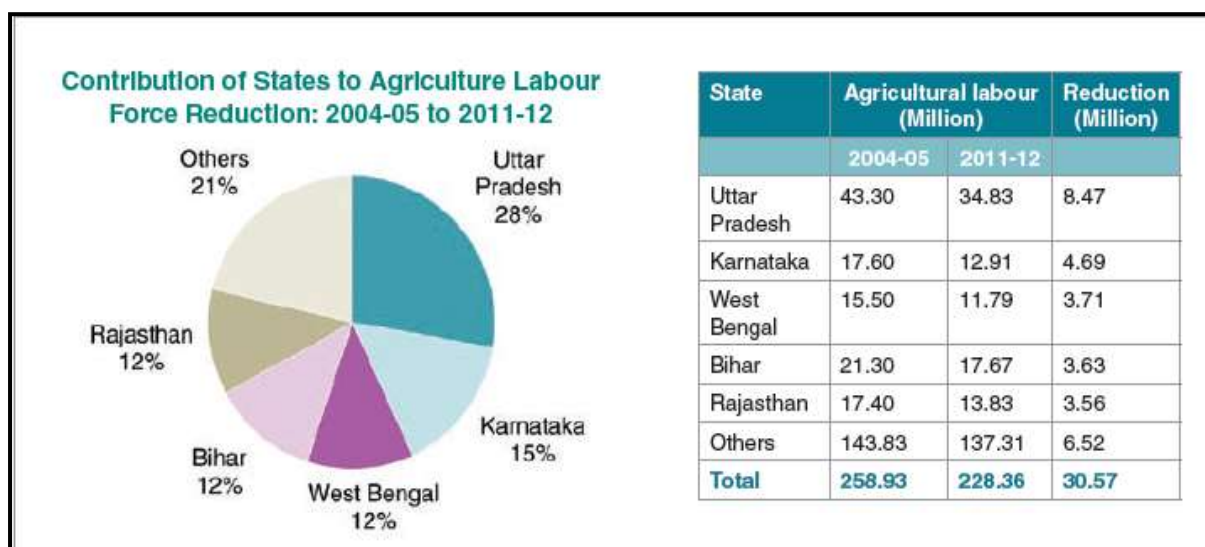
Fig 1. People employed in agriculture and total employment



Source: FICCI report, 2015

Close to 79% of this reduction has been contributed by the five states only - Uttar Pradesh, Karnataka, West Bengal, Bihar and Rajasthan while the remaining states constitute the rest 21% (Figure 2).

Fig 2. Contribution of states to agricultural labour force reduction



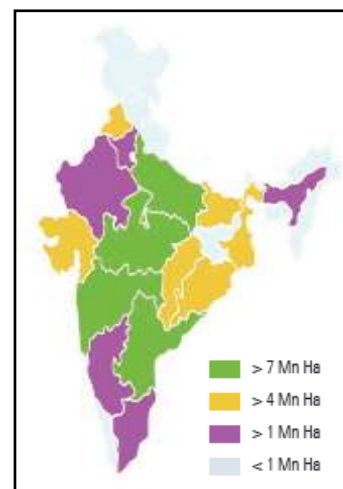
Source: FICCI report, 2015

3. Labour intensity across crops:

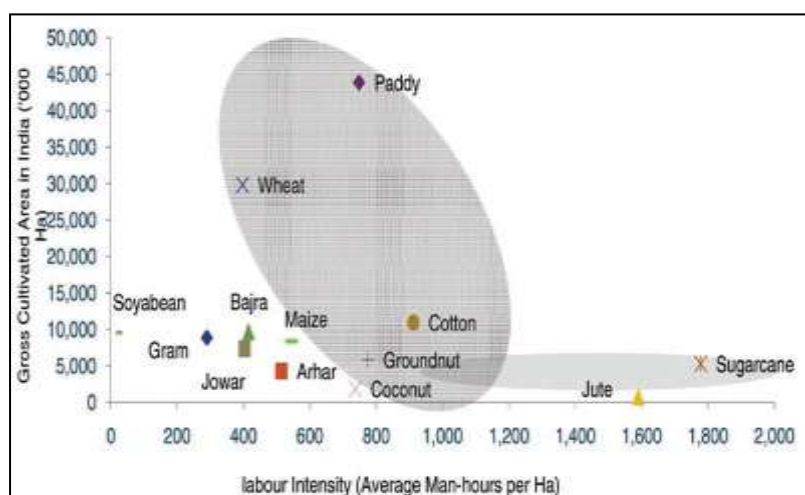
The impact of labour scarcity is more pronounced in case of certain crops like paddy, wheat, groundnut, cotton and sugarcane which require significant amount of labour hours per unit area cultivated and are also widely grown in the country (Figure 3). Andhra Pradesh, Maharashtra,

Madhya Pradesh and Uttar Pradesh have the highest area under cultivation of these five major crops (Figure 4). In these states labour shortage is likely to affect production and adequate steps are required to reduce the labour intensity associated with their cultivation.

Fig 3. Labour intensity across crops



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al area under paddy,
wheat,cotton, groundnut
and sugarcane in states**

