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LABOUR IN INDIAN AGRICULTURE:
A GROWING CHALLENGE





Contents

Foreword pg4

pg7 Executive Summary

Introduction pg9

pg11 Agricultural Workforce: An Overview

Explaining the Shift Away from Agriculture pg19

pg33 Strategic Options to Address Labour Shortage

Way Forward pg51

pg58 Conclusion

Annexure pg60

Foreword



The agricultural division in FICCI has been undertaking several field level studies and surveys to analyze the ground level concerns plaguing Indian agriculture. During interaction with the farmers the challenge of shortage in availability of agricultural labour came to the fore. Although several anecdotal evidences were available, we from FICCI decided to analyze the magnitude of the challenge and subsequently commissioned a research study to KPMG.

We have now come up with a comprehensive report based on published secondary data. Employment data generated from National Sample Survey Organization's (NSSO) Rounds on employment and unemployment shows that the percentage of people employed in agriculture has been consistently declining, from around 60% in 1999-00 to 49% in 2011-12. In absolute terms, between 2004-05 and 2011-12, there has been a net reduction of 30.57 million of labour from the agricultural sector.

This reduction in supply along with the support by a number of Government schemes, including MGNREGA has led to an escalation in farm wages which is adversely impacting the profitability of the farmer. Rural wages have been growing by 17% on average since 2006-07 outstripping urban wages. At the same time, the increase in wages, without an increase in productivity, is fuelling inflation.

This reduction needs to be compensated by adequate measures to reduce the overall labour intensity of the sector. Improved seed varieties, widespread extension services and farm mechanization remain three critical areas of intervention and focus.

The study shows that close to 79% of this reduction has been contributed by the five states - Uttar Pradesh, Karnataka, West Bengal, Bihar and Rajasthan.

The impact is more pronounced in case of certain crops which are labour intensive and are also widely grown in the country. A combination of these two factors highlights that Paddy, Wheat, Cotton Sugarcane and Groundnut are among the most likely crops to be affected by labour scarcity.

I am sure the book will be of interest to policy makers, industry players as well as the academia.



Dr. A Didar Singh
Secretary General
Federation of Indian Chambers of
Commerce & Industry (FICCI)

Foreword



As a country becomes affluent, the workforce tends to move away from low productivity agriculture sector to other high productivity sectors. In India a similar trend has been observed over the last decade with the share of workforce as well as the number of people employed in agriculture sector have reduced. This has led to a need to reorient our strategies to meet the needs of the farmers as well as to rejuvenate the sector.

The report aims to understand the impact of the shifting labour pattern and suggests ways to overcome the same. A two pronged approach, tackling both the input and output factors, is required that reduces the need for human labour, increases returns from agriculture and improves farm to retail linkages.

Indian Agriculture Labour Shortage – A growing problem, a study jointly prepared by KPMG in India and FICCI, provides a perspective on the shortage of labour in Indian agriculture which may act as a road map to changes in the agriculture landscape. We hope that you find this study insightful.

Rajat Wahi
Partner KPMG
Management Consulting Head
Consumer, Retail and Agri Sector



Executive Summary

The importance of agriculture in the context of the Indian economy is paramount. Not only is it a pivotal component in achieving several of India's goals- attaining food security, an 8% GDP growth rate and enhancing rural income but it is also the sector with highest share of workers in the country. The average growth rate in the agriculture sector in the last five years has been 4.1%.

It is an established trend that as an economy matures, there is a movement of agricultural workers from low productivity agriculture to higher productivity sectors. However in India, the trend has not been limited to just declining share of agriculture in total employment but also has led to a significant decline in absolute number of people employed in the agricultural sector. A comparison across two time periods, 2004-05 and 2011-12, indicates that while there was an increase in the size of the total workforce in the country, the size of the agricultural workforce reduced by 30.57 million people. The share of agricultural workforce in total workforce declined from 56.7% to 48.8% in the same 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.

Factors such as higher remuneration and growth of opportunities in alternate sectors coupled with the relatively lower rise in wages in agricultural occupations as compared to other sectors have led to the migration of workforce away from agriculture which has resulted in labour shortage and consequent escalation of cost of cultivation. Furthermore, government schemes like MGNREGA which have facilitated migration of labour to other segments need to be reformed.

Adequate measures are required to reduce labour requirement to avoid productivity from getting affected, which can have a detrimental effect on the eventual output and price. Other nations facing this issue have responded by widespread use of technology on farms to replace many traditional farming occupations. The factors to be considered by key stakeholders such as farmers, industry and government to reduce agriculture labour requirement are:

Input factors

- **Immediate Effect**: Adopt productivity enhancing techniques such as enhanced extension services, mechanization, promoting use of labour reducing seed technology and use of herbicides
- **Long Term Effect**: Increase returns from agriculture through research driven improvements in seed technology, intensive farming technique and sequential cropping technique

Output factors

- Strengthening linkages to agri-businesses through contract farming, agriculture cooperatives and farmer equity model

The state governments and the central government can undertake a number of initiatives to make agriculture more productive and remunerative. Freeing up the land lease market, encouraging the adoption of custom hiring and facilitating private trade through provisions in the APMC Reform, retargeting of MNREGA. and increasing investment in agricultural investments though greater coordination between various stakeholders will go a long way in this regard.

LABOUR IN INDIAN AGRICULTURE: A GROWING CHALLENGE



INTRODUCTION

Agriculture and Its Importance in the Indian Economy

The importance of agriculture can never be over-stated. Although the share of agriculture in India's GDP has been declining, yet agriculture and its allied sectors like forestry and fishing (but not including mining and quarrying) contributes nearly 14% to India's GDP, accounts for about 11% of our exports, and supports half of our population's livelihood, besides also being the source of raw material for a large number of industries.

Accelerating to a higher agriculture growth rate is critical for a variety of reasons – attaining food security, achieving an overall 8% growth rate in GDP as envisaged in the 12th Five year plan and enhancing rural income, which presently is abysmally low.

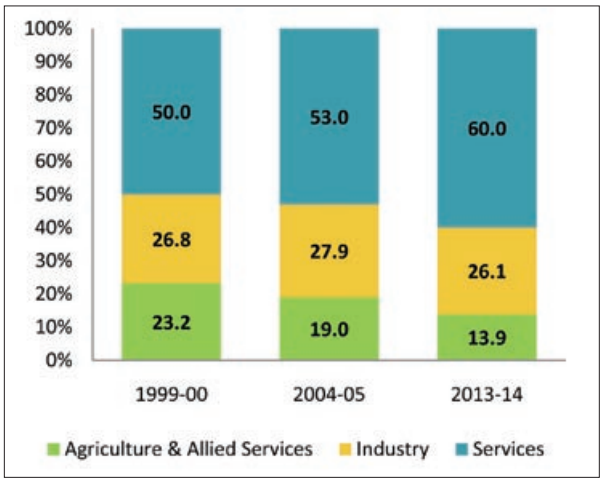
Irrespective of the relative contribution, the average growth rate in the agriculture sector in the last five years till 2013-14 (taking into account the advance estimates for 2013-14) has been 4.1%. The Twelfth Five Year Plan also envisages a similar growth rate.

Indian agriculture has marked its presence at the global level. India is world's largest producer of milk, pulses and second largest producer of rice, wheat, fruits, vegetables, sugarcane. India's food grain production crossed 250 million tonnes during the year 2011-12. Rice production crossed 100 million tonnes and wheat production crossed 90 million tonnes.

As of 2011,India's arable land area of 159.7 million hectares (394.6 million acres) is the second largest in the world, after the United States. Its gross irrigated crop area of 82.6 million hectares (215.6 million acres) is the largest in the world.

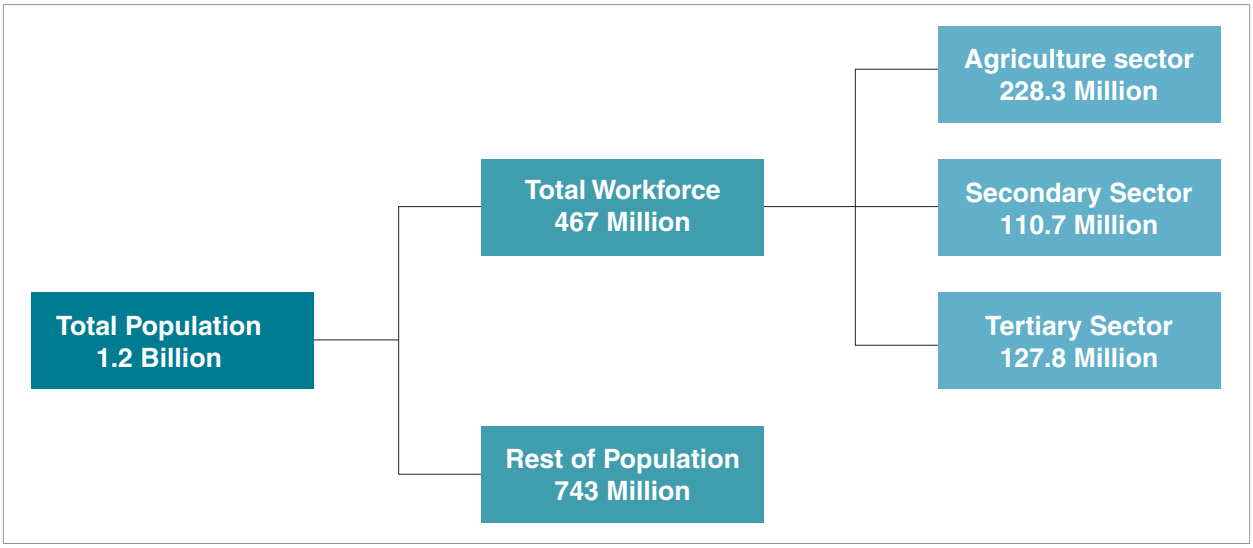
Despite its declining relative share in GDP, several innovative steps and measures are being undertaken and the sector has done reasonably in the last few years. However, one of the major bottlenecks that has emerged and can become an insurmountable problem in the foreseeable future is the issue of shortage of agricultural labour.

Share of GDP at constant (2004-05) prices



Source: Planning Commission, FICCI Research

Total workforce vs. Agricultural Workforce (2011-12)



Agriculture provides employment to not only the adult males of a households but also to women on the households . Women work extensively in production of major grains and millets, in land preparation, seed selection and seedling production, sowing, applying manure, weeding, transplanting, threshing, winnowing and harvesting.

Agriculture plays a significant role in overall socio-economic development. Therefore, fostering rapid, sustained and broad-based growth in agriculture remains key priority for the country. With the decreasing labour force in agriculture, increasing yield or productivity is the key to growth, which has to be accelerated. Shortage of labour and finding solutions thereof should become a major focus. India's crop yields are yet only 30% to 60% of the best crop yields achievable in the farms of developed as well as other developing countries. Improved seed varieties, widespread extension services and farm mechanization remain three critical areas of intervention and focus.



Chapter 1



Agricultural Workforce: An Overview

Agricultural Workforce: An Overview

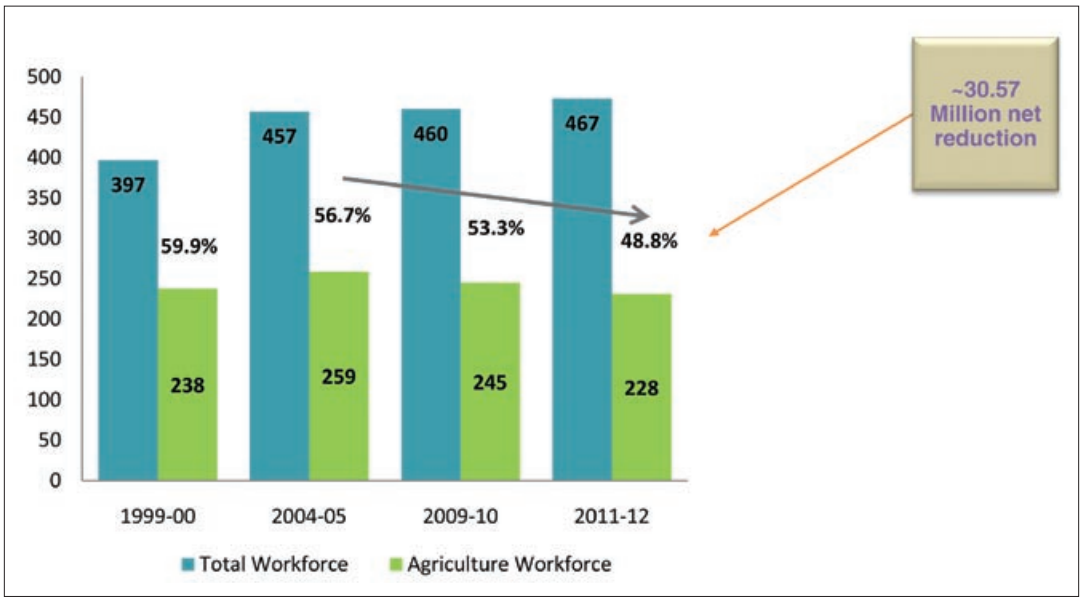
Employment data is generated from the National Sample Survey Organization's (NSSO) Rounds on employment and unemployment. Data used pertains to the 55th Round (1999-2000), 61st Round (2004-05), 66th Round (2009-10), and the 68th Round (2011-12).

Data shows that India's overall employment growth since 2004-05 has been anemic. At an average, only around 2 million people were added to the workforce since 2004-05 compared to around 12 million people that were added to the workforce every year as an average between 1999-00 and 2004-05.

However, the addition to non-agricultural employment has actually been around 6 million people every year since 2004-05, as the workforce employed in agriculture had started declining in absolute numbers and consistently so, since then. The size of the workforce in agriculture declined by around 30.57 million between 2004-05 and 2011-12, although the size of the total workforce increased. This is the first such period when a reduction in absolute numbers has been reported in agriculture.

It has been observed that over time that as economies progress and move towards development, workforce tends to move away from primary sectors of the economy. Consistent with this empirical evidence observed worldwide, even in India, the percentage of people employed in agriculture has been consistently declining, from around 60% in 1999-00 to 49% in 2011-12.

People Employed in Agriculture and Overall Employment



Source: NSSO, FICCI Research

Usually, as an economy matures, there is a movement of excess agricultural workers from low productivity agriculture to higher productivity sectors like manufacturing and services, and thus from rural to urban areas, and form lower wages to higher wages. The pace of this movement accelerates with higher economic growth, which gives rise to greater job opportunities in the non-agricultural sectors. Goldman Sachs (2014) calculated that labour is 4 times more productive in industry and 6 times more productive in services compared to agriculture. Higher productivity usually implies higher wages. Thus the natural movement away from agriculture. Such shifts are also coupled with technological advancement of the primary sector leading to lower labour intensity and higher capital investment in several instances.

India has also been experiencing a similar trend in its workforce movement. But the trend has not been limited to just declining share of agriculture in total employment but also has led to a significant decline in absolute number of people employed in the agricultural sector. A comparison across two time periods, 2004-05 and 2011-12, indicates that while the size of the total workforce in the country increased by roughly around10 million, the size of the agricultural workforce reduced by 30.57 million people. In the process the share of agricultural workforce in total workforce declined from 56.7% to 48.8% in the same period (considering principal and subsidiary activities). It not only indicates that fewer people are being added to the workforce in agriculture but also highlights the net migration to other sectors.

Between 2001 and 2011, India added 181.5 million to its population, half of which was in the rural areas. With agriculture being the mainstay in rural areas, what it signified was that enough labour should be available for agriculture. Moreover, agriculture in India has been characterized by a high degree of disguised unemployment. In other words even if some amount of labour was taken out from agriculture there would be no difference to output and productivity. Both these put together would suggest that labour availability for agriculture should not be a problem. This has been the popular perception.

Moreover, yields, especially for food grains have been increasing in the last several years. As per data from the Ministry of Agriculture, Directorate of Economics and Statistics, the Compound Annual Growth Rate (CAGR) of food grains yield between 1999-2004 was 0.1% but increased to 2.5% between 2004-2009. Increase in yield, it is argued could not have been possible if there was a shortage in agricultural labour.

