



## IMPACT OF NEW AGRICULTURAL TECHNOLOGY ON EMPLOYMENT AND INCOME OF FARMERS IN INDIA – AN OVERVIEW

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### ABSTRACT :

*Having discussed mandatory requirements in the previous article, the present article proceeds to analyze the impact of new agricultural Technology on Employment and Income of farmers in India – An Overview. In this article, importance of , agricultural technology and development, irrigation technology, technology dissemination, agricultural extension programmes, Indian Council of Agricultural Research relationship between technology and agricultural Green Revolution, achievements of new agricultural strategy boost to the production, employment growth, employments trends, growth of rural non-farm employment, doubling farmers income, state of Indian' , farmers income, status of farm mechanization in India have been discussed.*

**KEYWORDS :** *New Agricultural Technology, GDP, finance technology, distribution, Irrigation and Green Revolution.*

### INTRODUCTION

Agriculture is an important part of India's economy and at present it is among the top two farm producers in the world. This sector provides approximately 52 per cent of the total number of jobs available in India and contributes around 18.1 per cent to GDP. Agriculture is the only means of living for almost two-third of the employed class in India. As being stated by the economic data of financial year 2018-19 has acquired 7.39 per cent of India's GDP. The agricultural sector of India has occupied almost 43per cent of India's geographical area.

Despite its role, Indian sector is plagued by several problems like depending on monsoon scarcity of finance technology, low price, low demand etc. But in recent days the new technologies are entering the field with a goal of agricultural development.

Productivity in is mainly depend on two sets of factors viz., technological and institutional. Among the technological factors is the use of agricultural input sand methods such as improved seeds, fertilizers, improved ploughs, tractors, harvesters, irrigation etc. We live in a world where technology is at the heart of



our everyday lives. Technology can transform Indian by addressing challenges related to quality, quantity, distribution and storage adopting of technologies in sector has a lot of emphatics in total output, time consuming, farmer income and etc. On the other hand, the other hand, the entry of new technologies are occupies the work of labours. Thus, a new technology has a most effective impact on the product and also the labors, both negatively and positively, Since, There is a

need to evaluate the technology impacts on agriculture.

### IMPORTANCE OF NEW AGRICULTURAL TECHNOLOGY

Farmers no longer have to apply water, fertilizer, and pesticides uniformly across entire fields. Instead, they can use the minimum quantities required and target very specific areas or even treat individual plants differently benefits include:

- Higher crop productivity
- Decreased use of water, fertilizer, and pesticides, which in turn keeps food prices down.
- Reduced impact on natural ecosystems.
- Less run-off of chemicals into rivers and ground water.
- Increased worker safety.

In addition, robotic technologies enable more reliable monitoring and management of natural resources, such as air and water quality. It also gives producers greater control over plant and animal production, processing distribution and storage, which results in:

- Greater efficiencies and lower price.
- Safer growing conditions and safer foods.
- Reduced environmental and ecological impact.

### STATEMENT OF THE PROBLEM

Agriculture in India has experienced a substantial impact of new technology during the past decade. The new technology is characterized by frequent application of tillage, monoculture, application of inorganic fertilizer, irrigation, chemical pest control and genetic manipulation of crop plants and with the development of more complicated machines farming methods took a great leap forward. The same practices, however also may give rise to such labour saving machines and devices as tractors rotary ploughs harrows and tillers to go with them, electrically operated tube wells, sprayers and threshers that is the modern equipment already present on some India forms.

The new agricultural techniques are incurring. The production and income of farmer but now-a-days agricultural employment opportunities are decreasing and major farmers are no sufficient idea and knowledge to use new agricultural techniques. The present study goes to find the role of modern agricultural technology on employment and income in study area.

### REVIEW OF LITERATURE

The review of past literature forms an integral part of any systematic research work. The research finding of the previous studies do become quite useful in planning and conducting the research.

**Desai (1970)** studied six important crops on the basis of 176 farmers in South Saurashtra region and revealed that improved wheat used less manpower than the local one because of the shorter growth period for all other crops viz., Government, bajra, jowar and cotton improved varieties used more labour.

**Singh and Rai (1981)** decomposed total change in employment due to adoption of new dry land technology in Haryana state. They observed that in Hissar zone the contribution of technology and capital employment change was positive in all the size groups. In Narnaul zone, the contribution of technology component was however, negative. The interaction effect of capital and technology was positive and it contributed more in increasing employment than a single component in both the zones.