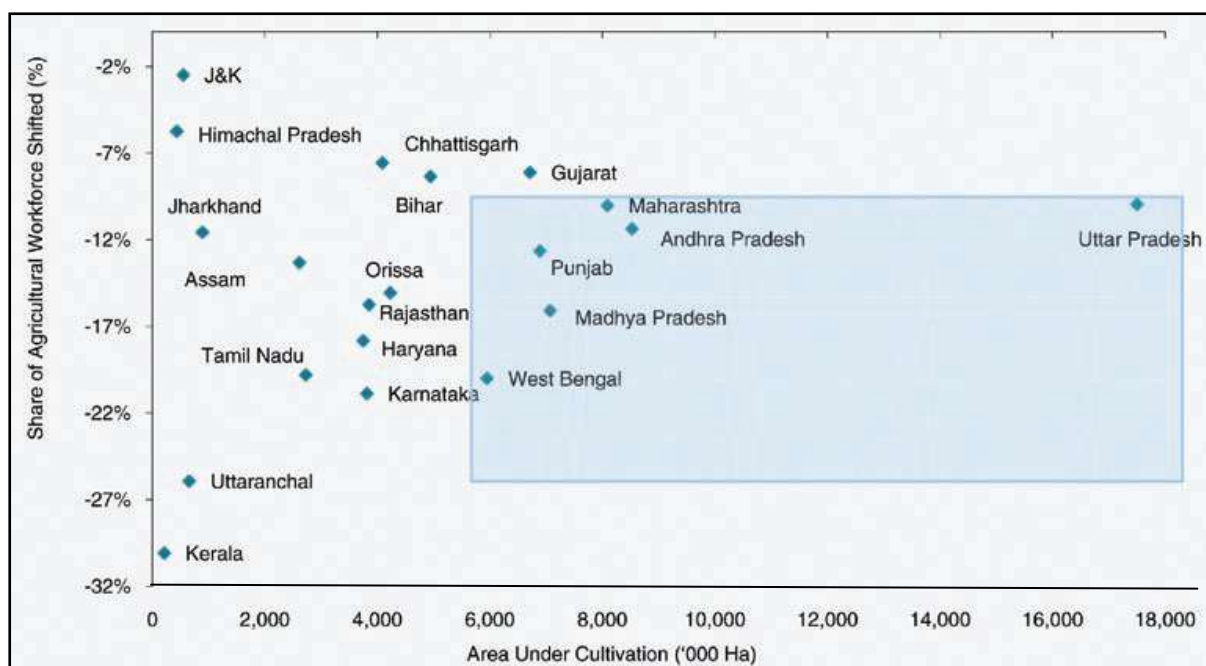


Source: FICCI report, 2015

4. labour intensive crops vs agricultural labour shift from 2004-05 to 2011-12:

Uttar Pradesh, Maharashtra, Andhra Pradesh, Punjab, Madhya Pradesh and West Bengal are the states which have substantial coverage under labour intensive crops and have also faced a considerable decline in labour availability (Figure 5). These states have a high propensity to face labour challenges going ahead and requires immediate attention.

Fig 5. Coverage of labour intensive crops vs shift of labour from agriculture



Source: FICCI report, 2015

5. Estimation of agricultural labour force reduction by 2019-20:

The size of the agricultural workforce is expected to shrink by another 23 million in the next eight years till 2019-20 and form only 41% of the total workforce and this trend calls for immediate steps to improve labour productivity in the sector.

6. Reasons for labour scarcity in agriculture:

The various reasons for labour scarcity can be categorised as follows:

1. Higher wages in other jobs available locally or lower remuneration in agriculture.
2. Shifting to a regular/ permanent job in the non-farm sector since agricultural job is seasonal.
3. Migration from rural to urban areas.
4. MGNREGA and other Government sponsored employment schemes.
5. Agriculture labour is presumed to be a low esteemed job.

6.1. Evidencing lower remuneration in agriculture:

Various reasons have led to lower remuneration from agriculture. The average land holding size has decreased to 1.16 Ha per farmer in 2011 from 2.3 Ha in 1971. Increasing cost of inputs like fertilizers and labour have increased the cost of cultivation and thus reduced returns from each farm. For small and marginal farmers who have limited bargaining power, the price obtained for their produce is often not commensurate with market rates affecting realizations further. This has led to lower wages in the agricultural sector.

Comparison of wages in farm and other sectors reveals that wages in other non-farm occupations are 15-20% higher than agricultural wages and industrial wages are 1.5 times higher than that of agricultural which clearly explains the preference for these sectors (Figure 6).

Fig 6. Comparison of Wages - Industries, Agriculture and Other Non Farm Occupations

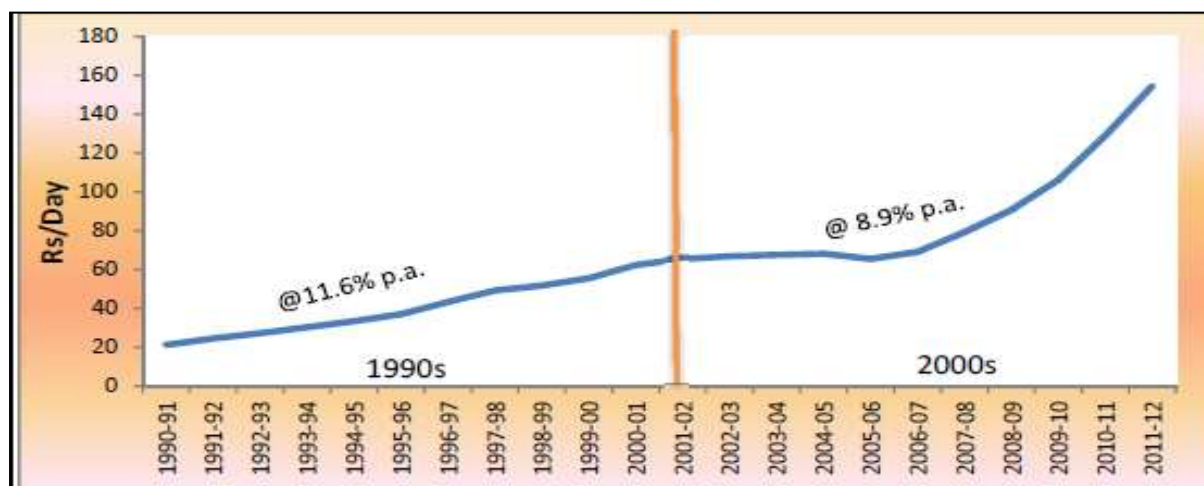


Source: FICCI report, 2015

6.1.1 All-India farm wage rates (1990-91 to 2011-12):

Nominal farm – wage rates were growing at 11.2% per annum in 1990s while it was growing at only 8.9% per annum in 2000s. Within 2000 decade, nominal farm wages grew at only 1.8 % per annum from 2001-02 to 2006-07 and at a high 17.5 % per annum during 2007-08 to 2011-12 (Figure 7). It was high in 1990s because in the 8th plan period (1992-97), agricultural sector growth rate was 4.8% but in subsequent 9th and 10th plan period it was reduced to ~2.5%. Thus this reduced growth rate along with falling world prices led to depressed farm incomes and thereby slow or even negative growth in real farm wages. Then because of slow recovery in global agri-prices from 2003 to 2005 and many government sponsored employment generation activities like MGNREGA led to higher wage rates after 2006-07.