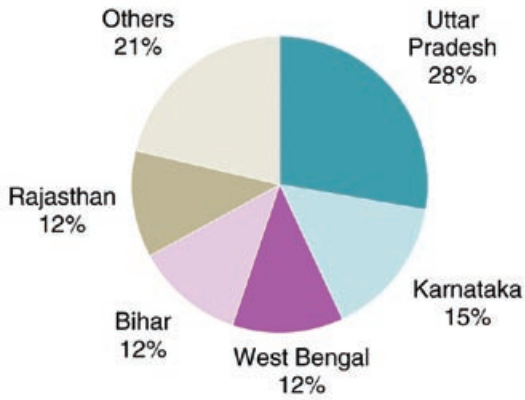
However in reality, the magnitude and pace of the shift away from agriculture has been substantial as has been evidenced here. It also has began to make an impact as the shortage in agricultural labour is currently not being compensated by adequate measures to reduce the overall labour intensity of the sector. As a result, the primary sector in many Indian states is experiencing severe labour shortage and escalation in farm wages which are adversely impacting the profitability of the farmer.

State Wise and Crop Wise effect of Agriculture Labour Availability

This reduction is a cumulative effect of similar reductions across all major states. 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%.



Contribution of States to Agriculture Labour Force Reduction: 2004-05 to 2011-12

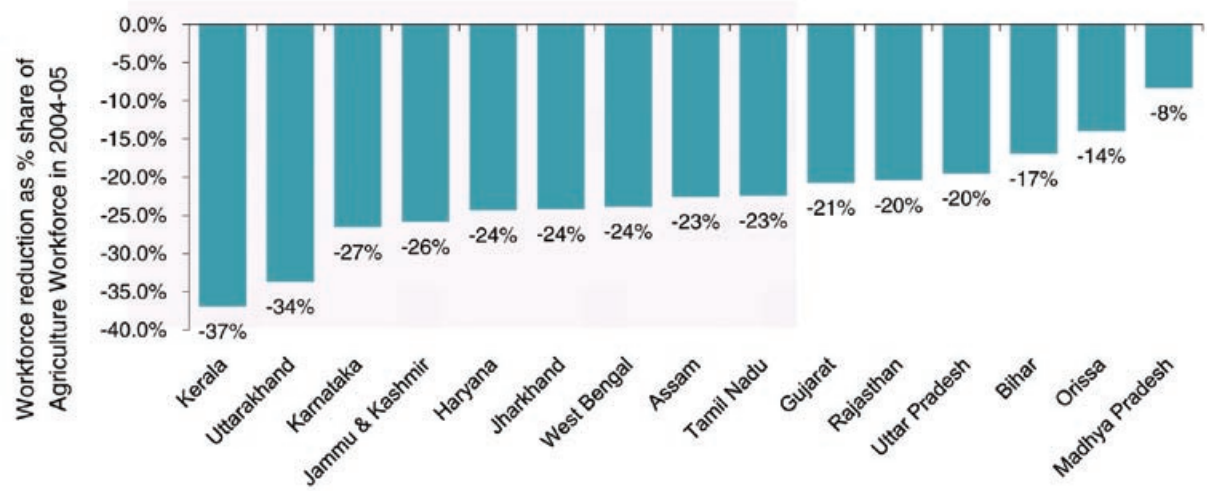


State	Agricultural labour (Million)		Reduction (Million)
	2004-05	2011-12	
Uttar Pradesh	43.30	34.83	8.47
Karnataka	17.60	12.91	4.69
West Bengal	15.50	11.79	3.71
Bihar	21.30	17.67	3.63
Rajasthan	17.40	13.83	3.56
Others	143.83	137.31	6.52
Total	**258.93**	**228.36**	**30.57**

Source: NSSO Reports 61st and 68th Rounds, Census of India, KPMG Analysis

An analysis across states (graph below) shows that for Kerala, Uttarakhand, Karnataka etc, even though the absolute magnitude of reduction is not large, it forms a substantial share of the agricultural workforce these states had in 2004-05. The analysis clearly highlights that between 2004-05 and 2011-12, a large percentage of the agricultural workforce across states moved away from agriculture.

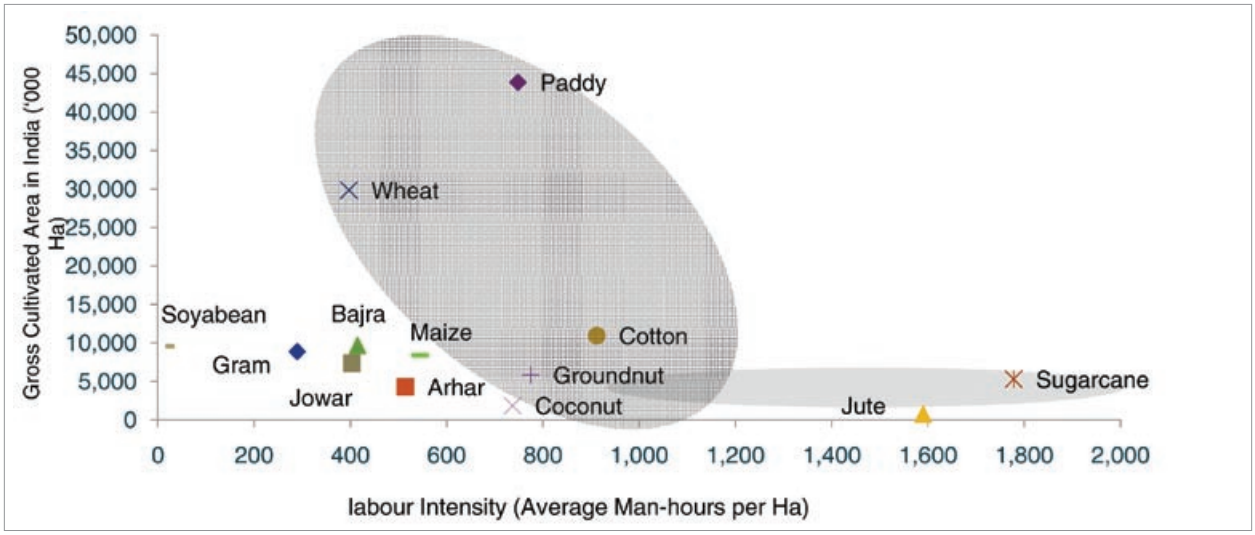
Change of Agricultural Workforce Between 2004-05 and 2011-12 (Base Year 2004-05)



Source: NSSO Reports, Census of India, KPMG Analysis

Labour Intensity Across Crops

Although labour scarcity affects the agriculture sector, the impact is more pronounced in case of certain crops which require significant amount of labour hours per unit area cultivated and are also widely grown in the country. A combination of these two factors (illustrated in the graph below) highlights that Paddy, Wheat, Cotton Sugarcane and Groundnut are among the most likely crops to be affected by labour scarcity.



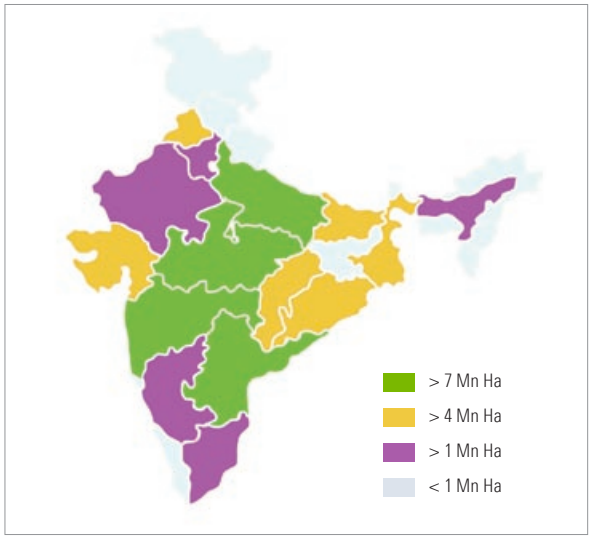
Source: Department of Agriculture and Co operation, KPMG Analysis
Note: Man hours for crops are an average across states, data pertains for 2011

The spread and coverage of the five key crops has been analyzed across states.

- Andhra Pradesh, Maharashtra, Madhya Pradesh and Uttar Pradesh have the highest area under cultivation of these five major crops, with a higher share of Paddy in all these cases. Maharashtra also has high cotton coverage while Andhra has both groundnut and cotton
- Bihar, Chhattisgarh, Gujarat, Orissa, Punjab and West Bengal fall in the next category. Of these states Punjab has a high coverage of wheat, while Gujarat has large coverage of cotton and groundnut

In these states labour shortage is likely to affect production and adequate steps are required to reduce the labour intensity associated with their cultivation.

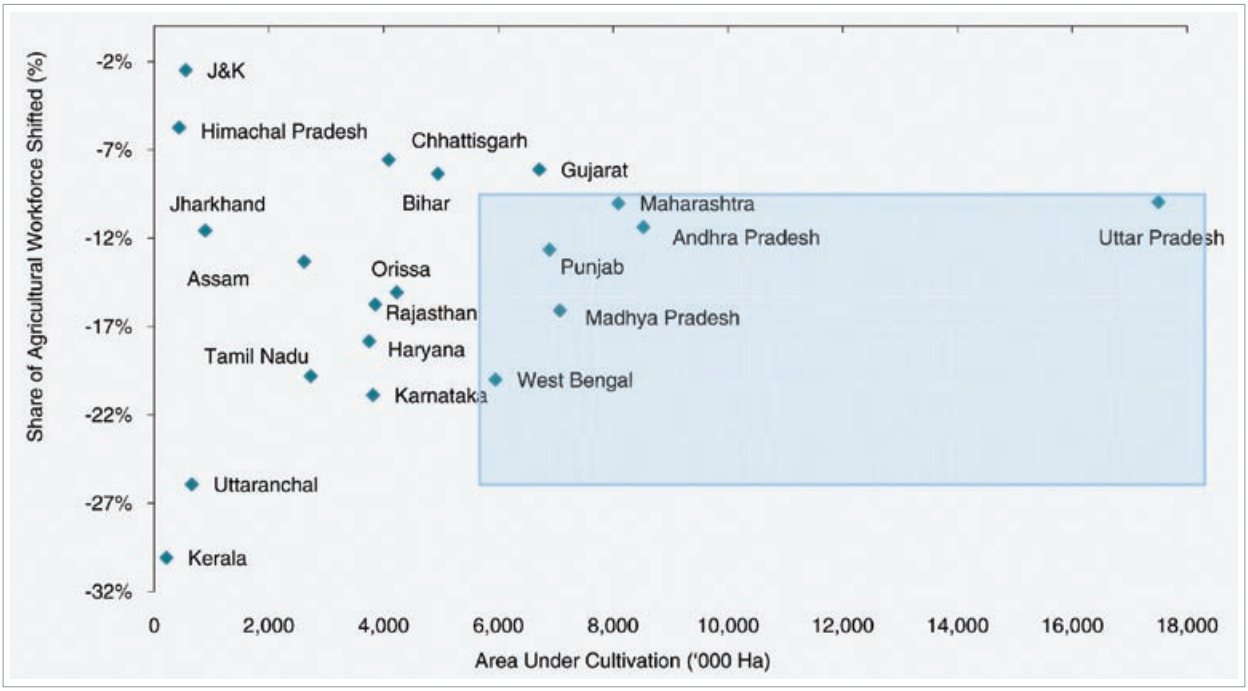
Total Area Under Paddy, Wheat, Groundnut, Cotton, Sugarcane



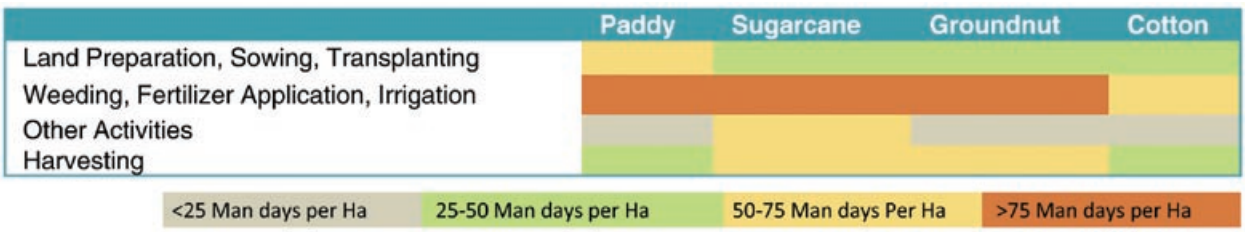
Source: Department of Agriculture and Cooperation, KPMG Analysis

In the graph below, the share of agricultural labour which shifted between 2004-05 and 2011-12 in various states was mapped with the area covered under agricultural crops like Paddy, Wheat, Sugarcane, Groundnut and Cotton. The map highlights Uttar Pradesh, Maharashtra, Andhra Pradesh, Punjab, Madhya Pradesh and West Bengal as states which have substantial coverage under labour intensive crops and have also faced a considerable decline in labour availability. These states have a high propensity to face labour challenges going ahead and requires immediate attention.

Coverage of labour Intensive Crops Vs Shift of labour from Agriculture



Average labour Requirement in Various Stages of the Crop Cycle



Source: Labour Scarcity – Its Immensity and Impact on Agriculture By C. Prabakar, K. Sita Devia and S. Selvamb

Various news reports and anecdotal evidences highlight the impact of labour shortage on some of these major crops across various states. For example, Andhra Pradesh which saw ~5% of its agricultural workforce in rural areas migrate to other sectors between 2004-05 and 2011-12 has reportedly witnessed significant labour shortage in rice cultivation. The state has over ~4.5 Mn Ha under rice and over ~1.5 Mn Ha under cotton and groundnut cultivation. Owing to the shortage in agriculture labour, farmers have adopted intensive rice farming and mechanization. The following news reports highlight the same.

Labour Shortage Affecting Rice Production in West Godavari, Andhra Pradesh

The West Godavari district has 0.25 Mn Ha under paddy which is the principal crop grown in the district along with some other cash crops and horticultural crops like oil palm, mango, sugarcane, tobacco and chili. The district had been facing the problem of labour shortage and the administration responded to this crisis by promoting mechanization to reduce the labour requirement.

The district administration took assistance from the National Bank for Agriculture and Rural Development (NABARD) to distribute power tillers, combined harvesters, transplanters and other implements to farmers with subsidy under a special scheme aimed at promoting mechanization in the district. The use of these machines are expected to reduce labour requirement significantly and provide much-needed support to farmers troubled by shortage of farmhands.

The Andhra Pradesh government in its 2013-14 budget allocated INR 2,500 Crores towards farm mechanization in the state.

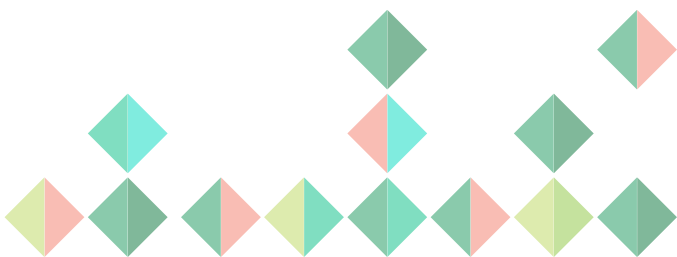
Source: The Hindu – December 2011

Similar experiences have impacted other labour intensive crops also. In Gujarat, for example, due to lack of labour to harvest sugarcane, a number of farms had to destroy their produce in 2011.

Labour Shortage Affecting Sugarcane Harvest in Gujarat

Close to 0.14 Mn tonnes of standing crops of sugarcane in Surat district of Gujarat were destroyed by farmers for lack of field hands to harvest it. Sugarcane harvesting, which requires special skills, is traditionally carried out by farm-hands who migrate from neighboring Maharashtra's Dhulia and Jalgaon regions each year to south and central Gujarat. Owing to the shortage of this migrant labour, many farmers either used tractors or set afire the crop to clear the fields for fresh sowing and to avoid rotting of standing crops. Both farmers and factories had to bear huge losses as a consequence.