**Croppenstedt et al. (2003)** observed that fertilizers adoption was restricted in Ethiopia the lack of well functioning credit markets was another barrier in adoption of new technology. This study found that farmers could not adopt new technology because of lack of funds although they got half profit.

**Mathur and Sharma (2009)** Studied the role of ICT sector for human development in India by enabling access to information, creation of employment, improving the quality of life, better livelihood

opportunities in rural areas, growth of and the related issues. ICT has reduced information asymmetry and a gap between rich and poor. The ICT density is continuously moving up in the rural area facilitating agricultural information to rural people.

**Soorya Anand (2018)** in this study Indian employment growth in issues the growth of employment in is an indispensable aspect of confront with as any other developmental goals in India. Recent employment trends portray an increase in growth of employment, but the contribution of agricultural sector was minimal. The growth of non-agricultural sectors and the anomalies within the agricultural sector have accentuated the decline of output growth in Indian. The growth in employment should be at par with the output growth in agriculture.

**Sharma H.L. (2018)** in this study role of allied sector in the rural development, and allied sector play a vital and critical role in a development economy like India by reducing poverty, unemployment and inequality, ensuring food security and achieving sustainable development. To improve productivity in the focus of policies has been on the rational use of inputs like seeds, water, fertilizers and machinery.

## OBJECTIVES

The present study was undertaken with the following objectives:

1. To study the role of new agricultural technology on employment and income of farmer in India.
2. To study the impact of new agricultural technology on production and productivity in the study region.
3. To assess the change in employment and income of farmer after adoption of technology in the study area.
4. To identify the different methods of technology adopted by farmers in the region.

## HYPOTHESES

In order to achieve the above objectives, the present study has set for the following hypotheses:

1. New agricultural technology reduces the employment opportunities of farmers in the study area.
2. After adoption of new agricultural technology enhances farmers' income in the study area.
3. There is less participation of farmers in use of agricultural technology in the study area.

## METHODOLOGY

Secondary data collected from newspapers, publications such as text books, magazine, articles, book reviews, and other documents of the society of the society to study the role of new agricultural technology on employment and income of farmer.

## IMPORTANCE OF IN THE INDIAN ECONOMY

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

Accelerating to a higher agricultural growth rate is critical for a variety of reasons attaining food security. Achieving an overall 8% growth rate in GDP as envisaged in the 12<sup>th</sup> five year plan and enhancing rural income which presently is abysmally low. Irrespective of the relating contribution, the average growth rate in the sector in the last five years till 2013-14 taking into account the advance estimated for 2013-14 has been 4.1%. The twelfth five year plan also envisages a similar growth rate.

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

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 emerged and can become an insurmountable problem in the foreseeable future is the issue of shortage of agricultural labour.

### TECHNOLOGY

It includes wide range of improved techniques, methods, equipments, processes and products by which farmers can increase their production and productivity, input profit and overall quality of life. Generally, technology is used to improve the human condition. The natural environment or to carry out other socio-economic activities. Technology is a complex blend of materials, processes and knowledge.

### CLASSIFICATION OF AGRICULTURAL TECHNOLOGY

Agricultural technology may be classified into two major categories:

1. Hardware (material technology) : where knowledge is embodied into a technological product such as tools, equipments, agrochemicals, seed materials, medicines etc.
2. Software (Knowledge based technology) : It includes technology knowledge, management skills and other processes that farmers and rural people need for better production in their enterprises. The word technology can also be used to refer to a collection of techniques.

### TECHNOLOGY DEVELOPMENT

In the conventional or central source view of agricultural research and development technology emanates from upstream activities in the formal research system and is adapted by Dourisfrem research until it is ready for discrimination to farmers. Some people have used and analogy from home economics rather than hydrology, speaking of quarter baked (national), half baked (parliamentary) and fully baked (development) technology. Others have referred to the development of experimental. Prototype and half the shelf technologies, all these analyses imply a linear process of technology development and dissemination, culminating in the adoption of new technologies by farmers. In practice however, agricultural innovations are derived not only from the laboratories and research stations of the national and international centres but from multiple sources. These sources include research minded farmers, innovative research practitioners at the local level research minded administrators, non government organizations (NGOs) private corporations and extension agencies.