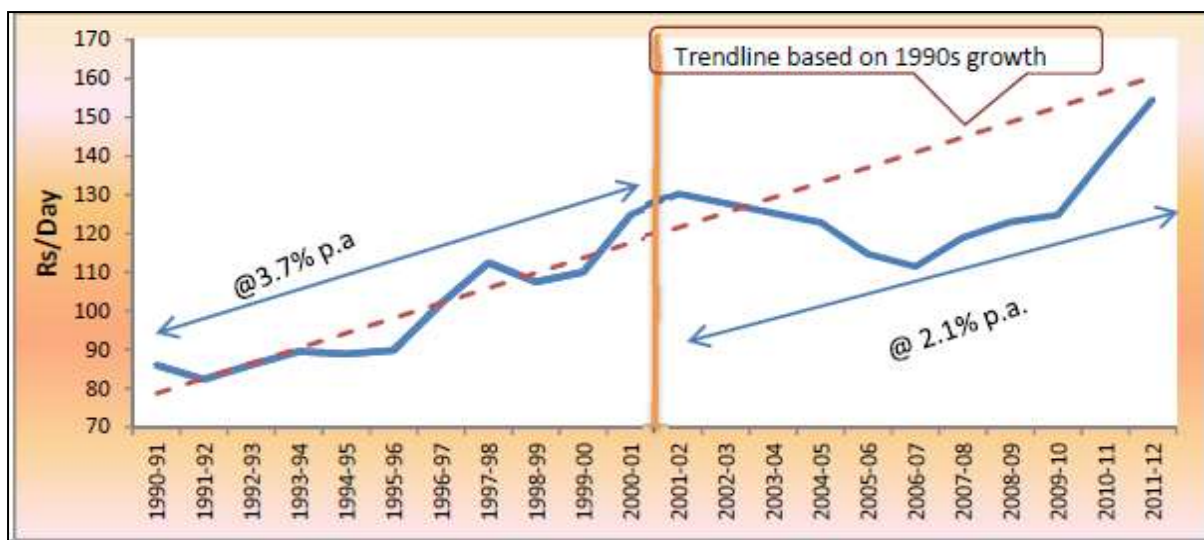
Fig 7. All- India nominal farm wage rate



Source: Gulati, 2013

Similar trend was seen in real farm-wage rates also, which fell by (-) 1.8 % per annum from 2001-02 to 2006-07 and then grew at 6.8 % per annum during 2007-08 to 2011-12 (Figure 8).

Fig 8. Average Real Farm Wage Rate at 2011-12 Prices

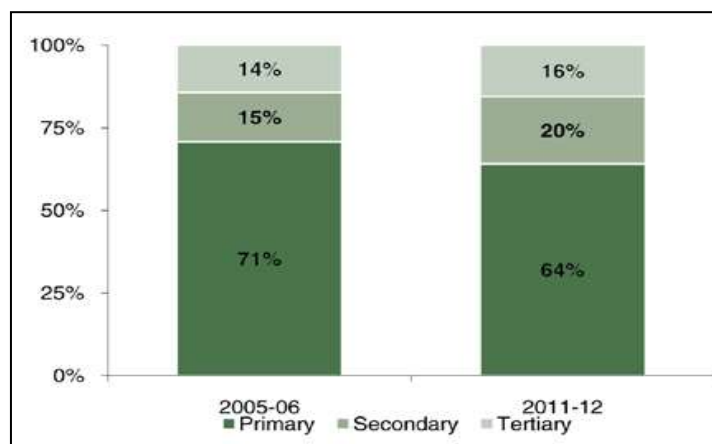


Source: Gulati, 2013

6.2. Shift towards non-farm sectors in rural areas:

While the share of primary sector in rural employment reduced from 71% to 64%, the secondary sector gained more from this shift and its share went up from 15% to 20%, while a small increase was witnessed in the tertiary sector as well between 2005-06 and 2011-12 (Figure 9). In the state also similar employment pattern shift was visible.

Fig 9. Share of different sectors in rural employment



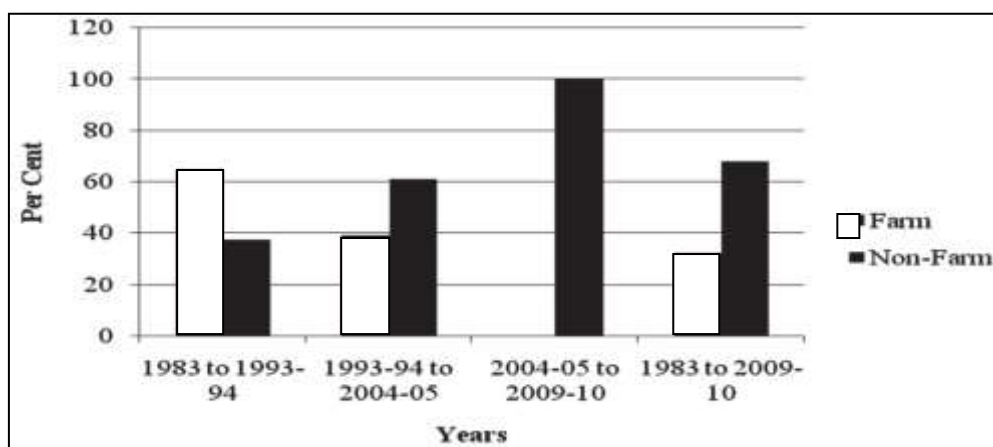
Source: FICCI report, 2015

Gender-wise disaggregation revealed a higher concentration of female workers in agriculture as compared to their male counterparts – 79.40% of total female workers and 62.80% of male workers were employed in the agriculture sector in 2009-10. Thus it is indicating increasing feminization of Indian agriculture (Chand and Srivastava, 2014).

Kumar *et al* (2011) has estimated the creation of additional employment opportunities in rural India from 1983 to 2009-10. He found that during 2004-05 to 2009-10 there was not at all any job creation in farm sector (reason may be distress in agriculture sector) and non-farm sector

emerged as a sole source of additional employment creation (because of MGNREGA) (Figure 10).

Fig 10. Sources of new jobs in rural India



Source: Kumar *et al*, 2011

6.3. Migration of labour:

The share of rural to urban migration among males increased by nearly 5 percentage points to 39% in 2007- 08 from 34% in 1999-2000. Nearly 60 per cent of urban male migrants and 59 percent of urban female migrants had migrated from the rural areas in 2007-08 (Alha *et al*. 2011). There are two critical factors that affect the movement of labour away from the agriculture sector- pull and push factors. Various pull factors are job opportunities in non-agricultural sector, the pace of urbanization, improvement in the educational status and the push factors are the status of wages and incentives in rural areas and MGNREGA. MGNREGA has actually reduced the push force of migration from rural to urban areas because it has created ample job opportunities in the rural area itself. Labourers are preferring MGNREGA work because of timely wage rates and less drudgery of work.

Sundaravaradarajan *et al*. (2011), on the basis of his study in Tamilnadu has identified various pull and push factors of out-migration and categorised them under economic and non-economic factors (Table 1).