Source: Indian Express – June 2011





Chapter 2



Explaining the Shift Away from Agriculture

The Pull and Push factors affecting Employment in Indian Agriculture

As an economy matures, there is a natural movement of excess workers from low productivity agriculture to higher productivity manufacturing and services, where both productivity and therefore wages are relatively higher. This rural urban shift and away from agriculture steadily gathers pace as the economy develops. Elabourating this phenomenon in greater details is crucial, as it is also supplemented by a wide variety of factors.

There are two critical factors that affect the movement of labour away from the agriculture sector. The first is the “Pull” factor. With accelerated economic growth, job opportunities in non-agricultural sector are created much faster and this leads to a pull on labour away from agriculture to higher productive and higher paying manufacturing or services sector.

However India’s economic growth has lost its momentum signifying a low pull factor on labour away from agriculture. Moreover in the non-agricultural sector, demand for labour has largely been informal in nature and mainly from small scale enterprises. The proportion of informal labour and the small scale of employment (firm size) has also meant that productivity is relatively lower in India’s non-agricultural sectors. In other words the pull factor has not been strong. It can be much stronger if India embarks on a period of sustained high growth and reform its labour laws.

Again, the shift from rural agriculture to urban manufacturing and services in India, has been happening at a slow pace. The urbanization rate in India is around 30% compared to 50% in China. While the trend of rural to urban migration is visible in India, the pace of migration has been quite slow, signifying slow and low pull factors at work.

On the other hand, the supply of labour from agriculture to other sectors is also affected by wages in the rural areas. Social welfare programs such as MGNREGA (the National Rural Employment Guarantee Act), has in effect been boosting rural incomes and incentives, thereby reducing the ‘Push” factor of movement away from agriculture. As rural wages rise, the urban labour market gets distorted and the ‘Push’ factor gets weakened.

The effect of these factors has not been identical on both genders. There has been less diversification in the occupations of rural women and their movement away from agriculture when compared to their male counter parts.

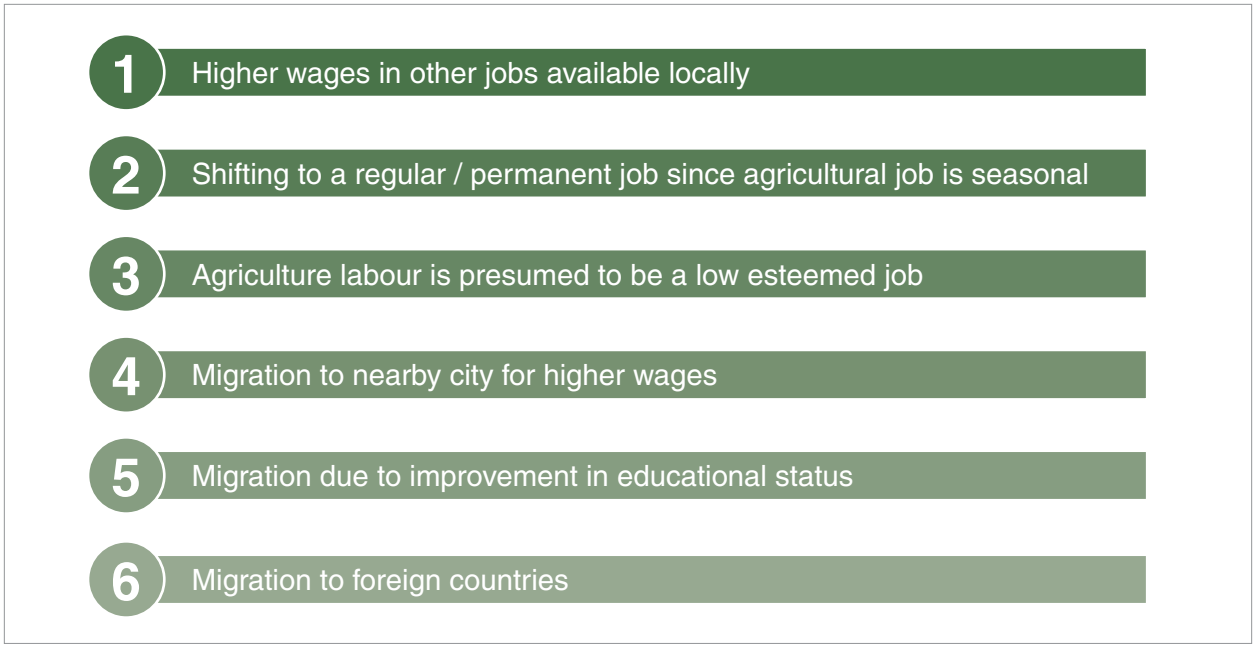
Supported by a number of Government schemes, including MGNREGA, Rural wages have been growing by 17% on average since 2006-07 and have outstripped urban wages (Goldman Sachs, 2014). The study found that the share of households enrolled in MGNREGA was indeed a significant explanatory factor for rural wage growth . The study also found evidence to support the hypothesis that inflation has been higher in states where MGNREGA has been implemented to a greater degree. It concluded that not only were agricultural workers not moving to urban areas, the increase in wages, without an increase in productivity, was fuelling inflation.

In a nutshell, availability of labour in agriculture crucially depends upon job creation in the non-farm sector, the pace of urbanization, social schemes and incentives in the rural sector and wages in the agriculture sector, besides certain social factors like children’s education and status.

According to a survey conducted in 2011 to assess the key reasons behind labour scarcity, 'higher wages in other locally available jobs' was ranked 'first' among various reasons identified. The survey reported that this was because higher wage rates prevailing in non-agricultural works like masonry, carpentry, electrical and plumbing, which were locally available, attracted agricultural labourers. As the skill set required in agriculture is negligible, labour tend to adapt other skill sets if they get higher wages.

Agricultural jobs being seasonal, labourers remain unemployed during lean season. This makes them seek a regular / permanent job that could provide them income throughout the year. This reason was ranked 'second'. Working as an agricultural labourer was considered as a low-esteem job in the rural areas and this reason was ranked 'third'. Out-migration due to improvement in educational status, migration to nearby town / city for higher wages and migration to foreign countries were ranked the fourth, fifth and sixth respectively. A report in the "Economist" outlined how agriculture labourers were increasingly seeking jobs as "Security Guards" in cities and towns, which besides giving them a higher wage also reduced their drudgery.

Reasons for labour Scarcity in Agriculture (In Order of Importance)

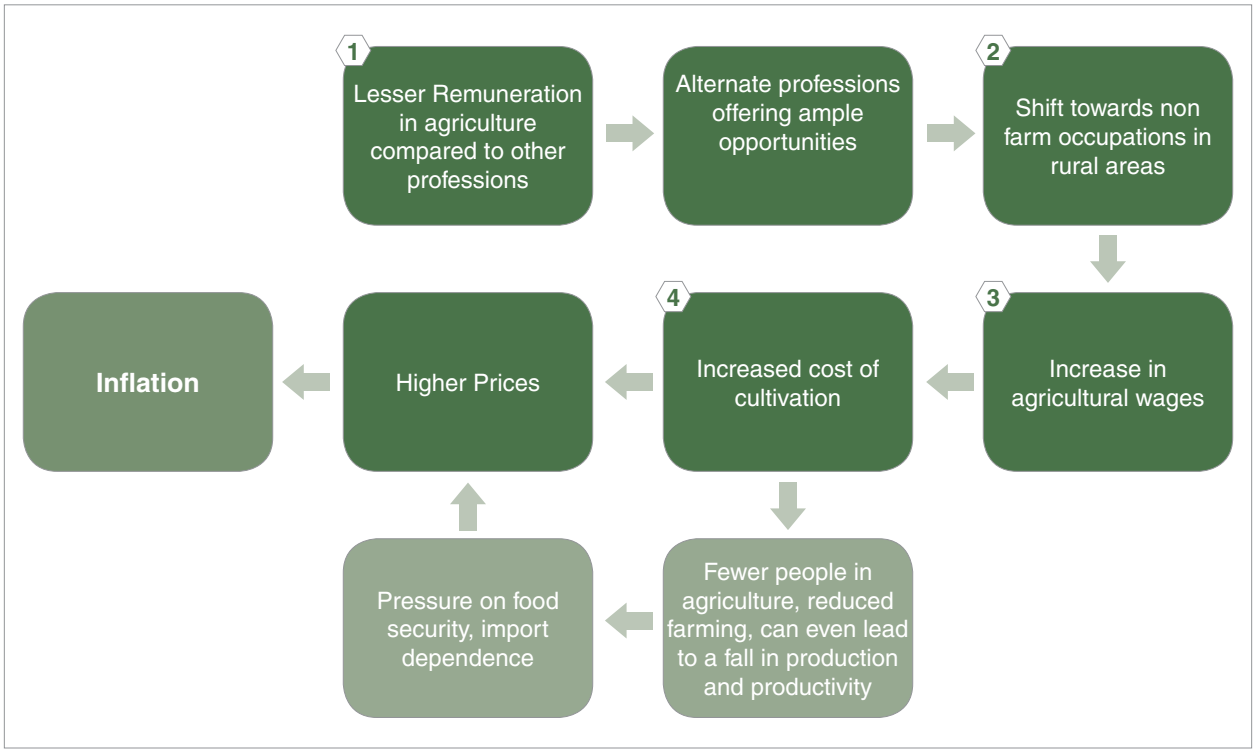


Source: Labour Scarcity – Its Immensity and Impact on Agriculture By C. Prabakar, K. Sita Devia and S. Selvamb

In the following sections, we have attempted to analyze the causes of labour scarcity and assess the plausibility and importance of some of the reasons listed above.

Solving the Conundrum of Labour Shortage

Indian agriculture needs to look forward to a boost in productivity as the cheap, surplus labour it has relied on traditionally moves out of the sector. If adequate measures are not taken to replace the labour requirement, productivity of farms may get affected and this may have repercussions on output prices.



As returns from agriculture reduces owing to increasing input costs and the benefits of price rise often not trickling down to farmers, returns from agriculture are getting impacted. This is affecting the ability of the farmer to pay competitive wages to workers. On the other hand, opportunities are being created in alternate industries which are growing at a faster rate. These sectors also offer year round employment and are attracting agri-workers.

These factors are leading to a shortage of labour in farms leading to a huge demand supply gap. As a result, agricultural wages are increasing every year at a rather high rate and in turn increasing the overall cost of farming with no significant increase in returns.

While labour shortages faced in various parts of the country are an outcome of multiple other factors, the causes listed above seem to have a marked influence on this phenomenon and have been analyzed in greater detail in the following sections.

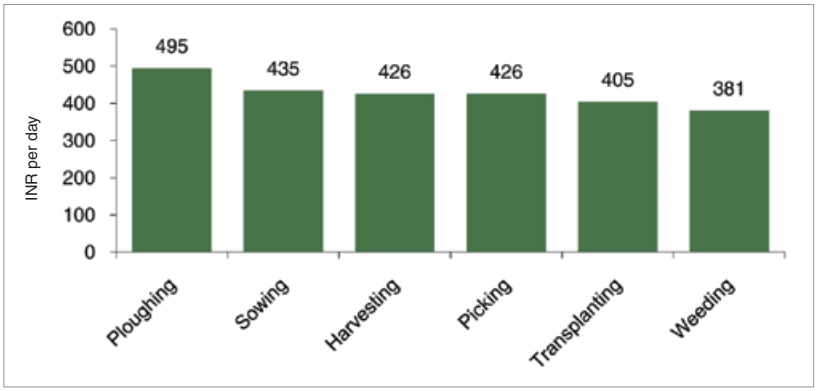
Evidencing Lower Remuneration in Agriculture

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. A comparison of remunerations for farmers across crops shows that a farmer only earns ~INR 2,400 per month for each hectare of paddy and ~INR 2,600 per month for a hectare of wheat. Farm labourers on the other hand earn less than ~INR 5,000 per month. A KPMG study done in 2012 in Andhra Pradesh covering 3 districts stated that a small farmer earned INR 1,100-3,000 per month, large farmers between INR 3,000 – 6,000 per month while landless labourers earned between INR 1,300 – 3,000 per month.

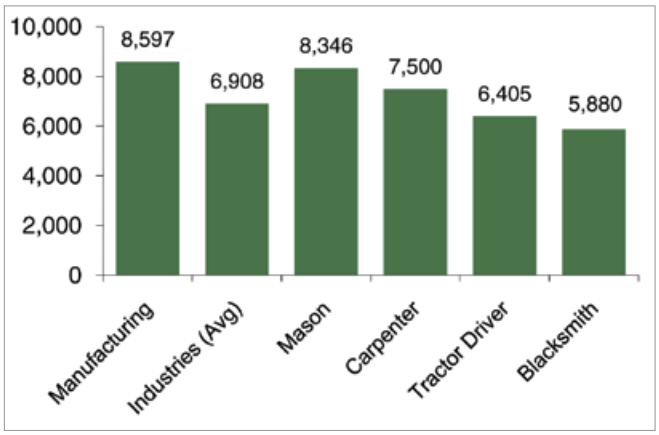
Farm Realization By Crop

Crop	Realization Per Ha Per Month
Paddy	2,402
Wheat	2,263
Sugarcane	15,464
Cotton	7,260
Groundnut	2,332
Soyabean	1,675

Average Remuneration By Profession (INR per day)



Source: Department of Agricultural Co operation, Indiastat, KPMG Analysis
Note: Realization pertains to 2010-11



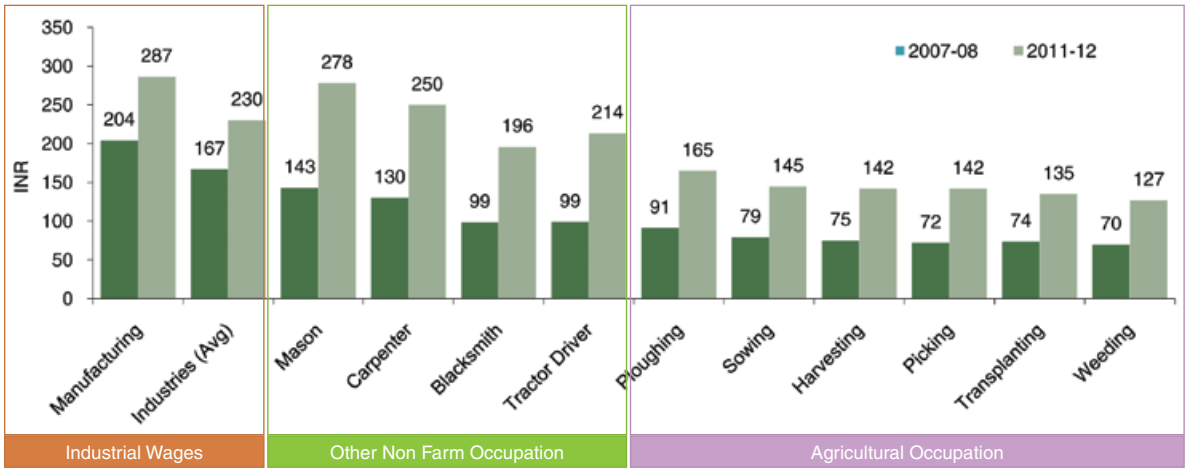
Source: Indiastat, KPMG Analysis

For women, the agricultural daily wages are between 15% to 30% lower than those of men depending on the agricultural activity.

An average industrial worker on the other hand earns close to INR 7,000 per month while a construction worker earns over INR 8,000 per month. Additionally, jobs in the non farm sector are available round the year unlike agriculture jobs which are seasonal in nature.

Comparison of wages in farm and non farm employment reveals that many simple jobs in non-farm sectors offer higher wages. Daily wage of a mason in construction is more than double the average wage for weeding and close to double that of ploughing. Wages for non farm professions like carpentry, drivers, blacksmith etc are at least 15-20% higher than agricultural wages. Industrial wages when compared to agricultural professions are more than 1.5 times which clearly explains the preference for these sectors.