### IRRIGATION TECHNOLOGY

Water is the undoubtedly the fine qua mom for all irrigation activities, worldwide particularly in India an unpredictable monsoon coupled with an increasing demand for food production has induced an imperative need for irrigation options other than those that are either extremely labourious and time consuming or simply too expensive for small and marginal farmers. Electric and diesel pumps can be used to extract ground water for irrigation any large acres of land, however, some cost effective technologies that are being availed by a major section of farmers are as follows:

- A. Treadle pump:** It is a foot operated water lifting device that can irrigate small plots of land of small holders in regions that have higher under table (not deeper than 25 feet). A treadle pump is a low cost system, simple in design and easily manageable it appropriately answers the irrigation need for the small farmers.
- B. Drip irrigation technology:** Drip irrigation is a water saving technology which enables slow and regular application of water directly to the roots of the plants through a network of economically designed plastic pipes and low discharge emitters. It maximizes crop productivity through increase in the crop yield and also the area for cultivation and protects the environment through conserving soil, water and fertilizer resources thus increasing the farmers' income.

## TECHNOLOGY DISSEMINATION

Technology dissemination is a system in which package of technology and services which include appropriate technology, relevant media system, credit input supply system prices and marketing and trained manpower are put into practice to increase agricultural productivity Ways to technology dissemination:

1. Government
2. Private.

## AGRICULTURAL EXTENSION PROGRAMMES

Major extension programmes are implemented under the Sum Mission or Agricultural Extension (SAME) of the National Mission of Agricultural Extension and Technology (NMAET) such are

1. Support to state extension programmes for extension reforms:
  - Under implementation in 652 districts of 29 states and 3 UTs of the country.
  - Promotes decentralized farmer driven and farmer accountable extension system through an institutional arrangement for technology dissemination in the form of an Agricultural Technology Management Agency (ATMA) at district level.
2. Mass media support to agricultural extension.
  - related programmes are broadcast through 180 narrow casting centre's, 18 regional centre's and 1 national centers of Doordarshan Kendras and 96 FM Station radio for 30 Minutes five/six days a week.
3. Agro –climatic and agro-business centre's.
  - Two months training is imparted to eligible selected candidates through nodal training institutes identified across the country.
4. Kisan Call Centre's (KCCs)
  - Provides related information through toll free telephone lines.
  - A countrywide common eleven digit number 1800-180-1551 has been allotted for kisan call centre. The number is accessible through all mobile phones and landlines of all telecom networks' including private services providers relies to the farmers' queries are given in 22 local languages.
5. Exhibitions and fairs.
  - Regional agricultural fairs are organized by the state agricultural universities / ICAR institutes with the support of DAC to disseminate information on development of agriculture.
6. Information and communication telecommunication (ICT) Interventions.
  - DAC has developed 80 portals, applications and websites covering both the headquarters and its field offices/directorates.
  - The important portals include seed net DACNET, AGMARKNET, RKUY, ATMA, NHM, INTRADAC, NFSM and APY.
  - A farmer's portal has been developed to provide advisories to farmers under different subject matter areas up to block level after integrating large number of websites across the country. A SMS portal has also been under operation since July 2013 providing SMS based advisories to farmers as per their priority.

## Indian Council of Agricultural Research

### Krishi Vijyan Kendra

- The Indian Council of Agricultural Research (ICAR) has created a network of 642 krishi Vijyan Kendras (KVKs) in the country to facilitate farmers' access to agricultural technology generated by national agricultural research System. As a part of this facilitation process, the KVKs access, refine and demonstrate various technologies to find out the suitability and to demonstrate the production potential in farmers' fields.
- Besides this, extension related components of other sub missions under NMAET are also converged.

## RELATIONSHIP BETWEEN TECHNOLOGY AND AGRICULTURE IN INDIA

Till 1970s of the last century, Indian was in a poor condition. The agrarian economy was largely consumption oriented and there were poor irrigation facilities and simple agricultural implements, agricultural yield was very low and dependency on nature was very high.

The food grains were not enough to feed the population with a view to augment the yield. The Indian government had no option but to introduce green revolution. The green revolution was a movement towards excessive mechanization of agriculture. The agriculturists were motivated and assisted to undertake the technology based farming, irrigation facilities were developed.