Table 1. Pull and push factors for out migration in Tamil Nadu

Pull factors	Push factors
Economic:	Economic:
Availability of job at destination	Lack of continuous work at origin
Hope of getting a job at a destination	Low wages at origin
Higher wage at destination	Mechanization of agriculture
Information about employment	Economic status of family
Flexible hours of work at destination	Decline in per capita land availability
Non-economic:	Non-economic:
Skill development	Population pressure
Ambitions	Social differentiation
City connections and relatives	Poor infrastructure
Glamour of city life	Penetration of market economy

Urban comforts	Family feud
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Source: Sundaravaradarajan *et al*, 2011

Singh *et al* (2011) has estimated the impact of migration on the family welfare in Bihar and UP and found that observed that there has been improvement in the education of children, food consumption, overall happiness and health in most of the migrant families. The destination areas of migration are also positively impacted because of availability of more labour at cheaper rate. But it has impacted only agriculture sector negatively.

6.4. Linkage between MGNREGA and labour shortage:

MGNREGA coverage data shows that states like Uttar Pradesh, Madhya Pradesh, Rajasthan, Tamil Nadu etc which have lost maximum labour from agriculture reported the highest employment under MGNREGA indicating a positive linkage between MGNREGA and the issue of labour shortage (Table 2).

Table 2. number of household provided employment under MGNREGA- Million

Number of Households Provided Employment under MGNREGA- Mn					
	2007-08	2009-10	2011-12	2012-12	Average (2008-13)
Andhra Pradesh	4.8	6.2	4.9	5.3	5.0
Uttar Pradesh	4.1	5.5	7.3	4.4	4.9
Rajasthan	2.2	6.5	4.5	4.0	4.4
West Bengal	3.8	3.5	5.4	4.7	4.1
Madhya Pradesh	4.3	4.7	3.7	2.5	4.0
Tamil Nadu	1.2	4.4	6.3	6.5	3.9
Bihar	3.9	4.1	1.7	1.5	3.1
Karnataka	0.5	3.5	1.7	0.8	1.5
Kerala	0.2	1.0	1.4	1.6	0.9
Gujarat	0.3	1.6	0.8	0.6	0.8
Maharashtra	0.5	0.5	1.4	1.3	0.8
Punjab	0.0	0.3	0.2	0.2	0.2
Haryana	0.1	0.2	0.3	0.2	0.2
Total	33.9	52.5	49.9	41.6	42.7

Source: FICCI report, 2015

Vanitha & Murthy (2011) has estimated the participation of labour in agricultural activities before and after the implementation of MGNREGA in Mysore district of Karnataka and found the significant decreased participation after MGNREGA implementation.

Table 3. labour supply to agricultural work in Mysore district of Karnataka

Season	Before MGNREGA	After MGNREGA	Decreased participation
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Kharif	80.39	66.27	14.12 (17.55)
Rabi and summer	64.12	30.39	33.73 (52.60)
Total	122.83	82.17	40.67 (33.11)

(Note: No. of person days, Figures within parentheses indicate the percentage decline)

Source: Vanitha & Murthy, 2011

The decline in labour supply for agriculture is higher in rabi and summer seasons (52.6%) than in kharif (17.55%), as most of the MGNREGS works are executed during the period from September to May (Table 3).

7. Impact of labour scarcity:

7.1. Changes in cropping pattern: Prabakar *et al* (2011) has estimated the probability of retention of different crops in Cuddalore district of Tamil Nadu for determination of the probable changes in cropping pattern. The probability of retaining paddy, the principal food crop, is only 37%, of sugarcane 46% whereas the probability of retaining cashew is 75% and of coconut is 67%. So cropping pattern can be seen clearly towards the tree crops which are less labour requiring. If this trend continues then of the total cropped area, around 32% will be under cashew and 21% under coconut — the tree crops and sugarcane and paddy will occupy 18% and 14%, respectively.

7.2. Differences in the Productivity Levels of Labour-Scarcity Affected and Unaffected Farms: The same study stated above has also observed a significant difference in the average productivity between the labour-scarcity-affected and unaffected farms. The productivity difference was more pronounced in cotton (14.5%) and paddy (11.8%) crops (Table 4).

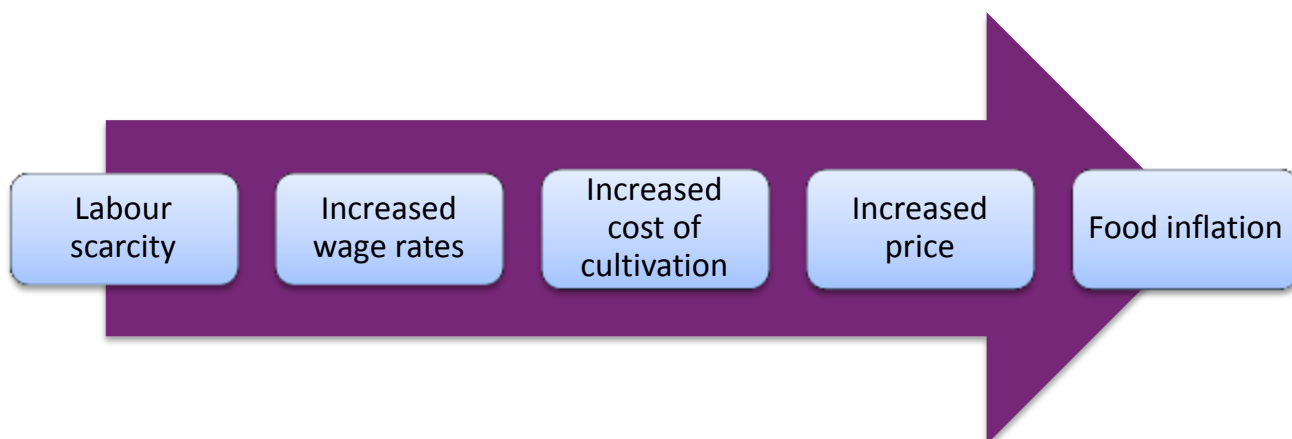
Table 4. Productivity levels of labour-scarcity-affected and unaffected farms in Cuddalore district of Tamil Nadu

Crop	Productivity		Productivity difference (kg/ha)
	Labour-scarcity unaffected farms(kg/ha)	Labour-scarcity affected farms(kg/ha)	
Paddy	5,090	4,487	603 (11.8)
Sugarcane	1,53,292	1,44,165	9,127 (6.0)
Groundnut	3,767	3,592	175 (4.6)
Pulses	850	780	70 (8.2)
Cotton	1,410	1,205	205 (14.5)

(Note: Figures within the parentheses represent the difference in per cent values with reference to unaffected farms.)