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



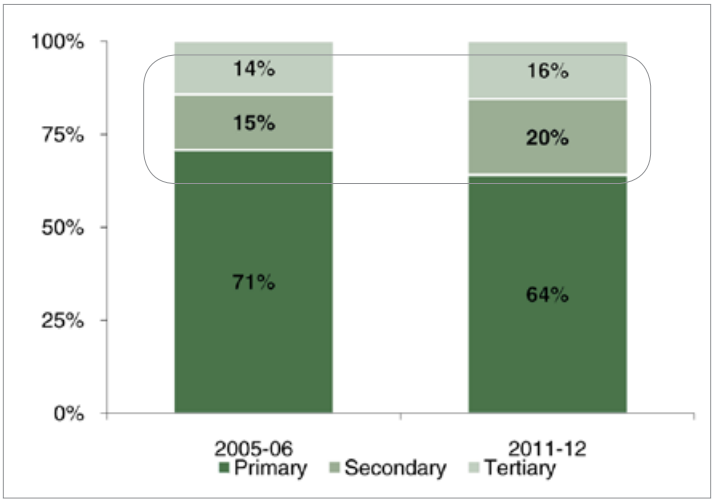
It can be seen that across states non agricultural wages for various professions are consistently higher than agricultural wages including states like Kerala, Punjab and Tamil Nadu which have high agricultural wage rates. Although agricultural wages have grown at a higher rate in most states compared to non farm occupations like masonry & carpentry, in absolute terms it still offers lower compensation.

	2005-06			2011-12			CAGR		
	Carpentry	Masonry	Agriculture[2]	Carpentry	Masonry	Agriculture	Carpentry	Masonry	Agriculture
Kerala	215	214	218	489	477	381	*15%*	*14%*	*10%*
Punjab	174	173	95	375	376	286	*14%*	*14%*	*20%*
Tamil Nadu	130	138	77	374	398	275	*19%*	*19%*	*24%*
Himachal Pradesh	194	196	83	341	340	273	*10%*	*10%*	*22%*
Andhra Pradesh	86	109	62	226	278	265	*17%*	*17%*	*27%*
Haryana	152	186	116	322	351	256	*13%*	*11%*	*14%*
Rajasthan	142	156	67	324	369	213	*15%*	*15%*	*21%*
West Bengal	99	102	79	200	219	213	*13%*	*14%*	*18%*
Karnataka	98	109	68	227	234	203	*15%*	*14%*	*20%*
Maharashtra	108	122	51	230	273	195	*13%*	*14%*	*25%*
Uttar Pradesh	126	139	79	266	306	163	*13%*	*14%*	*13%*
Gujarat	137	149	98	230	293	156	*9%*	*12%*	*8%*
Assam	117	126	66	221	242	152	*11%*	*11%*	*15%*
Bihar	104	118	63	235	262	146	*15%*	*14%*	*15%*
Orissa	117	119	50	238	254	134	*13%*	*13%*	*18%*
Madhya Pradesh	88	104	55	162	209	125	*11%*	*12%*	*15%*

Source: Bureau of labour and Employment, Indiastat, KPMG Analysis
Note: Wages for ploughing used as representative, wages for male agricultural workers considered as indicative

Shift towards Non Farm Sectors in Rural Areas

The shift towards the secondary sectors like construction and manufacturing in rural areas is evident between 2005-06 and 2011-12. 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. At an all India level, construction constitutes ~42% of secondary sector employment in rural areas and movement away from agriculture has been a result of growing opportunities in this space.

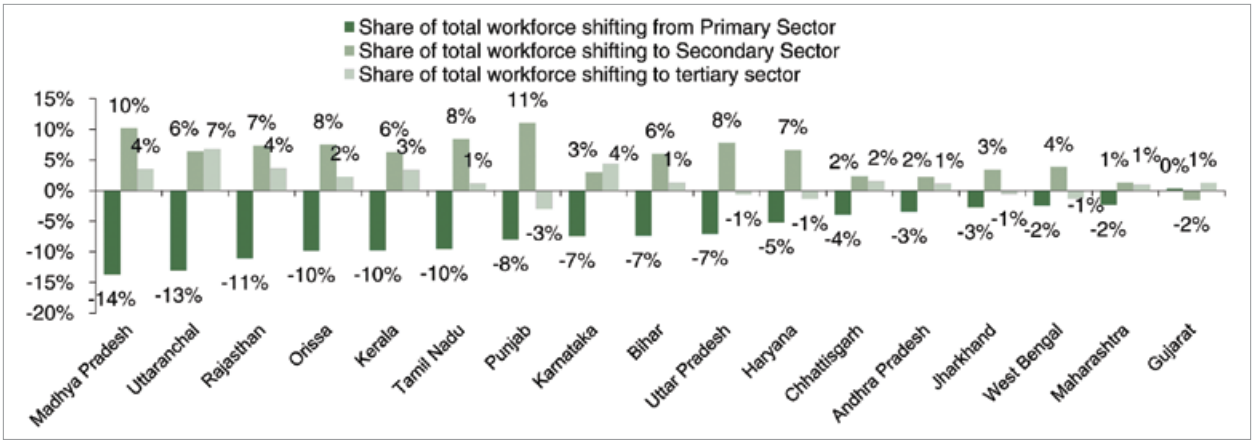


- Primary: Agriculture, fisheries, forestry
- Secondary: Mining, Manufacturing, Construction, Electricity- gas -steam and air conditioning supply, Water supply – sewerage - waste management and remediation activities
- Tertiary: Wholesale and retail trade, Repair of motor vehicles and motorcycles, Transportation and storage, Financial and insurance activities etc

Source: NSSO, KPMG Analysis

A similar phenomenon is observed at a state level where majority of the movement has happened from agriculture to secondary sectors with some movement to the tertiary sector (except West Bengal, Punjab, Haryana and Jharkhand where share of both primary and tertiary sector has reduced with a large increase in secondary sector employment). In Punjab for example, the share of primary sector in employment reduced by 8%, tertiary sector reduced by 3% while secondary sector gained 11%.

Employment Pattern Shift between 2007-06 to 2011-12 in Rural Areas



Source: NSSO, KPMG Analysis



The preceding pages in this chapter successfully establishes the “Pull” factors from the non-farm sectors which has led to migration of labour from agriculture to non-agricultural sectors.

Lower remuneration in the agriculture sector has been the primary reason why this migration has taken place. This was established by comparing wages in other non-farm occupations and across the various states.

This fact was seen to be prevalent both in the urban sector and even in the rural sector which led to the migration. However, it is also important to see the movement of wages in the agricultural sector per se over a period of time.

Gulati (2013) estimates that, while the nominal farm wages grew at an average annual rate of 8.9 % during the 2000s (2001-02 to 2011-12), they 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.

A similar pattern emerges for real farm wages - real wages, which noticeably, 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. Over an extended period of 1990-91 to 2011-12, real farm wages have grown at an average annual rate of growth of 2.9 %, which is quite low. In fact, if the wages had followed the trend of the growth of 1990s, the real farm wage rate would have exceeded the wage level in 2011-12.

Put together, the period 2001-02 to 2006-07 was a specially difficult period for farm workers as farm wages actually declined during the period. Cumulatively this also perhaps explains why the additional labour force was still getting absorbed in the 1990s and early 2000s, but beyond 2004-05 there has been a net reduction in agriculture labour force.

As for the various states with respect to real farm wages, disaggregated data at the state level show that major states like Kerala, Rajasthan, Karnataka, Tamil Nadu, Maharashtra, Assam and Madhya Pradesh have observed a wage growth higher during the 1990s than the 2000s. On the other hand Gujarat and Haryana stand out with low growth of real farm wages throughout the entire period (Gulati, 2013). Overall, within the 2000s, most of the states experienced negative growth of real farm wages during 2001-02 to 2006-07.

An explanation of the higher wages in agriculture seen after 2006-07 is due to the “Pull” factors of GDP growth that has helped pull the real farm wages. This is broadly in line with what has happened in several other developing economies like Thailand and China (Yusuf & Saich, 2008). This was coupled with the “Push” factor of Government intervention in the rural labour market through MGNREGA since 2006, which has empowered the rural labour to negotiate higher wages for their farm work.

We next analyze the “Push” factors like MGNREGA.

Impact of MGNREGA

The Mahatma Gandhi national rural employment guarantee act (MGNREGA) is the largest right-based social protection initiative in the world. It was implemented in a phased manner starting with the 200 most backward districts in Phase 1 in February 2006. The importance of NREGA lies in the fact that it creates a right based framework for wage employment programs and makes the Government legally accountable for providing employment to those who ask for it. In this way, the legislation goes beyond providing a social safety net towards guaranteeing the right to employment.

Daily Wages Under MGNREGA in Key States - INR						
	2007-08	2009-10	2011-12	2012-13	Agriculture 2012-13	CAGR
Andhra Pradesh	71	100	121	137	265	*10%*
Bihar	81	100	120	122	146	*8%*
Gujarat	100	100	124	134	156	*10%*
Haryana	135	141	179	191	256	*11%*
Karnataka	74	100	125	155	203	*15%*
Madhya Pradesh	88	100	122	132	125	*10%*
Maharastra	69	69	127	145	195	*24%*
Punjab	98	100	153	166	286	*16%*
Rajasthan	100	100	119	133	213	*10%*
Tamil Nadu	80	100	119	132	275	*10%*
Uttar Pradesh	100	100	120	125	163	*9%*
West Bengal	75	100	130	136	213	*11%*

Source: Indiastat, KPMG Analysis
Note: Ploughing wages used as proxy for agriculture

It aims at providing at least 100 days of guaranteed employment in a financial year to every household whose adult members volunteer to do unskilled manual work with 6 Km of residence. Most of the activities are reported to be less tedious and over lesser time compared to agricultural field work. As a result, this scheme is often reported to have a significant role to play in the labour shortage and agricultural wage rise.

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: MGNREGA Website, KPMG Analysis



MGNREGA wage rates in most states, however, is lower than prevailing agricultural wage rates, except states like Bihar and Madhya Pradesh where it is comparable to agricultural wages. However, 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 linkage between MGNREGA and the issue of labour shortage.

A KPMG study conducted in Andhra Pradesh brought to light the impact of the MGNREGA scheme on the availability of farm labour and rising agricultural wages. It was noted that in a number cases Panchayats took the initiative to maintain calendars for MGNREGA work and agricultural requirement in order to avoid overlaps which suggests that MGNREGA is likely to have a role in the agricultural labour shortage experienced across states.

Case Study

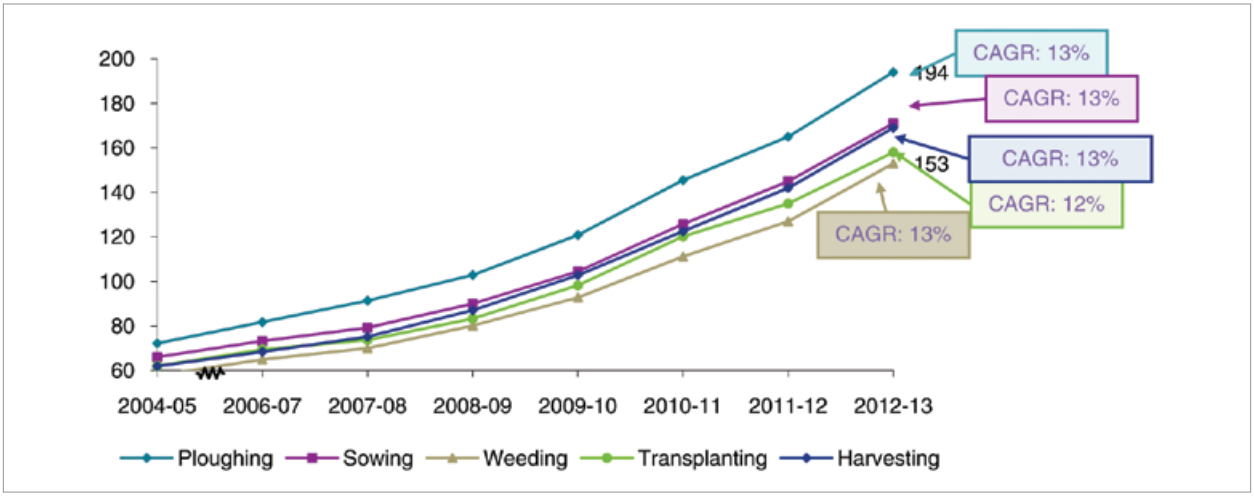
A recent study done by KPMG to study the Impact of MGNREGA wage employment program on the agricultural farmers in Andhra Pradesh highlights the following key observations

- The agriculture productivity over all has done well in the state however the **farmers feel that the rising inputs costs** (including a higher demand of wages by the labourers) **is due to the implementation of MGNREGA jobs** which has helped labourers bargain for better prices from them
- The input costs in the three surveyed Districts (Mahabubnagar, Kurnool and East Godavari) have shown a significant increase in the investment cost per acre of cultivation. Among the districts covered in the study, East Godavari has the highest cost in input for labour which has led to farmers opt for crop holidays and stop production. Seasonal calendars are being drawn out in the district to **ensure accessibility of labour for farm lands by stopping MGNREGA works during peak farming seasons**
- The scheme has created a platform for wage labourers in the state to be in a better bargaining position for wage rates. **MGNREGA is providing alternative employment opportunities** for wage labourers, which is enabling them to **demand higher wage rates** from farmers and in places, **shorter working hours.**
- In a number of villages, Panchayats played an active role in deciding the scheduling shelf of MGNREGA works so that it does not overlap with the cropping season and there was labour available for work on the fields

As mentioned previously, “Push” factors like MGNREGA also played an important role in determining availability of agricultural labour. One it has been instrumental in pushing up the wage rate in agriculture; and two it has also played a role in labour availability in the rural areas. Nominal farm wages had increased by 17.5 % per annum during 2007-08 to 2011-12; while real farm wages grew at 6.8 % per annum during 2007-08 to 2011-12. This has affected the affordability factor in the agricultural sector, besides impacting availability at all times. Reduction of labour force in agriculture has been a country wide phenomenon in the last few years, affecting almost all regions to varying degrees. Unavailability of labour during peak seasons for operations like sowing, harvesting etc is a common complaints among farmers.

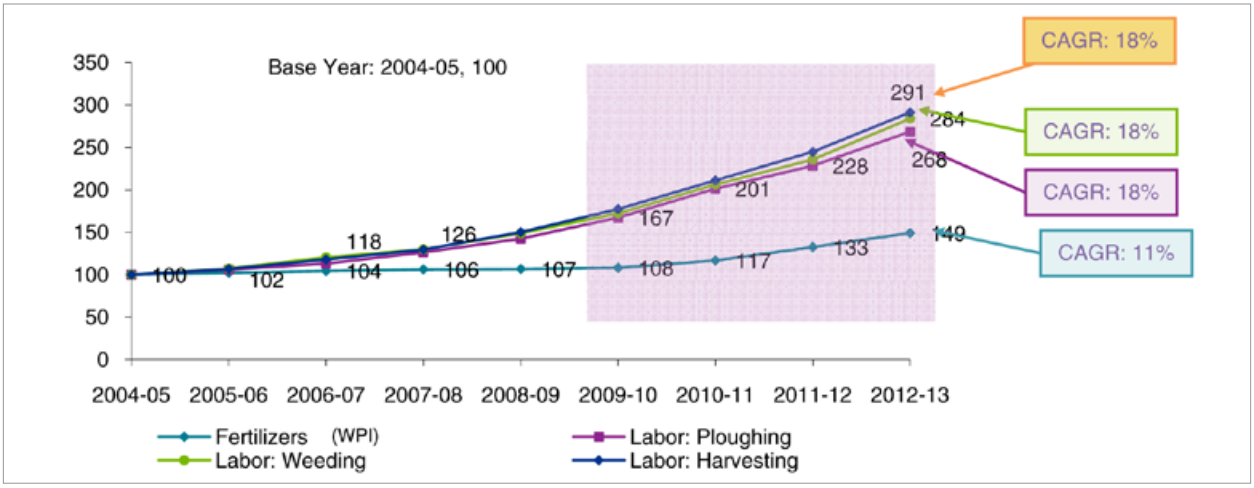
Steep Rise in Agricultural Wages since 2006-07 and its Effect

As a result of "Push" factors like MGNREGA coupled with a net decline in labour available for agriculture, there has been a steep rise in wages of various agricultural professions since 2006-07. Owing to the shortage, farmers end up paying higher wages in order to attract labour to their farm. Availability of other non farm options and employment guarantee from the government has arrested migration of casual labourers for employment. Moreover, various studies report that casual labour on farms is more tedious compared to alternate options available and is considered a last resort by the rural workforce.