Hybrid varieties of seeds were made available to the farmers. The conspicuous result of the green revolution was the augmentation of agricultural yield and a shift from poor consumption oriented to modern market oriented farming since then, there has not been any crisis of food grains in the country. However, the results of green revolution were not uniform been uniform impact on the regions and all categories of farmers.

The impact on these crops had not been as much as on the wheat. It is only the big farmers who gained much Gujarat, Punjab and Haryana benefited more than other states. In Uttar Pradesh the western parts benefited more than the eastern ones. Today, the agriculture has been highly mechanized. The process of harvesting which used to be months long involving a large number of people have been reduced to a few days work without engaging any major manpower.

The use of technology has reduced the risk factors in particularly these unleashed by nature not only that quick processing has been made possible, technology has reached farmers' dependency on and vulnerability to the nature.

## GREEN REVOLUTION

As a result of the new agricultural strategy area under improved seeds has gone up since 1966. The new varieties are of short term duration and consequently instead of growing one crop, two crops and sometimes even three crops are grown. In the case of wheat, unprecedented enthusiasm had prevailed among farmers in Punjab, Haryana, Delhi, Rajasthan and Western Uttar Pradesh for the new Mexican varieties like Lerma, Roja, Sonara-64, Kalyan and PV18 and a situation developed in which the demand for seeds by the farmers exceeded the supply.

Traditional relies heavily on indigenous inputs such as the use of organic manures, sees, simple ploughs and other primitive agricultural tools, bullocks etc. Modern technology on the other consists of chemical fertilizers, pesticides, improved varieties of seeds including hybrid seeds, agricultural machinery, extensive irrigations use of diesel and electric power etc. Since 1966, the use of modern agricultural inputs had increased at a compound rate of 10 per cent per annum in contrast to the traditional inputs rising at the rate of only one per cent per annum during the same period. The new agricultural technology uses such resources like fertilizers pesticides, agricultural machinery est., which is produced outside the agricultural sector. As a result, industries supplying the modern farm inputs are growing at a rapid rate massive programmes of farm mechanization and irrigation have also led to an increase in the consumption of electricity and diesel in rural areas.

## Achievements of the new Agricultural Strategy boost to the Production of Cereals

The major achievement of the new strategy is to boost the production of major cereals viz., wheat and rice. Table 1, gives the production of principal food crops during the last 50 years. A close look at the table reveals the increase in rice production from 35 million tons in 1960-61 to 107 million tons in 2013-14 signifying a breakthrough in this major crop of India. The yield per hectare has also recorded an improvement from a little more than 11 quintals in 1960-61 to nearly 24 quintals now.

**Table-1 Progress in food grain production (million tons)**

Production	1960-61	1990-91	2013-14	2014-15
Rice	35	75	107	105
Wheat	11	55	96	89
Coarse cereals	23	32	43	42
Total Cereals	69	162	246	236
Total Pulses	13	14	19	17
Total food grains	82	176	265	253

Source: Ministry of Government of India. 2009, Economic Survey, 2014-15

The production of wheat which stood at 11 million tons in 1960-61 rose to 96 million tons in 2013-14. Part of the increase in wheat production can be attributed to an extension of the area but the yield per hectare rose from 8.5 quintals to 30.8 quintals per hectare signifying 3.6 times rise in the last 53 years.

### EMPLOYMENT GROWTH IN INDIAN

The economic was reforms and globalization policies initiated in India. Since 1991, heralds a new trajectory of development which entails the structural transformation of the economy with the liberalization policies. Indian economy has witnessed new facets of development by making the economy more market and service oriented and enhancement of foreign investments. This economic transition has paved the way for economic growth to rise to about 8 to 10 per cent which hovered around 4 per cent in the pre-transition period (Janakarajan *et al.*, 2015).

Albeit, the economic reforms and globalization policies have resulted in agricultural transformation of the economy, the flipside is that the growth in employment from 1990-2000 to 2004-15 has occurred after the phase of deterioration of and a period of jobless growth from 1993-94 to 1999-2000 (Abraham, 2008).

As remains the backbone of Indian economy, the absolute growth and development of our economy relies totally on the growth of sector. But the advent of behind from its stipulated growth patterns. Despite the growth in employment the output employment, the output remains static which poses a serious threat to the overall development of our economy.