Source: Prabakar *et al*, 2011

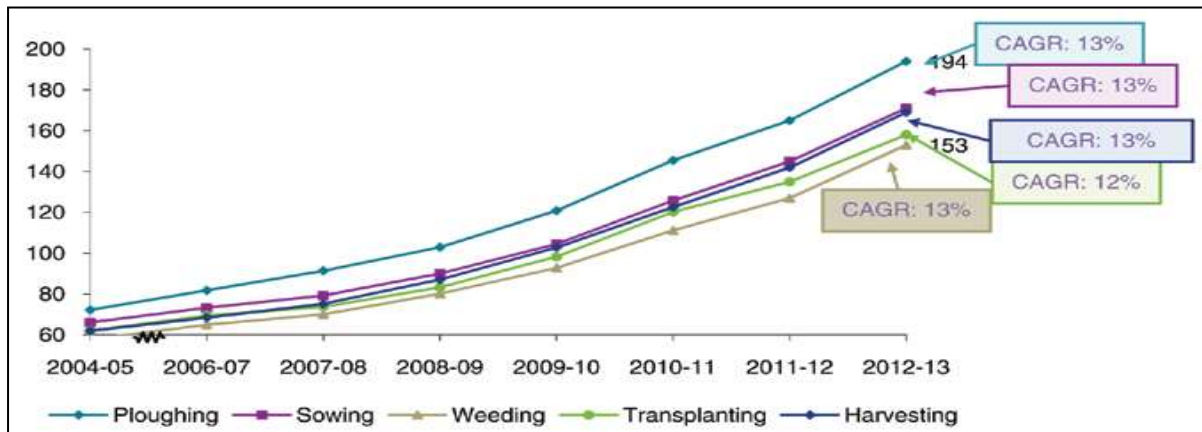
8. Consequences of labour scarcity:



Labour scarcity along with other factors like growth in GDP, MGNREGA have caused increased wage rates thereby increased cost of cultivation which is directly reflected in higher output prices and therefore resulting in food inflation.

8.1. Steep Rise in Agricultural Wages since 2006-07: Wages for almost all the agricultural operations have increased significantly since 2006-07 at a growth rate of around 12-13% (Figure 11).

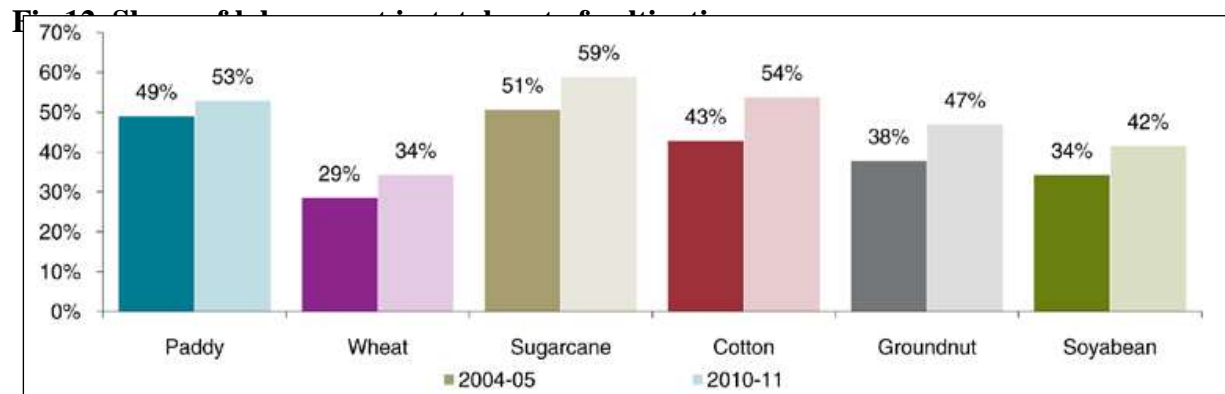
Fig 11. Wages for agricultural operations



Source: FICCI report, 2015

8.2 Rising Share of Labour Cost in Overall Cost of Cultivation:

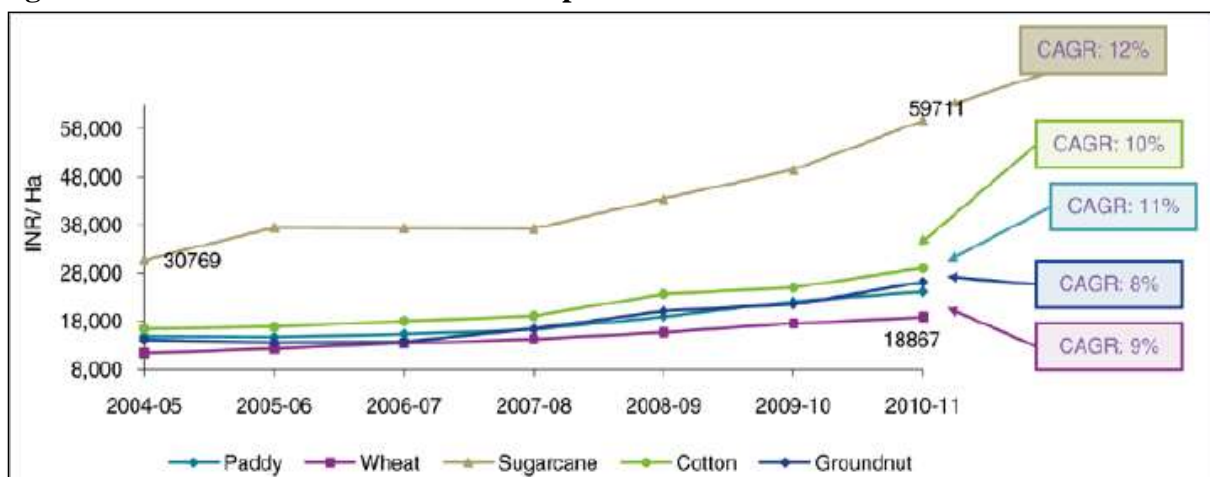
Because of higher wages the share of labour cost in overall cost of cultivation has also increased from 2004-05 for all the crops (Fig 12).



Source: FICCI report, 2015

8.3 Increased Cost of Cultivation and Resulting Food Inflation: As a consequence of wage rate escalation, cost of cultivation has risen significantly in the last few years. This trend is witnessed across all major crops, especially the ones which are labour intensive (Figure 13).