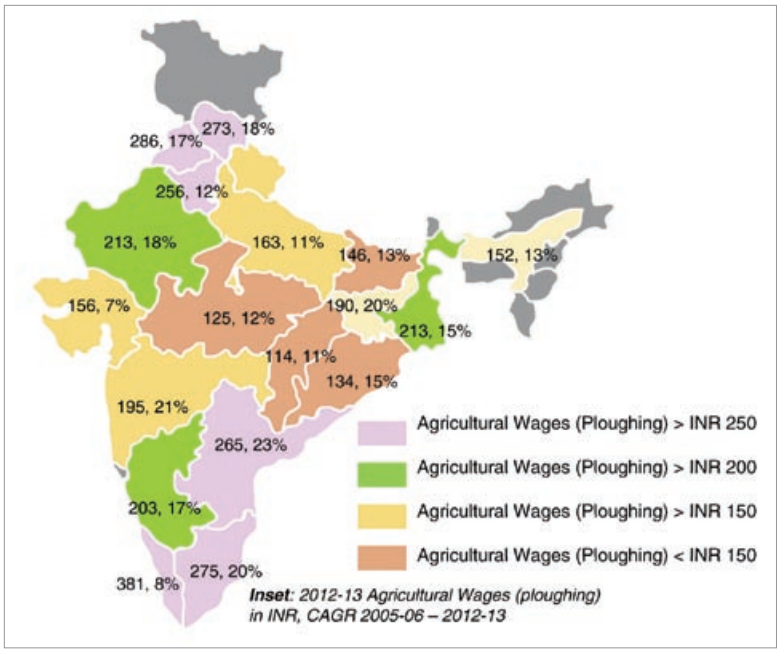


Source: Bureau of labour and Employment, Indiastat, KPMG Analysis

It can be further observed that input costs like labour and fertilizers have increased at a higher pace in the recent years (2009-10 to 2012-13). labour costs alone increased by ~18% while cost of fertilizers increased by ~11% resulting in increase in overall cost of cultivation.



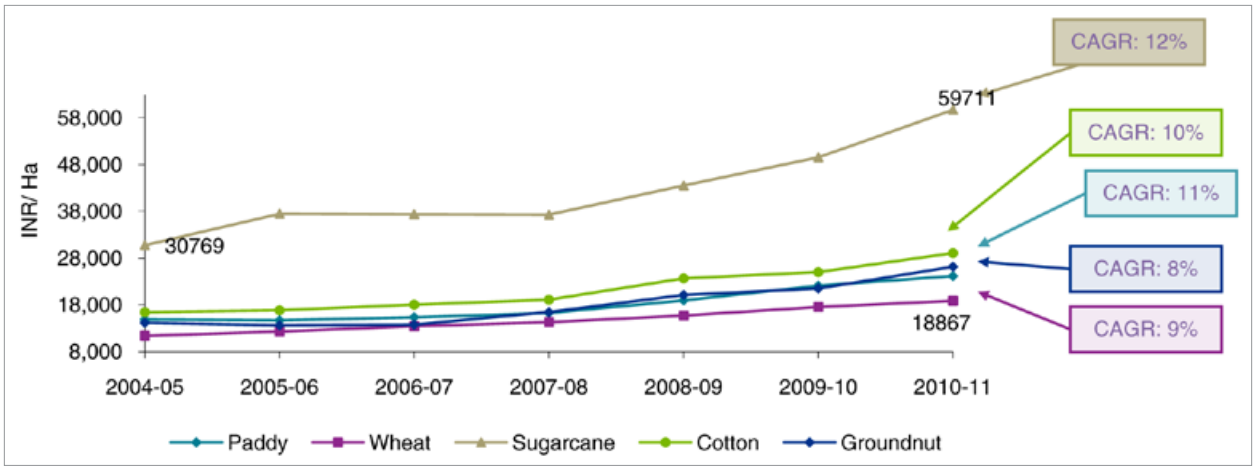
Source: Office of Economic Advisor, Indiastat



Source: Bureau of labour and Employment, Indiastat, KPMG Analysis

The illustration on the left shows that agricultural wages across states have been growing at varying rates. Kerala, Tamil Nadu, Andhra Pradesh, Punjab and Haryana have the highest wages in agriculture and have been growing at robust pace. It is interesting to note that in Kerala, Tamil Nadu and Haryana more than 15% of the workforce moved out of agriculture between 2004-05 and 2011-12 and this may have resulted in the sharp increase in wages. On the other extreme, Madhya Pradesh, Chhattisgarh, Orissa and Bihar have very low wages growing at an annual rate of just over 10%.

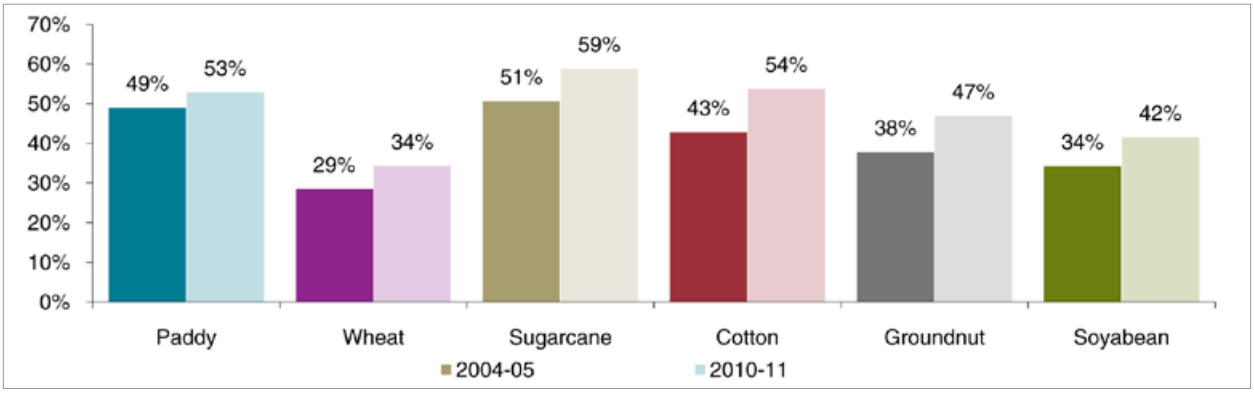
Cost of Cultivation



Source: Department of Agriculture and Cooperation
Note: Average cost of cultivation is a simple average of costs available across various states growing the crop

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. The above analysis of the average cost of cultivation (as published by the Department of Agriculture and Co-operation till 2010-11) reveals that the cost of cultivation of these crops have 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%.

Share of Labour Cost in Overall Cost of Cultivation



Source: Department of Agriculture and Co-operation, KPMG Analysis

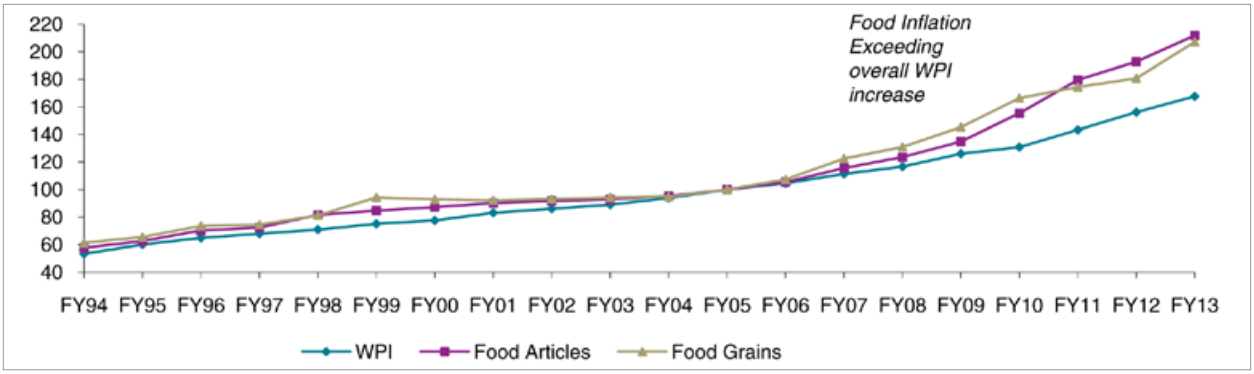
The figure above illustrates how labour costs in agriculture have risen at a faster pace compared to other inputs which are part of the overall operational cost of cultivation and thus across crops.

While on one hand, higher wages are beneficial in reducing poverty and improve conditions of one of the lower paid segments of the rural workforce, it can bear fruit only if the farmer is able to reduce his labour requirement and not let higher wages affect the cost of his output.

However, in the last few years, this has not been the scenario. This rise in wages and increase in overall input costs may have partly affected the inflation of food prices. Between 2005-06 to 2011-12, food prices have increased at close to 10% CAGR while overall inflation was in the range of 7% CAGR.

This leads us to believe that beyond a point, the farmers will either pass the increasing costs of cultivation to consumers leading to a price inflation or they may relinquish the profession as earnings become even less lucrative compared to other sectors. This will have a cascading impact on food production and consequently affect prices of food commodities.

Wholesale Price Indices and Food Inflation



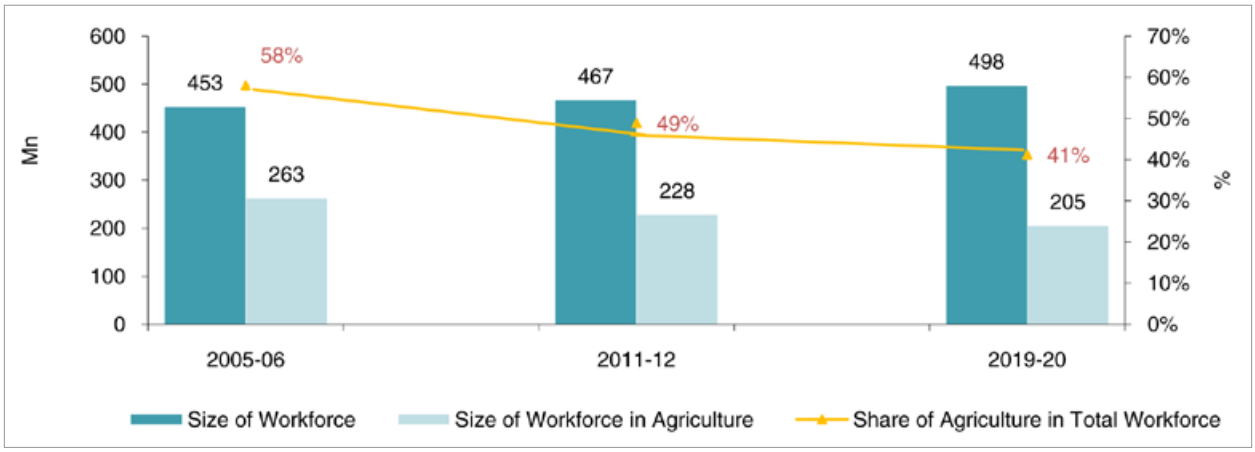
Source: Bureau of labour and Employment, Indiastat, KPMG Analysis

Estimation of Labour Force Reduction in Agriculture by 2019-20

In the period 2004-05 to 2011-12, robust growth in the secondary and tertiary sectors led to significant job creation in these sectors. As a result, a large share of the agricultural labour force moved to these professions which offered better remuneration. Although 10 million people got added to the workforce, there was a net outflow of 30.5 million people from agriculture. Employment in secondary and tertiary sector grew by 4.5% and 3.3% a year in the same period (CAGR) supported by a GDP growth of 8% and 9.8% in these two sectors respectively in the same time period.

The GDP growth rate in the subsequent two years since 2011-12 has slowed down and is expected to grow only at around 5.3% in the long term till 2019-20. Job creation in the primary and secondary sector is likely to slow down as a result of lower growth expectations in the sectors. As a result, the exodus from agricultural workforce is expected to slow down in the coming years till 2019-20 compared to the earlier six year period in consideration. Nevertheless, the size of the workforce in this sector 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.

Employment in Agriculture (Million)



Source: Planning Commission, Economic Intelligence Unit, KPMG Analysis

Chapter 3



Strategic Options to Address Labour Shortage

Improving Agricultural Productivity

On a PPP basis, overall labour productivity in India is quite low compared to most South East Asian countries. Nevertheless, in India labour is 4 times more productive in industry and 6 times more productive in services compared to agriculture.

If we compare productivity per person in agriculture to productivity per person in all other sectors combined, them as the table below illustrates, the latter was 6.2 times more productive in 2005-06, which declined to 5.8 times in 2011-12. India lags behind other BRIC nations where for the period of 2011-12 Brazil had a gap factor of 3.35, Russia had 2.67 and China 4.85. This implies that agriculture in India is unattractive compared to other BRIC nations.

	Unit	2005-06	2011-12	CAGR
Share of Employment of Agriculture	%	58%	49%	
Employment in Agriculture	Mn	263	228	-2.3%
Employment in All Other Sectors	Mn	190	239	3.8%
Agri GDP (constant prices)	INR Mn	5,944,870	7,394,950	3.7%
Total GDP (constant prices)	INR Mn	32,530,730	52,435,820	8.3%
GDP per capita in Agriculture	**INR**	**22,614**	**32,373**	**6.2%**
GDP per capita in All Other Sectors Combined	**INR**	**139,660**	**188,688**	**5.1%**
Agricultural Productivity Gap Factor		**6.2**	**5.8**	

Source: Planning Commission, Economic Intelligence Unit, KPMG Analysis

While this analysis justifies better returns in non agriculture occupations and explains the trend of labour shifting away from agriculture, the problem needs to be addressed by taking adequate measures to reduce labour requirement and increase productivity in the sector. Most nations have responded with widespread use of technology on farms to replace many traditional farming occupations, a trend India will soon have to follow.

Moreover, the requirement of labour for agriculture is not fixed and changes throughout the year based on the season and crop activity. It is also dependent on the crop being cultivated, for example, rice requires more labour during sowing that other crops. labour scarcity at any point of the crop lifecycle leads to reduction in crop yield, reduction in cropping intensity and changes in traditional cropping pattern.

Again, India is a vast country with 16 agro-climatic zones. Technological interventions for Black cotton soil will be vastly different from alluvial soil. Therefore technological and other solutions need to crop specific and also geography specific.

Empirical studies have evaluated the effect of shortage of labour on various crops. A comparison of labour sufficient and labour insufficient farms shows a marked difference in yield due to labour shortage (the table below illustrates the same). Among the crops considered for the study, paddy and cotton are the worst affected. The impact of labour scarcity is felt lesser in pulses as compared to the other crops since their cultivation requires relatively less labour. Moreover, the labour intensive operations such as weeding and harvesting of pulse crops fall in the months of March and April which are virtually considered off-season months in agriculture.

Productivity levels of labour scarcity affected and unaffected farms:

Crop	Productivity		Productivity difference	
	labour-scarcity-unaffected farms	labour-scarcity-affected farms		
	(kg/ha)	(kg/ha)	(kg/ha)	(%)
Paddy	5,090	4,487	603	11.8%
Sugarcane	153,292	144,165	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%

Source: labour Scarcity – Its Immensity and impact on Agriculture by C. Prabhakar, K. Sita Devi and S. Selvam

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:

Input factors:

- Immediate Effect: Adopt techniques that can replace and/or reduce the requirement of human labour
- Long Term Effect: Increase returns from agriculture and arrest the migration of workforce from agriculture to other sectors

Output factors

- Agri-linkages factor

Input factors:

Labour Substitution in Indian Agriculture

Various technologies can be practiced which either replace labour or reduce the requirement of labour and the variability in labour requirement throughout the year. Some of these technologies are already being implemented in various parts of the country yielding beneficial results, while considerable amount of support is required to develop other technologies which can effectively address the issue.