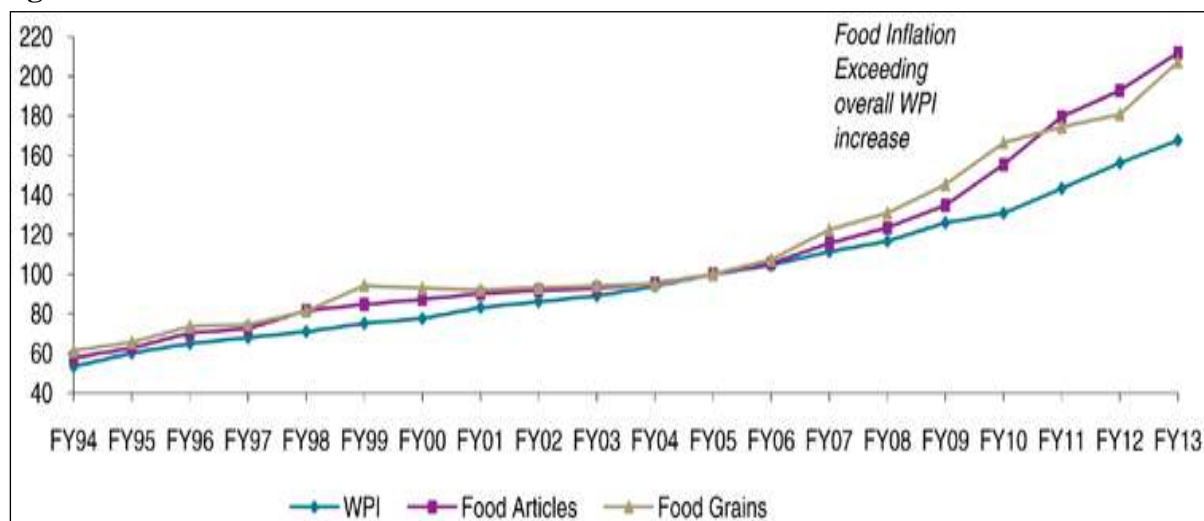
Fig 13. Cost of cultivation of different crops



Source: FICCI report, 2015

The cost of cultivation of these crops has been growing at over 10% each year. The higher cost is passed on by the farmer, which has partly resulted in increasing wholesale prices of principal food commodities like rice and wheat at ~10% as opposed to overall inflation of ~7% (Figure 14).

Fig 14. Wholesale Price Indices and Food Inflation



Source: FICCI report, 2015

9. Strategic Options for Labour Shortage:

The problem of labour scarcity in agriculture has repercussions across states and needs to be addressed in order to contain its impact on the overall sector and the nation. A two pronged approach with respect to input factors and output factors has to be considered:

9.1 Input factors:

- **Immediate effect:** Adopt techniques that can replace and/or reduce the requirement of human labour as follows:
 - a. **Mechanization of farms:** Mechanization of activities like sowing and harvesting can significantly reduce labour intensity.
 - b. **Promoting technology for seeds which reduce labour requirement:** For example seeds supporting direct sowing in rice which can save the labour required for transplanting.
 - c. **Increasing use of herbicides:** Use of herbicides can cut down on the labour required for weeding fields substantially.
- **Long Term Effect:** Increase returns from agriculture and arrest the migration of workforce from agriculture to other sectors by adopting improved seed technology, improved cultivation practices like SRI etc.

9.2 Output factors

- Better farm to the Agri-business linkages so that no. Of intermediaries can be reduced thereby causing better price realization by the farmer which will improve their bargaining power and agriculture viability can be increased.
 - a. **Contract Farming:** The buyer and farmer form an agreement with conditions on quantity, quality, delivery schedule in lieu of pre determined price and production support.
 - b. **Agricultural Cooperatives:** The co-operative acts as an interface between the small farmers and buyers. It provides order taking, shipment and logistics, billing, collection and remittance services for farmers.

- c. **Farmer Equity Model:** A model of producers company where producers will directly invest their equity funds into the company.

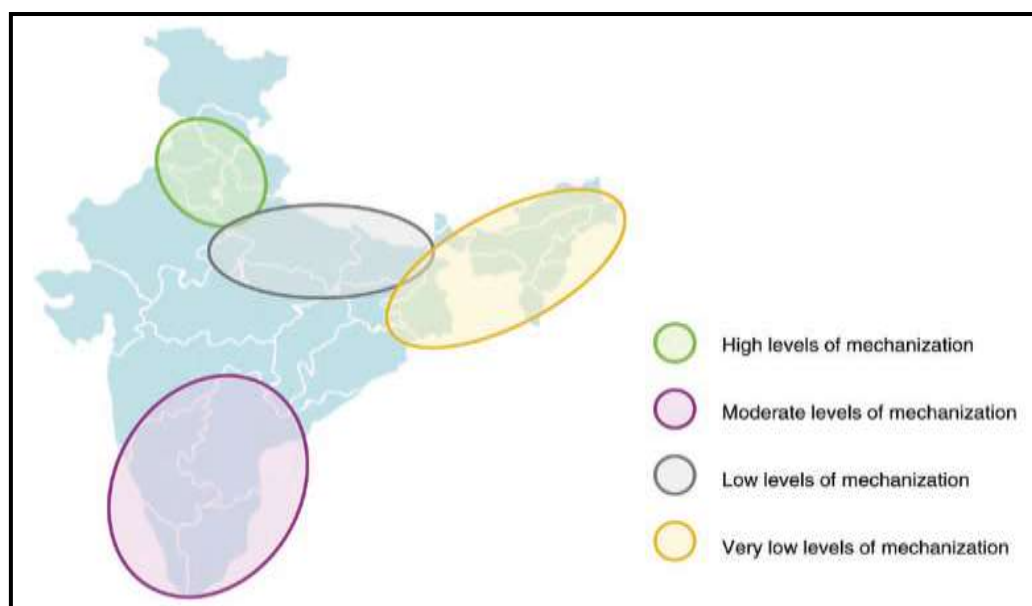
Among all these solutions, **farm mechanization** can be the best as it will not only solve labour scarcity and its other associated problems but will also improve agricultural productivity and efficiency.

10. Mechanization in India: mechanization in India is lower than developed countries and lowest among BRICS nations.

11.1 Levels of mechanization: We can categorise the level of mechanization in India into 4 levels as follows:

- ❖ High level of mechanization: Punjab, Haryana and western UP: farm mechanization is concentrated which increases their productivity.
- ❖ Moderate level of mechanization: Farm mechanization in south India has increased considerably but still has a long way to go before adapting to a higher level.
- ❖ Low level of mechanization: Uttar Pradesh and Bihar are the future potential states which have started using farm implements with support extended by the Government.
- ❖ Very low level of mechanization: West Bengal, Orissa and the North eastern states are in the process of adopting farm mechanization (Figure 15).

Fig 15. Different levels of mechanization in India



Source: FICCI report, 2015

11.2 Extent of mechanization by farm operations in India:

Overall mechanization by farm operations in India is only 40-50% (Table 5).

Table 5. operation wise farm mechanization in India

Operation	Extent of mechanization in India
Soil working and seed bed preparation	40%
Seeding and planting	29%

Plant protection	34%
Irrigation	37%
Harvesting and threshsing	60-70% for wheat and rice and <5% for others
Overall	40-45%

Source: Presentation on farm mechanization before Parliamentary consultative committee (Jan,2013),DAC

11.3 Crop-wise farm mechninery use:

Reddy *et al.* (2014) has estimated crop-wise farm machinery use for TE 2010. Machine labour (Rs/ha) is used as a proxy for farm mechanization. Highest machine labour use was found in wheat followed by sugarcane and paddy. While the growth rate of machine labour used was highest in maize followed by chickpea and cotton (Table 6).