The empirical study on labour Scarcity – Its Immensity and impact, clearly highlights the fact that adoption of labour saving techniques in fields can not only address the issue of labour shortage but also boosts yields.

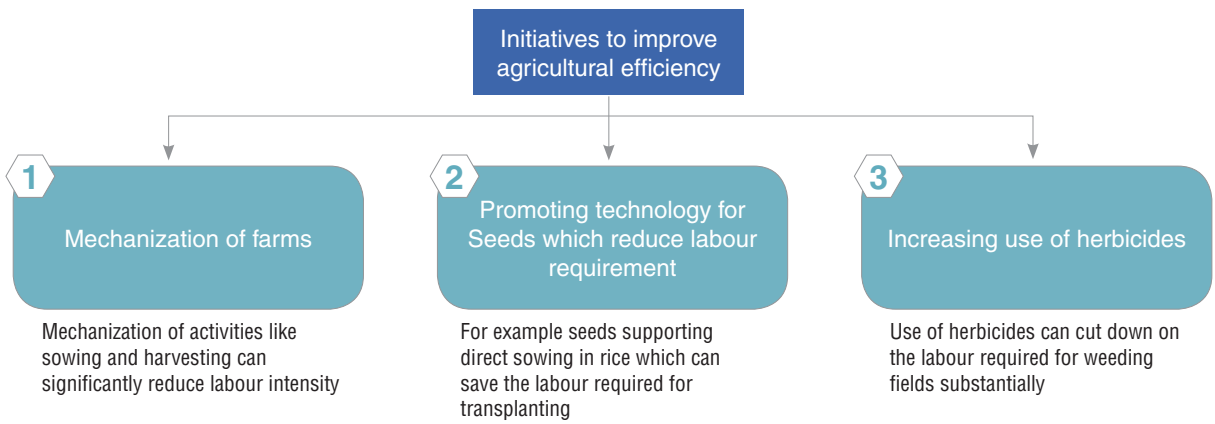
Productivity levels of farms which have adopted technology vs. farms which haven't:

Crop	Technology		Technology difference	
	adopted	non adopted		
	(kg/ha)	(kg/ha)	(kg/ha)	(%)
Paddy	5,142	4,492	650	12.6%
Sugarcane	153,675	144,680	8,995	5.9%
Groundnut	3,777	3,205	572	15.1%
Cotton	1,437	1,172	265	18.4%

Note: Crop labour-saving technology / implement considered were:
Paddy - Transplanter, Harvester, Cono weeder
Sugarcane – Planter, Mini tractor, Harvester
Cotton - Drip irrigation, Harvester, ULD Pesticides,
Groundnut - Seed cum fertilizer drill, Micro irrigation,

Source: labour Scarcity – Its Immensity and impact on Agriculture by C. Prabhakar, K. Sita Devi and S. Selvam

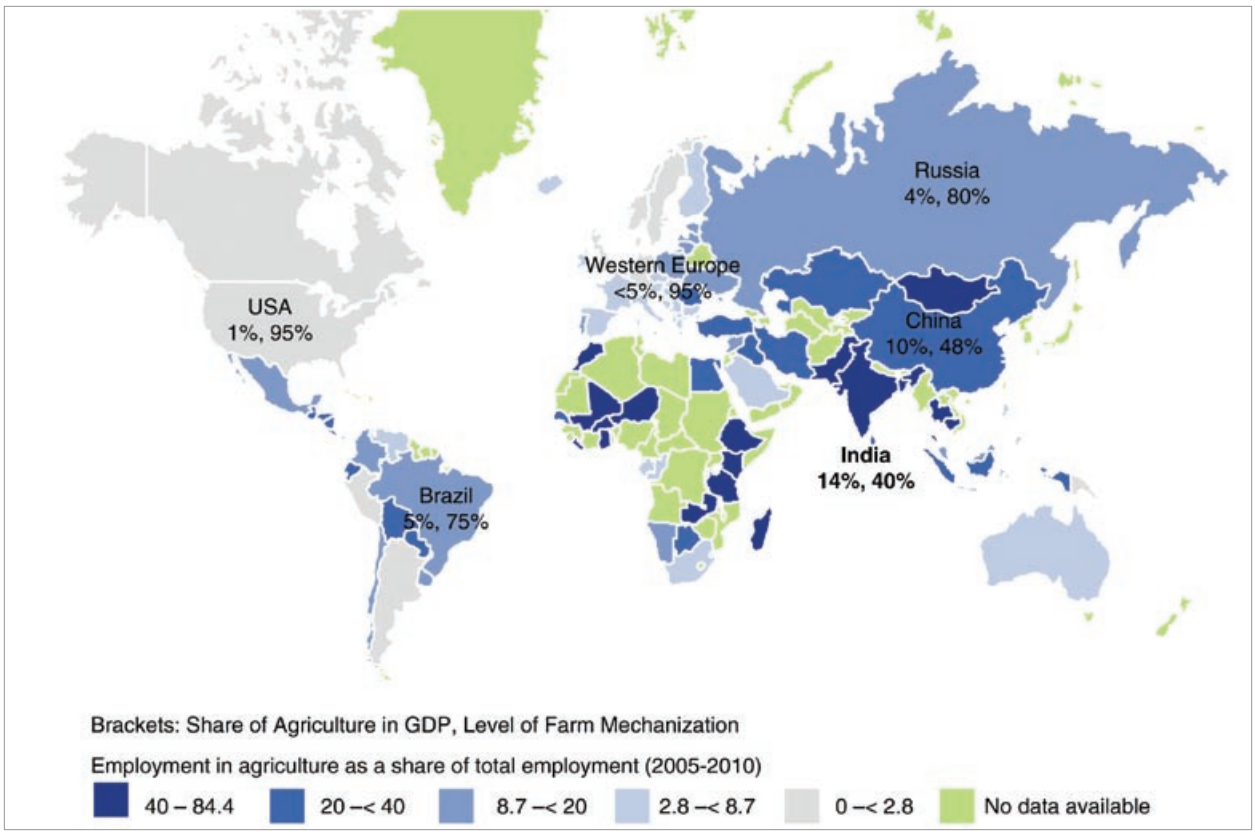
There are three key initiatives which can be adopted to help farms reduce their labour requirement in the near term, as illustrated below:



Farm Mechanization

The growth in farm mechanization follows a certain pattern worldwide. Farm operations requiring high power inputs and low control are mechanized first while operations requiring high degree of control and low power inputs are mechanized last. This is because any power intensive work, can be done faster mechanically and at a lower cost whereas converting human knowledge into machine knowledge is difficult and costly. It can be noted from the illustration below that most developed nations with low share of employment in agriculture and high mechanization have much higher GDP from agriculture compared to developing nations like India where employment is agriculture has a higher share while mechanization is much lower.

Population engaged in Agriculture, Share of Agriculture in GDP vis-à-vis level of farm mechanization



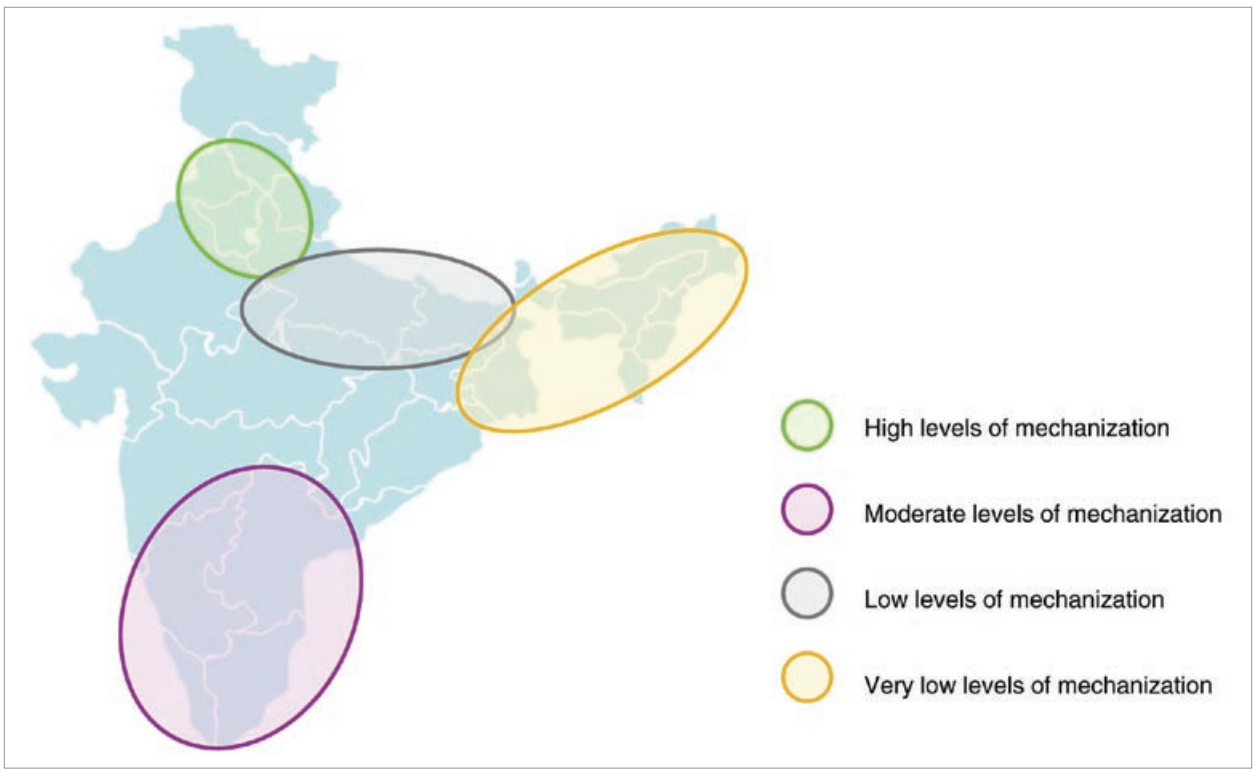
Note: For India, the year considered in 2009-10

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

Mechanization in India

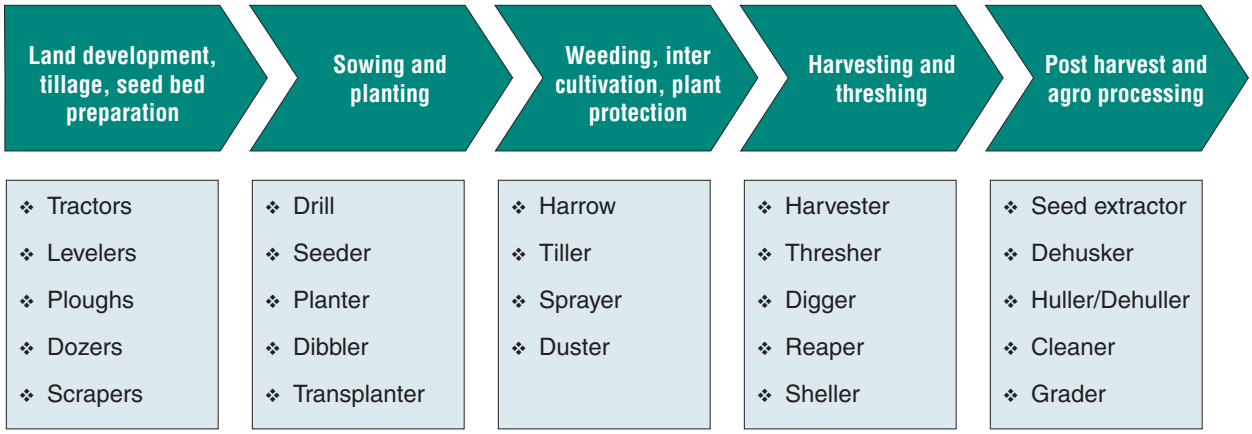
Current level of farm mechanization in India is not only lower compared to other developed countries but is also the lowest among the BRIC nations. Higher cost of mechanization compared to manual labour, lack of skill required to operate farm machinery and smaller landholdings have so far prevented India from enjoying the benefits of mechanization. However, a closer look at regions reveals varying degrees of penetration of machines in farms and clearly highlights the fact that regions with high agricultural output have already implemented various mechanical farming techniques to address the labour shortage.

Levels of farm mechanization in India:



- Punjab, Haryana and western Uttaranchal are the major states where farm mechanization is concentrated which increases their productivity.
- Farm mechanization in south India has increased considerably over the decade but still has a long way to go before adapting to a higher level.
- Uttar Pradesh and Bihar are the future potential states which have started using farm implements with support extended by the Government.
- West Bengal, Orissa and the North eastern states are in the process of adopting farm mechanization.

While tractors, tractor driven devices and tillers are the most common form mechanization in India, a variety of tools and machines are available which can reduce the labour requirement across the lifecycle of a crop.



However, various studies have revealed that mechanization in other processes like seeding and planting, plant protection, harvesting and threshing can have significant impact on labour requirement.

Extent of mechanization by farm operations:

Operation	Extent of Mechanization in India
Soil working and seed bed preparation	40%
Seeding and planting	29%
Plant protection	34%
Irrigation	37%
Harvesting and threshing	60-70% for wheat and rice and <5% for others

Source: Farm Mechanization in India, Dept. of Agriculture and Cooperation – Ministry of Agriculture 2013

A closer look at two simple machines used for seeding and harvesting respectively brings to light the applicability of such devises across crops as well as the benefits accrued to the farmer in terms of reduced labour requirement.

Motorized single-axle mowers and reapers for harvesting cereals

Single-axle mowers and reapers generally range in power from around 1.5 - 10 kW. Crops suitable for harvesting by these machines include rice, wheat and barley. Hay or grass mowers are available with cutter bars or rotary cutters. Reapers also have cutter bars and are generally designed for row crops and usually have mechanisms for stacking the crop. The work rates of mowers and reapers are substantially higher than hand reaping. For example a 2.2 kW reaper harvests rice at the rate of 2.4 hectare per day.

Combine Harvesters

The combine harvester is a machine that harvests grain crops such as wheat, oats, rye, barley, maize soybean and flax. The name derives from its combining three separate operations comprising harvesting - reaping, threshing, and winnowing - into a single process.

During the 1980s the use of combine harvesters increased manifold in Punjab. In the table below the effect of this increase on man-hours has been tabulated. The impact of the combine harvesters is visible in the over all reduction in manual labour by 22.9% in spite of increasing yield.

Effect of combine harvesters on human labour in Punjab:

	1985-86	2006-07	Absolute change	Change %
	Human labour (man-hours)			
Family	511	319	-192	-37.57
Permanent	193	153	-40	-20.73
Casual	385	368	-17	-4.42
Total labour	1,089	840	-249	-22.87

Source: Dynamics of labour Demand and its Determinants in Punjab Agriculture, Punjab Agricultural University 2013

During the period 1985-86 to 20006-07, baring transplantation of paddy, almost all other operations for wheat and paddy have been completely mechanized in Punjab. The increase in the use of combine harvester in wheat and paddy during the same period was about 1,189% and 355%, respectively.

Support Required to Enable Mechanization of Farms

Fragmented land holdings and high cost of machinery have traditionally been the impediments to the growth of mechanization in India. Besides, typical crop architectures in India prevent the efficient use of machinery designed for other countries. In order to support adoption of mechanical farming in India, innovative techniques have to be implemented to address each of these issues.

Increase Efficiency of Mechanization

Efficiency of mechanization and reduction in wastage can be addressed by the following ways, depending on the situation and crop

a. Improving the architecture and suitability of crops through Seed Technology

b. Improving the suitability of equipment being used through indigenization

Seed technology

The crop architecture of Indian crops differs from that of crops grown in other countries. Imported machinery is not always suited for Indian crop architecture and hence the efficiency of mechanization are lower than expected. Designer crop architecture needs to be developed to increase a crop's suitability to mechanization. An example of this is the 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. Boll opening is fluffy and clean cotton is picked up with low trash content. Its average yield is 20 qt./ha and it has field resistance against insect-pests and diseases.

Indigenization of Equipment

Mechanization of Indian farms often fall short of the expected benefits, primarily owing to wastages resulting in the process. This happens as the equipment imported from other countries are not aligned to the needs of Indian farms and crop types. This raises the need to develop machines which are suitable for Indian conditions. Various farm equipment manufacturers in India are already customizing their offerings.

Mahindra came up with a modern multi-utility tractor called the Shaan with a 23.5 HP engine. Most imported tractors have a 25+ HP engine and are more suited for large holdings. Shaan on the other hand is a sub 25 HP engine with 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.

Increase Affordability of Mechanization

It is extremely difficult for small farmers to afford machines to be used on their fields, especially given the difficulty of availing credit. However, a co-operative based Custom Hiring Model can be put in place whereby a single machine can be used by multiple farmers on a pay per use basis. The government in various states has started such a model where government owned machines such as ploughs, cultivators, paddy transplanters, inclined plate planters, reapers, threshers, power tillers etc. are made available to farmers at rates prescribed by the Government for completion of different farm operations in a short duration. A group of farmers belonging to adjacent small farms which are individually not suitable for mechanization can make use of such models to use equipment collectively at affordable costs.

Promoting Technology for Seeds which Reduce Labour Requirement

With improved varieties of seeds, labour is saved in terms of work input per kg produced due to improved germination and higher yield. On the other hand, technology is enabling development of seeds with special features that can directly replace or reduce the labour intensity of the cultivation process. For example, in rice the most labour intensive activity is transplanting of seedlings from the nursery into the field. Seeds have been developed which support direct seeding in rice and thus eliminates the labourious transplanting process.

Direct Seeded Rice (DSR)

Direct seeded rice is a cost effective rice establishment method where dry seed is drilled into the non-puddled soil. The need for a nursery and tasks such as pulling transporting and transplanting of seedlings are avoided as pre-germinated seeds are directly sown.

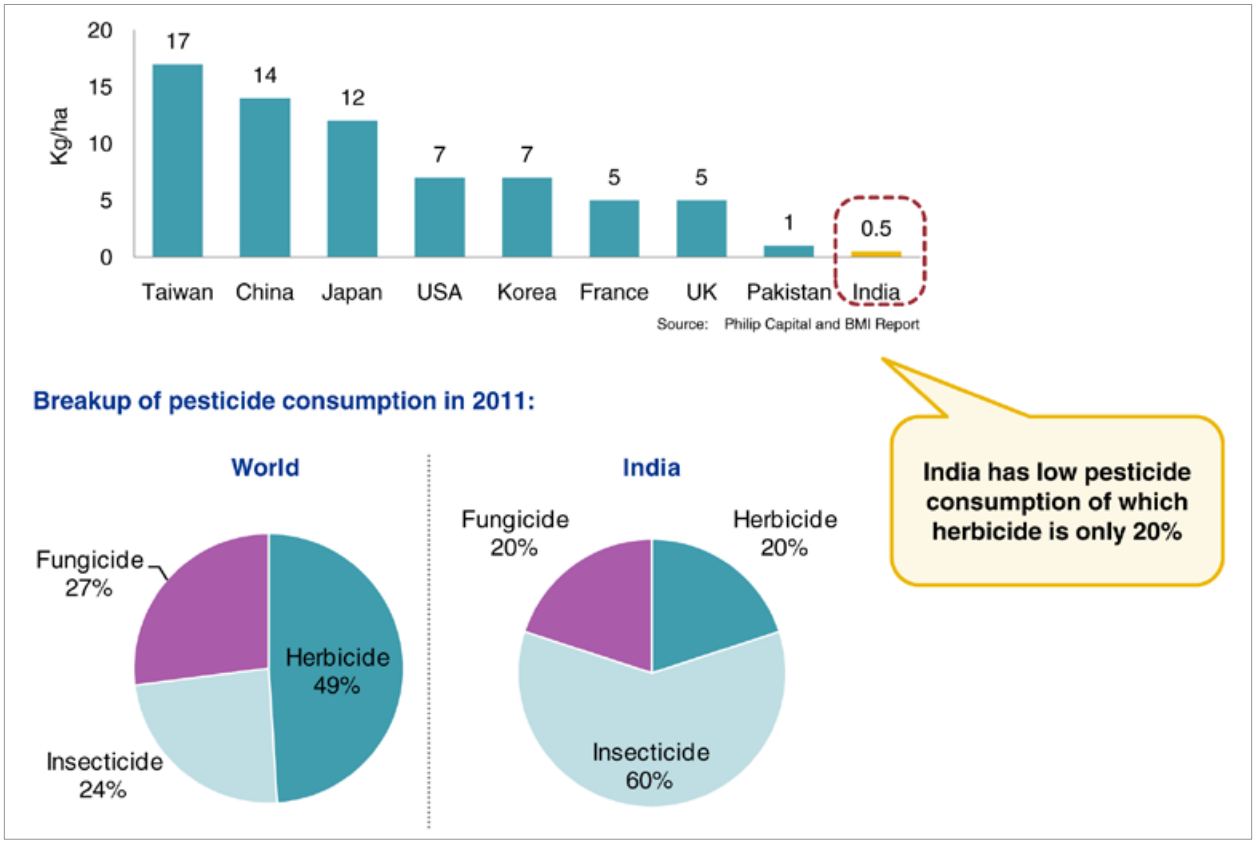
Benefits of Direct Seeded Rice

- By using DSR farmers can avoids repeated puddling, soil degradation and plow-pan formation
- As the DSR crop matures 10-15 days earlier than normal rice, this facilitates timely establishment of rice and succeeding crops
- Use of this seed helps save water by 35-40% and increase yields by 10%
- As sowing is the most labour intensive portion of rice cultivation, using DSR solves labour scarcity problem and reduces drudgery of labourers

Herbicide

Weeding in India is usually done by manual labour. The efficiency of the work is often lowered by hot, and humid weather conditions during the rainy season. In case of rice, over 20% of the total labour requirement is for weeding. Globally, the process of weeding is done away with by using herbicides which prevent the growth of unwanted weeds or plants. India, however, ranks far behind other peer nations in terms of overall pesticide usage currently. While herbicides are a large component of the global pesticide usage, in India it forms only 20% of the total market. This trend is often noted among labour surplus nations. However, as labour availability becomes an issue, farmers gradually adopt herbicide usage and do away with manual weeding. Such trends have been noted in other Asian countries like South Korea, Taiwan and Philippines.

Worldwide pesticide usage in 2011:



Source: Philip Capital Report

Multiple studies have shown that using weedicide is an effective way to reduce dependency on labour. It also has a positive impact on the yield of crops as it gives the farm more resources to focus on other steps of cultivation. An empirical study illustrates the reduction in labour requirement for rice, sugarcane and maize when herbicides were used. In the course of this experiment, the requirement of labour for weeding reduced by ~22% and as a result the overall labour requirement also reduced by ~8%.

Labour requirement of farms which use herbicicde vs. farms which don't:

Activity	Herbicide		Herbicide difference	
	adopted	Non adopted		
	(man hours)	(man hours)	(man hours)	(%)
Preparatory cultivation	102	87	(15)	-14.5%
Manuring	28	41	13	48.4%
Sowing & Planting	201	213	12	6.2%
Weeding	194	237	43	22.3%
Irrigation	158	144	(14)	-8.7%
Plant Protection	17	10	(7)	-41.6%
Harvesting	215	257	42	19.6%
Total labour hours	914	989	75	8.2%

Case Study

The Directorate of Weed Research has demonstrated the effect of herbicide usage specifically for grassy weeds and broad leaved weeds in wheat (using clodinafop (60g/ha) at 25-30 DAS followed by 2,4-D (500 g/ha) at 30 DAS) as compared to when the weeding was done manually.

	With herbicide usuage	Without herbicide usuage
Productivity per hectare	38-40q/ha	25-30 q/ha
Cost of production per hectare	INR 9,000-10,000	INR 9,000-9,500
Gross Income per hectare	INR 40,000 (40q at INR 1,000 per quintal	INR 28,500 (30q at INR 950 per quintal

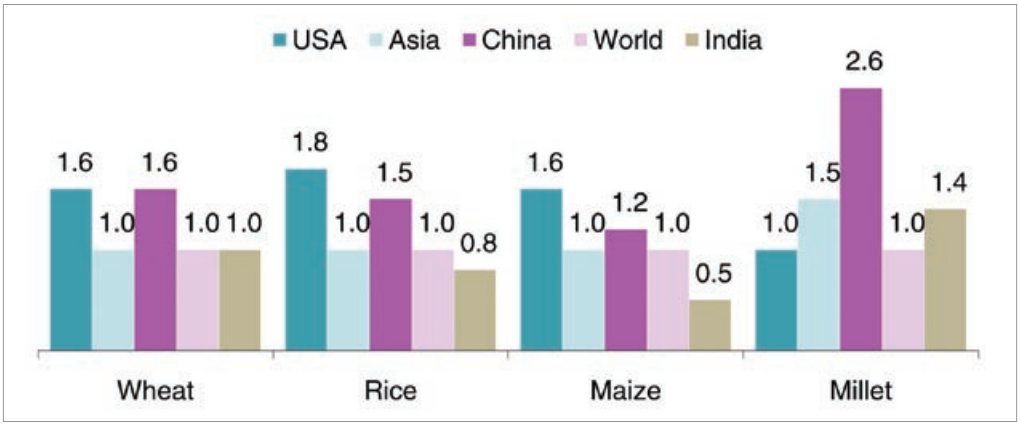
The price per quintal was lower for wheat produced without the use of herbicide. This is due to the presence of impurities like weed seeds.

Source: Directorate of Weed Research

Making Agriculture More Profitable

Focusing on the productivity of the agricultural sector to lift the incomes of farmers is one of the most direct ways to make agriculture viable.

Yield of select food grains in 2012 (Indexed to world average):



Note: (a) Asia include China

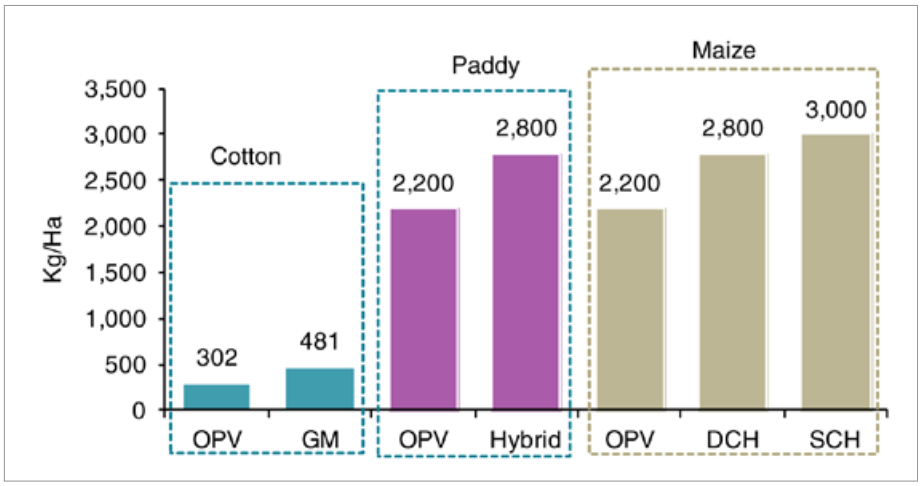
Source: Food and Agriculture Organization of the United Nations, FAOSTAT

Indian agriculture currently lags behind in productivity when compared to other South East Asian nations. India's yield per hectare is half the average level for China, Vietnam, Indonesia, Malaysia, and Thailand. Consequently, farm incomes are low and climbing slowly. The farm worker productivity in India grew at 3.2 % per year between 2000 and 2010, as compared to manufacturing and services, where labour productivity over this period grew by ~5.6% per year, respectively. The agricultural sector also suffers from under-employment of about 20 %.

In this section we discuss a range of technical levers that can help improve the yield and productivity of Indian farms. Raising productivity benefits the entire rural ecosystem associated with agriculture, including smallholders, wage-earning labourers, and related businesses.

Research driven improvements in seeds

Increase in Yield through Seed Technology:



Note: OPV: Open Pollinated Variety, GM: Genetically Modified, SCH: Single Cross Hybrid, DCH: Double Cross Hybrid

Source: National Seed Plan, Department of Agriculture and Co operation

It is estimated that all factors remaining constant, use of quality seeds alone can increase crop yield by 15-20%. Difference in yields across various regions of the world can thus be partially attributed to the quality of seed used. Seed technology coupled with agronomic innovations (plant spacing, tillage etc) can have significant impact on crop yields.

Intensive Farming

Intensive farming is an agricultural production system characterized by high use of inputs such as capital, labour, or heavy use of pesticides and chemical fertilizers relative to land area to obtain higher output per unit land. It involves innovation in agricultural machinery, farming methods and techniques for achieving economies of scale in production and creation of new markets for consumption. Such farming techniques can increase productivity of farms drastically. One such productivity enhancing technique is SRI (Systematic Rice Intensification) which is being practiced in various parts of the country to improve yields.

Case Study

Systematic Rice Intensification (SRI) is a methodology aimed at increasing the yield of rice using the following principles:

- rice field soils are kept moist rather than saturated as this improves root growth and supports the growth and diversity of aerobic soil organisms. This reduces the water requirement by half.
- rice plants are planted singly and spaced optimally widely to permit more growth of roots and canopy and to keep all leaves photo synthetically active; and
- rice seedlings are transplanted when young, less than 15 days old with just two leaves, quickly, shallow and carefully, to avoid trauma to roots and to minimize transplant shock.
- When SRI is combined with other techniques like use of fertilizers and mechanization the impact on yield is increased.

Andhra Pradesh:

SRI was introduced in Andhra Pradesh in kharif 2003 in all 22 districts of the state. The state gained many advantages by using this system

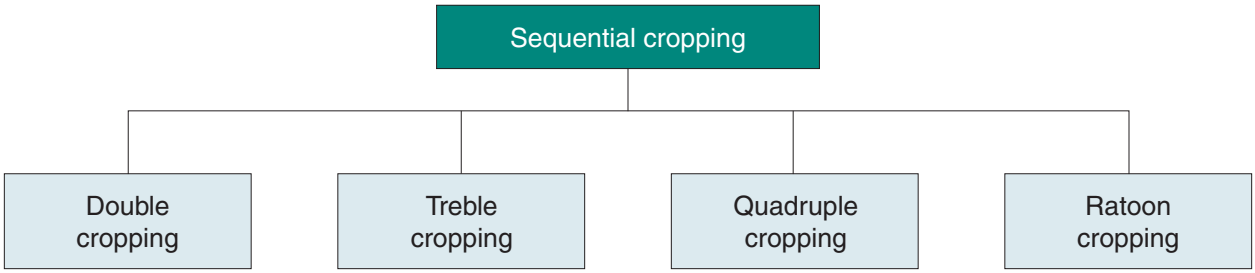
- Number of grains increased by 38-66%, with an overall average increase of 48% when compared with conventional flooding
- Grain yield increased between 21 – 30% with overall increase of 25%
- SRI cultivation practice was cheaper by 6-19% for farmers as compared to conventional cultivation methods
- Gross income grew by an average of 28% and net income by 65%

Sequential-cropping

Sequential-cropping is the practice of growing two or more crops in the same space during a single growing season where the succeeding crop is planted after the preceding crop has been harvested.

This allows for more efficient use of growth resources including light, nutrients, soil and water. The increasing population puts pressure on land to increase productivity per unit area, unit time and for unit resource used.

There are various cropping systems which can be followed:



Output Factors:

Better Farm to Agribusiness Linkages

Innovative farm to agribusiness linkages will drive disintermediation and enable hassle free procurement of produce. These linkages help in increasing the bargaining power of small farmers and improves their income from the marketplace hence increasing agricultural viability.