Table 6. Crop-wise use of machine labour in TE 2010

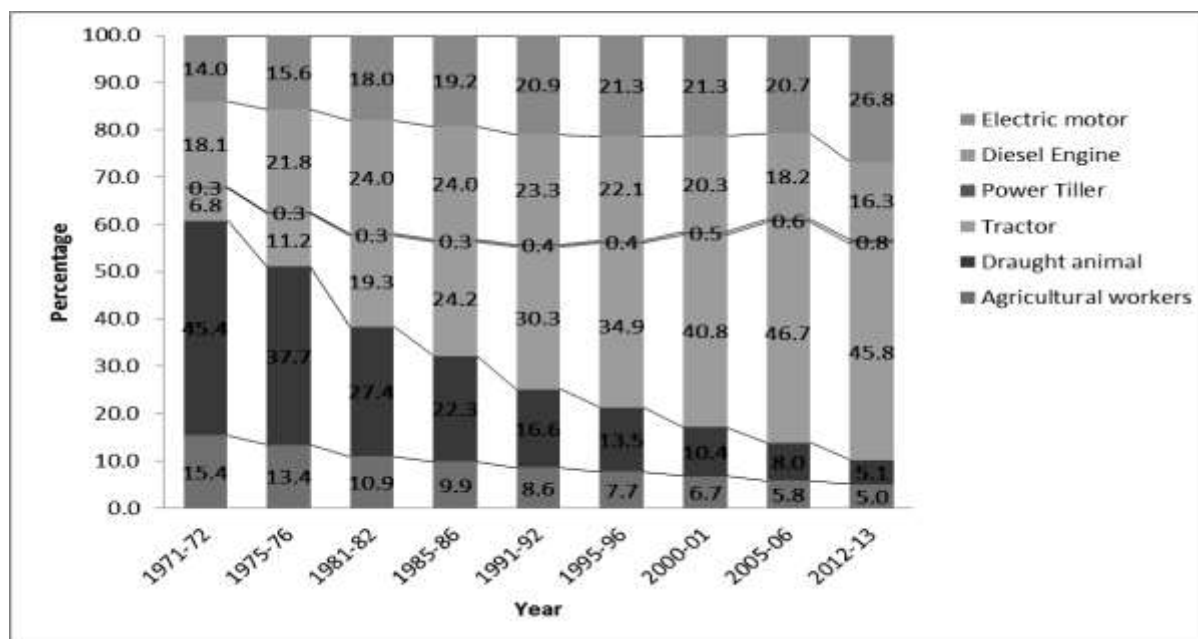
Crop	Machine labour TE 2010 (Rs./ha)
Maize	1610 (7.42)
Chickpea	1986 (5.41)
Cotton	2051 (4.84)
Paddy	2200 (4.22)
Wheat	3840 (3.98)
Sugarcane	2386 (1.04)

(Note: Figures in parentheses are CAGR (per cent) machine labour from 1997 to 2010)

Source: Reddy *et al.*, 2014

11.4 Use of power sources in Indian Agriculture: Agricultural workers, draught animals, tractors, power tillers, diesel engines and electric motors are used as sources of farm power in Indian agriculture. The percentage share of agricultural workers and draught animal power sources in total power reduced from 15.4 to 5.0 % and 45.4 to 5.1 %, respectively over the years from 1971-72 to 2012-13. On the other hand, the share of tractor and electric motor in farm power availability increased from 6.8 to 45.8 % and 14 to 26.8 %, respectively during the same period. The share of tractor power was maximum and increased by 39 % (Fig 16). **The total power availability on Indian farms has increased at a CAGR of 4.58% from 0.293 to 1.841 kW/ha during the same period.**

Fig 16. Trend in use of power sources in Indian agriculture

Source: Mehta *et al*, 2014

11.5 Status of farm mechanization in India:

The Indian agricultural equipment market is experiencing a rapid growth with expected strong potential for future growth as well. The tractor market in India is estimated at 600,000 units annually by sales which have grown at a CAGR of 11.4% since 2006. Tractor density (tractors per thousand hectare of net sown area) is 33 in India and it is highest for Haryana (84) followed by Punjab (76) and Uttar Pradesh (51). The combine harvesters market in India is estimated at 4,000-5,000 units annually by sales which have grown at a CAGR of 28 % since 2006. In case of market growth per annum, the highest growth of 50% was for rice transplanter (Table 7).

Table 7. Market overview of the major farm machinery used in India

Name of machinery	Market size annually (units)	CAGR from 2006 to 2012-13
Tractor	600,000	11.4%
Power tiller	56,000	13.4%
Combine harvester	4,000-5,000	28%
Thresher	100,000	10%
Rotavator	60,000-80,000	20%
Rice transplanter	1,500-1,600	50%
Self-propelled vertical conveyor reaper	4,000-5,000	
Zero till seed drill	25,000-30,000	
Multi-crop planter	1,000-2,000	
Laser land leveller	3,000-4,000	
Power weeder	25,000	

Source: Mehta *et al*, 2014

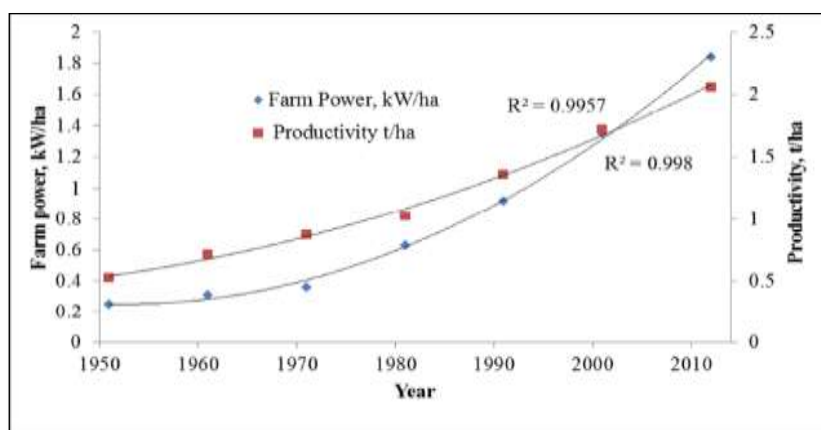
11. Estimated contributions from farm mechanization:

Besides reducing the labour requirement farm mechanization helps in saving of seeds, fertilizers, time, increase in cropping intensity and therefore resulting in overall increase in farm productivity as follows.