There are three different models to strengthen the link from farms to agribusinesses:-

Contract Farming

Farmer

↕

Buyer

The buyer and farmer form an agreement with conditions on quantity, quality, delivery schedule in lieu of pre determined price and production support

- This is primarily a buyer driven model with large corporate companies such as Pepsi Co and ITC. initiating it.
- In this way farmers can bypass the intermediaries and sell directly to large corporate companies.
- The farmers get pre determined price for their produce and technology support whereas the companies get a secure supply.

Agricultural Cooperatives

Produce from multiple farmers

Co Operative

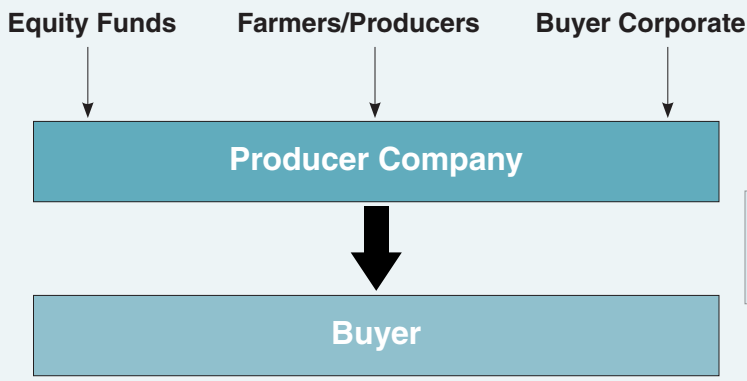
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Buyer

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.

- This is primarily a producer driven model with farmers coming together to form a co-operative
- It allows the buyers to deal with aggregators rather than individual farmers
- The co-operative performs the role of an intermediary while providing support for overhead tasks to farmers
- In India, currently most of the farm co-operatives are state controlled with limited success in sectors other than dairy

Farmer Equity Model



The buyer has a stronger grip on the supply chain while producers earn a profit share.

- It ensures direct equity stake of the producer in the producer company.
- Provides ease of interaction for buyer companies with farmers
- Higher producer commitment
- Due to its structure, the producer company has less restrictive borrowing and credit norms.

Chapter 4



Way Forward

Although agriculture is a state subject, even policies implemented by centre have an impact on it, for example, centre enacted MNREGA which has impacted agriculture. Going forward, the state government and central government can undertake a number of initiatives to make agriculture from productive and attractive:-

State Government:

- Free up land lease market
- Custom hiring model
- APMC Reform

Central Government:

- MNREGA reforms
- Invest in Research

State Government Initiatives

Free up Land Lease Market

Landholding sizes in India have been reducing over the years from 1.33 Ha in 2001 to 1.13 Ha in 2011 owing to fragmentation of holdings. Various tenancy regulations in India have restricted the consolidation of holdings which is an essential step in this sector. Increase in landholding sizes can, above all,

1. Improve viability of mechanization
2. Improve farmers access to credit
3. Improve returns per farmer

The extent and nature of agricultural tenancy regulation and restriction varies from state to state. The states, however, do fall into four general categories:

- Virtual ban on all agricultural tenancies: Kerala, Jammu and Kashmir.
- General prohibition on agricultural tenancies, but exempt certain categories of persons such as widows, minors, marginal holders and/or members of the armed forces: Karnataka, Himachal Pradesh, Madhya Pradesh, Uttar Pradesh, Orissa and Telangana area of Andhra Pradesh.
- No explicit prohibition on tenancy, but discourage tenancies by empowering tenants with protected rights on the tenanted land, either as perpetual tenants or through rights to purchase within a specific period: West Bengal, Punjab, Haryana, Gujarat, Maharashtra, Bihar, and Assam.
- Few restrictions on tenancies, although establishment of minimum lengths of tenancies and/or maximum rent levels: Rajasthan, Tamil Nadu and non-Telangana areas of Andhra Pradesh.

As opportunities in the non-farm economy increase, tenancy markets can facilitate a broader choice of livelihood opportunities such as migration, specialization, and investment. Households better suited to pursue non-farm livelihoods will be benefited if they are able to rent out their land for others to cultivate. In order to ensure that capital is used rationally on small farms, it would be advisable to free up the land lease market so that a market guided optimal holding size evolves, ensuring rational utilization of land, labour and capital.

Suggested reforms include:

- Ensure that the landowner is not dispossessed of his land in the process of leasing and that the lessee has no tenancy rights.
- Prolonging the lease period to 10-15 years and removing any ceiling on size of lease to enable corporate to invest in technology to make the farms more productive.
- Ensure that the land automatically reverts back to the farmers/landowners at the expiry of the lease period.
- These steps would help farmers and private sector companies to aggregate agricultural land and invest in farm technology, drip irrigation and best practices to enhance productivity and quality of agricultural produce.

Custom Hiring

Custom hiring models can be put in place more actively by state governments whereby farm machinery is available to farmers on a pay per use basis. This reduces the capital requirement of farmers while giving them the opportunity to mechanize farming. It will be especially beneficial for small and marginal farmers who have small landholdings which make the fixed cost of buying farm machinery prohibitive.

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. For instance, severe labour 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.

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. In such a situation, custom hiring is believed to be best suited model for accelerating farm mechanization in India. This model attempts to unbundle farm mechanization from ownership by ‘farmers only’ approach to creation of services.

While custom hiring is prevalent in India for some of the agriculture machinery, it is highly unorganized and sporadic in present situation. The reasons behind this boils down to few facts. Firstly, the custom hiring centres need a minimum scale for efficient operation as the activity is capital intensive.

They also have a longer gestation period due to lower asset utilization on account of the seasonal nature of agriculture demand. Secondly, there is a significant entry barrier for small entrepreneurs to establish these centres. Small entrepreneurs are neither credit worthy nor are there special policy incentives for promoting them. The third major factor that would determine the success of organized custom hiring in the country would be the credit policy of the banks. Generally, the banks insist on heavy collateral guarantees apart from hypothecation of farm equipments for giving loans and as a result, the response from entrepreneurs is decreasing.

So far, policy interventions have been focusing on creating individual ownership of agricultural equipments, which by far has failed to achieve desired level of farm mechanization in country. 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. There is an emergent need to explore options for creating congenial policy framework that would incentivize establishment of custom hiring centers on a business model in country.

Case Study

The Department of Agriculture under government of Madhya Pradesh has taken various steps to promote agriculture, one of them being custom hiring services. Machines are hired to the farmers, and other institutions for deep ploughing, land levelling, light cultivation etc.

- There are 37 chain type tractors with heavy duty Mold Board ploughs available for hire to farmers. These machines carry out deep ploughing.
- The Directorate owns a fleet of 76 bulldozers, which are used for leveling, bunding terracing of agricultural lands and construction of water harvesting structures.
- A fleet of 135 wheel tractors with equipments for light cultivation and other agricultural operations is available

These machine are hired to the farmers on custom basis at the rates prescribed by the Government for completion of different farm operations in a short duration.

APMC Reform

State governments had introduced agricultural produce market committee (APMC) acts to created a network of mandis (markets) where prices would be determined through auctions. The primary reason was to shield farmers from moneylenders and traders. Traders in these mandis needed a government license to operate and generated revenue through commissions paid by farmers and retailers. All sales and purchase could occur only at these mandis.

However, the APMC system become a breeding ground for abuse. The market power exerted by the middlemen or arhatiyas often resulted in collusion and exploitation of farmers. Auctions were not held and the tax on transactions was diverted elsewhere. This led to calls for reevaluation of the government's role in the agricultural market, culminating in the Model APMC Act in 2003. It has several provisions to increase private trade, but the state government still has a large role to play in facilitating the provisions.

In Punjab's Apni Mandis, for instance, farmers sell directly to buyers or consumers. Basic infrastructure like market yard, lighting etc. are provided by the APMCs. Farm level extension services of the relevant departments are also pooled in, securing the benefit of on-going Government scheme to "Apni Mandi" farmers. The benefits include input subsides, better quality seeds and loans at reasonable rates of interest from the Bank. Apni Mandis are being organized at about 26 cities and towns of the State including Chandigarh.

Such innovations do not always pan out. In Karnataka's Raitha Santhe, farmers were to sell directly to consumers under the management of gram panchayats or local authorities. However the project never took off due to the santhe being too far away from the city and poor connectivity.

Case Study

Gujarat suffered a drought in 1999-2000 but was able to bounce back and registered 8.2% growth annually in agriculture and allied sectors (includes forestry and fishery).

Since 2005, the state government has held the annual krishi mahotsav (agricultural conclave) where together farmers, scientists, officials, and ministers come together to discuss the way ahead. This is followed by a month-long mass contact program, in which krishi raths (agricultural department vehicles touring the state) visit every village to share knowledge and distribute kits to select farmers to promote new technology adoption through demonstration. Functionaries from different departments visit the villages at the same time providing farmers with extension services.

The canal irrigation potential was created through the Sardar Sarovar Project as well as a focus on community-based decentralized sources. Micro irrigation has been promoted through subsidies, and as a result, the area under micro-irrigation increased from nearly 20,000 hectares in 2003–04 to 140,000 hectares in 2009–10. Efforts were made to create the necessary agricultural infrastructure, including feeder lines to deliver electricity to farms and roads to connect almost all villages. To revive R&D, the Gujarat Agricultural University was divided into four smaller institutions, with focus on sharing knowledge with farmers. Gujarat has also enacted agricultural produce market committee reforms.



Central Government Initiatives

MGNREGA Reforms

Recommendation for Gram Panchayats: At present, the Gram Panchayats have a limited role in the selection of the works to be carried out in their villages. The introduction of seasonal calendars by the Gram Panchayats will ensure that the landless labourers get adequate time under the MGNREGA as well as on farms. This will lead to implementation of those activities which are relevant to increasing agriculture productivity such as weeding, identifying irrigation facilities in appropriate catchment areas where agriculture will be impacted, rain fed and drought prone areas. This will ensure the direct impact on agriculture projects for the benefit the community.

Recommendations on modifying current structure of MGNREGA to improve convergence with Agriculture: The inclusion of agricultural activities under the auspices of the MGNREGA is a demand of the farming community. It is suggested that the Government of India include of some agricultural activities (such as weeding, irrigating, sowing and cutting for harvesting) into the MGNREGA shelf of works and provide labour for specific crop interventions. This would ease some of the pressure on the farmers due to increasing wage rates and at the same time provide employment to the landless labourers.

To ensure that the big farmers do not take advantage of the potential merger of agriculture activities into MGNREGA, the following can be initiated:

- Identify the farms of small and marginalized farmers in the region and allocate labour requirement for activities that would help ease the burden of hiring expensive labour.
- Ensure that large farmers pay a percentage of the wages paid to the labourers for work done on agriculture activities.

Invest in Research

India's spending on agricultural research was about 0.4% of agricultural GDP in 2009. This is low when compared to the spend by Brazil (1.8%) and sub-Saharan Africa (0.6%). This is a sign of lack of focus on research and translates into relatively little knowledge being created. Along with this, the existing knowledge base has not been effectively made available to farmers.

The Department of Agriculture has 751 extension workers per million farmers, fewer than the 926 available from private farmer associations and the 1,078 employed by producer cooperatives. There are numoureous way the government can boost agricultural research and its avilability-

1. Improve coordination among individual research institutions
2. Increase the engagement of farmers in extension services
3. Enhancing private-sector participation

Public extension will need to play an important role for poor farmers and in remote geographies. The Indian government has historically used television and radio (such as the Krishi Darshan TV show) as the medium to get information to farmers but that has to move to mobile innovations. Weather forecasts, new seed information, minimum support price information and tips on improved farming practices can be sent to farmers through mobile phones.

Case Study

In 2014, Arcadia Biosciences, Inc. and Maharashtra Hybrid Seeds Co. Ltd. (Mahyco) announced the achievement of development of Salt Tolerant technology for rice. Arcadia's Salt Tolerance (ST) technology enables plants to produce increased yields under saline water and soil conditions. Mahyco has demonstrated that rice varieties incorporating ST technology showed substantial increases in key plant performance measures such as plant growth and yield. This development will be beneficial in expanding the range of usable acreage for crop production and reducing requirements for fresh water.

Conclusion

India's goals of attaining food security, an 8% GDP growth rate and enhancing rural income cannot be achieved without higher agriculture growth rate which has been 4.1% in the last five years.

Between 2004-05 and 2011-12 was the first instance of workforce reduction in agriculture declined by around 30.57 million in spite of the total size of workforce continued to increase. Higher remuneration and growth of opportunities in alternate sectors is leading to the migration of workforce away from agriculture. This has resulted in labour shortage, increase in wages and consequent escalation of cost of cultivation. Government schemes like MGNREGA are affecting labour adversely and need immediate policy interventions

If adequate measures are not taken to reduce labour requirement, productivity of farms may get affected and this may have spiraling effects on output prices. Most nations facing this issue have responded by widespread use of technology on farms to replace many traditional farming occupations, a trend India will soon have to follow.

Key stakeholders like farmers, industry and government need to take adequate steps to tackle the problem of labour shortage. Indian labourers are 4 times more productive in industry and 6 times more productive in services as compared to agriculture. The factors to be considered to reduce agriculture labour requirement are:

Input factors:

- Immediate Effect: Adopt techniques that can replace and/or reduce the requirement of human labour such as **mechanization**, promoting use **of labour reducing seed technology** and use of **herbicides**
- Long Term Effect: Increase returns from agriculture through **research driven improvements in seed technology, intensive farming technique and sequential cropping technique**

Output factors

- Strengthening linkages to agri-businesses via contract farming, agriculture cooperatives and farmer equity model

The state government and central government can undertake a number of initiatives to make agriculture from productive and remunerative:-

State Government:

- **Free up land lease market:** The land lease market is encumbered by tenancy regulations restricting the consolidation of holdings. A few suggested reforms are to ensure that the landowner is not dispossessed of his land in the process of leasing and that the lessee has no tenancy rights, prolong the lease period to 10-15 years and remove any ceiling on size of lease and ensure that the land automatically reverts back to the farmers/ landowners at the expiry of the lease period.

- Custom hiring model: While the model is prevalent in India for some of the agriculture machinery, it is highly unorganized and sporadic in present situation. Custom hiring models can be put in place more actively by state governments whereby farm machinery is available to farmers on a pay per use basis. This reduces the capital requirement of farmers while giving them the opportunity to mechanize farming.
- APMC Reform: The Model APMC Act in 2003 has several provisions to increase private trade, but state governments still has a large role to play in facilitating the provisions. State government may facilitate sale of agriculture produce directly from farmers to consumers, reducing the role of middlemen.

Central Government:

- MNREGA reforms: It is suggested that seasonal calendars be introduced by the Gram Panchayats to ensure that the landless labourers get adequate time under the MGNREGA as well as on farms. Also some agricultural activities (such as weeding, irrigating, sowing and cutting for harvesting) should be included into the MGNREGA shelf of works. This can ease some of the pressure on the farmers due to increasing wage rates and provide employment to the landless labourers.
- Invest in Research: India's spends on agricultural research is lower than of Sub-Saharan Africa. The central government can boost agricultural research and its availability by improving coordination among individual research institutions, increasing the engagement of farmers in extension services and enhancing private-sector participation.



Annexure

Estimation of Labour Force Reduction in Agriculture by 2019-20

	2005-06	2011-12	CAGR	2019-20	Expected CAGR
Population	1098	1210	1.6%	1345	1.2%
Workforce Size	453	467	0.5%	498	0.8%
Workforce Population Ration	41%	38.6%		37%	
Employment in Agriculture	**263**	**228**	**-2.3%**	**205**	**-1.3%**
Employment in Secondary Sector	85	111	4.5%	138	2.8%
Employment in Teritary Sector	105	128	3.3%	155	2.4%
Growth in GDP		8.3%		5.3%	*projected*
Growth in Agri GDP		3.8%		3%	*projected*
Growth in Industrial (Secondary) GDP		8.0%		4.9%	*projected*
Growth in ServicesGDP		9.8		7.1%	*projected*
Reduction in Agricultural Workforce by 2020	**23**				

Source: Planning Commission, Economic Intelligence Unit, KPMG Analysis