Savings in seed	15-20%
Savings in fertilizers	15-20%
Increase in cropping intensity	5-20%
Savings in time	20-30%
Reduction in manual labour	20-30%
Overall increase in farm productivity	10-15%

Mehta *et al* (2014) has also found the positive correlation of agricultural productivity with the level of farm mechanization (Figure 17).

Fig 17. Positive correlation between farm power and productivity



Source: Mehta *et al*, 2014

14. Schemes for promoting agricultural mechanization (by Dept. Of Agricultural and Cooperation):

- ❖ **Outsourcing of training and demonstrations of newly developed equipments:** Through this scheme, State Governments organize demonstration of improved/newly developed agricultural/horticultural equipment as identified by them at farmers' fields. In the year 2012-13, an outlay of Rs. 12.08 crores has been made. Out of total outlay, Rs. 4.00 crores is earmarked for North Eastern States.
- ❖ **Macro management of agriculture (MMA):** under this a level of 25-50% subsidy on procurement cost is made available on the models approved by the department under

institutional financing. Self Help Group of farmers (SHGs), user groups, cooperative societies of farmers etc are also made eligible for assistance under the programme.

- ❖ **The Farm Machinery Training & Testing Institutes (FMTTIs)** located at Budni (Madhya Pradesh), Hissar (Haryana), Garladinne (Andhra Pradesh), and Biswanath Chariali (Assam), have been imparting training to farmers, technicians, retired/ retiring defence personnel etc., in the selection, operation, maintenance, energy conservation and management of agricultural equipments. During the year 2011-12, 6422 persons were trained till 31st March, 2012 against the annual target of 6000 in different courses.
- ❖ **Promotion and Strengthening of Agricultural Mechanization through Training, Testing and Demonstration:** implemented during the Eleventh Plan. It conduct of demonstration of improved/newly developed agricultural/ horticultural equipment, identified by the State Governments/Government Organizations at farmers' fields. During the year 2012-13, the number of demonstrations conducted by the State governments was 16022.
- ❖ **State agro – industries corporations:** act as catalysts in providing access to industrial inputs to farmers. Thus, 17 SAICs were set up in the joint sector with equity participation of the Government of India during 1965 to 1970.
- ❖ **Gender friendly equipment for women:** Under the Central Sector Scheme – Promotion and Strengthening of Agricultural Mechanization through Training, Testing, and Demonstration, and under the scheme for Outsourcing of Training and Demonstration of Newly Developed Agricultural Equipment at Farmers' Fields, separate physical targets have been fixed and 10 per cent of the funds have been allocated for women farmers. A list of about 30 identified gender friendly tools and equipment developed by the Research and Development Organization has been sent to all states and UTs.
- ❖ **Sub mission on agricultural mechanization:** it is an integrated scheme which was initiated in 12th 5Y plan and aiming at inclusive growth of farm mechanization. It has following objectives:
 - ✓ Increasing the reach of farm mechanization to small and marginal farmers and to the regions where availability of farm power is lower.
 - ✓ Offsetting adverse economies of scale and higher cost of ownership of high value farm equipments by promoting cooperative based 'Custom Hiring Centres' for agricultural Machinery.
 - ✓ Passing on the benefit of hi-tech, high value and hi-productive agricultural machinery to farmers through creating hubs for such farm equipments;
 - ✓ Promoting farm mechanization by creating awareness among stakeholders through demonstration and capacity building activities;
 - ✓ Ensuring quality control of newly developed agricultural machinery through performance evaluation and certification at designated testing centres located all over the country.

15. Increasing the efficiency of mechanization: India is having a very diverse kind of situation in crop as well as in landholding pattern. Therefore for increasing the efficiency of

mechanization either we have to improve the suitability of crop for mechanization or we have to improve the suitability of machines by indigenization.

- ❖ **Improving the architecture and suitability of crops through Seed Technology:** For example: high yielding medium maturing Narma variety HS 6 in cotton. Being synchronous in flowering and boll opening, less number of pickings are needed. This makes it suitable for mechanized picking.
- ❖ **Improving the suitability of equipment being used through indigenization:** for example: Mahindra came up with a modern multi-utility tractor called the Shaan with a 23.5 HP engine and a 750 kg payload trolley and can be used for a range of activities. With a top speed of 40 kmph and a 23.5 HP engine, the Shaan is especially suited to small and medium sized farms. In 2007, the Shaan was recognized by the American Society for Agricultural & Biological Engineers Award as one of the 50 Outstanding Innovations of the Year.

16. The way forward: some initiatives from both central and state government side are required for maintaining the viability of agriculture.

✓ **State government initiative:**

Free up land lease market: under this some tenancy reforms for removing the constraint of smaller landholdings are suggested as follows:

- Prolonging the lease period to 10-15 years and removing any ceiling on size of lease.
- It will help to farmers and private sector companies to aggregate agricultural land and invest in farm technology, drip irrigation and best practices.

✓ **Central government initiative:**

MGNREGA reforms:

1. Recommendations for Gram Panchayats:
 - The introduction of seasonal calendars. It will lead to implementation of activities relevant to increasing agricultural productivity and also it will avoid the overlapping of MGNREGA works with the peak agriculture season.
2. Recommendations on modifying current structure of MGNREGA to improve convergence with Agriculture:
 - Inclusion of some agricultural activities (such as weeding, irrigating , sowing and cutting for harvesting) into the MGNREGA shelf of works.
 - It will ease some of the pressure on the farmers due to increasing wage rates and at the same time provide employment to the landless labourers.
 - large farmers can pay a percentage of the wages paid to the labourers for work done on agricultural activities.

17. Summary and conclusion: The traditional belief of surplus agricultural labour, zero marginal productivity and opportunity cost of labour does not seems valid today. There has been a net reduction of 30.57 million agricultural labour from 2004-05 to 2011-12. Reasons for the labour scarcity are lesser remuneration in agricultural Sector, shifting to a permanent job in

the non-farm sector, migration and MGNREGA. Impact can be seen in terms of changing cropping pattern, reduction in crop yield and cropping intensity, higher wages and higher cost of cultivation which is reflected in higher output prices thereby causing food inflation. So adequate measures to reduce labour requirement need to be taken up, otherwise productivity of farms may get affected and this may have spiraling effects on output prices. In this context, farm mechanization is the need of the hour. But in India some constraints are there against mechanization like higher cost, lack of skill and smaller landholdings. Government has initiated several schemes for combating the higher cost and lack of skill problem. If required measures are taken by the government like MGNREGA reforms, freeing up land lease market then increased farm mechanization is the best among all the possible solutions and its positive effect on agricultural productivity, efficiency and viability will be clearly realised.

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