### EMPLOYMENT TRENDS IN INDIA.

The rural employment crisis in India is directly linked to the sector on which nearly 60 per cent of the India's labour force relies on. The growth of has dropped to 2% since 1996-97. The share of agriculture in GDP has also declined to about 20 per cent (Acharya, 2007). Nonetheless, the rural employment in the Indian economy had shown a positive growth during these periods. The growth of rural employment despite the slow progress of agricultural growth reflects the crisis in agricultural sector which have serious implications for the growth of rural unemployment despite the slow progress of agricultural growth reflects the crisis in agricultural sector which have serious implications for the growth of rural unemployment and to the economy as a whole. Lack of farm employment persuades the unemployed to enter into other non-farm employment opportunities available to them. This will intact slacken the productivity of sector and increases rural non-farm employment. Hence the rural labour market has undergone a spectacular change from farm activities to non-farm activities.

**Table-2 Employment shares of major sectors (%)**

Period		Industries (%)	Services (%)
2011	48.8	23.45	27.75
2012	47	24.36	28.364
2013	46.66	23.77	29.55
2014	45.52	23.94	30.54
2015	44.36	23.89	31.74
2016	43.44	23.72	32.84
2017	42.74	23.79	33.48

Source: *Employment Trends in India, 2017*

Table 2 depicts the percentage share of different sectors over the years. The share of agricultural sector was worth noting that in the year 2001, the share was 48.8% at the same time the share of industry and service sectors was 23.45% and 27.75% respectively. From 2012 to 2017, the share of agricultural sector was 47%, 46.67%, 45.52%, 44.36%, 43.44% and 42.74% respectively. The percentage share has come down to 42.74% in 2017 whereas industrial sector and service sector shows increased to 23.79% and 33.48% respectively. The share of agricultural sector in employment has shown a negative trend and declines over the years.

**Table-3 Sectoral growth rates of rural employment (%)**

Particulars	1983-84 to 1993-94	1993-94 to 1999-2000	1999-2000 to 2009-10
Agricultural	1.37	0.69	0.19
Non Agricultural	3.23	3.64	4.17
Manufacturing	2.02	2.74	0.63
Construction	5.35	8.27	12.04
Trade/Hotels	3.76	4.88	3.41
Transport/ communication	7.35	6.56	4.44
Financial services	-	6.13	5.20
Other Services	-	0.08	0.77

Source: *Planning Commission Data Book, 2014*

Table 3 depicts the declining employment growth in Indian economy. The rural non-farm employment shows a continuous growth from 3.23 per cent in 1983-1993-94 to 4.03 per cent during 1999-2000 to 2009-0. In 1993-94 to 2004-05 it was 3.64 per cent non-farm sector also includes certain sub sectors such as manufacturing, construction, hotels and trade, transport/communication, financial services and other services.

**Table-4 Agricultural employment growth rates (%)**

Particulars	1983-84 to 1993-94	1993-94 to 1999-2000	1999-2000 to 2009-10
Agricultural self employment	0.53	2.89	1.01
Agricultural wage employment	1.06	-3.18	0.89
Total Agricultural employment	0.03	0.85	0.45
Agricultural GDP	2.88	1.76	2.37
Implied employment elasticity	0.01	0.49	0.17
Total Agricultural Wage rate	2.74	1.46	2.15

Source: *Planning Commission Data Book, 2014*



The above table 4 depicts the scenario of employment growth in . Over the years, the data shows that agricultural wage employment presents a predominant that needs to be addressed. In 1993-94 to 1999-2000 the agricultural wage employment was 1.06% which reduces to -3.18 in 1999-2000 to 0.85 in 1999-2000 to 2004-05. Though agricultural self employment also declined from 0.53% in 1993-94 to 1999-2000 it increases to 2.89 in 2004-05 to 2009-10. In short. The employment growths rate in shows a declining trend over the years.

## **DOUBLING OF FARMERS' INCOME**

### **Agricultural growth and farmers' welfare**

Continuing critical role of in India. Agriculture is the principal source of livelihood for about 48% of the population of the country. It caters to the food security of the nation besides generating exportable surplus. It provides the bulk of wage goods required in non- sector and most of the raw materials for the industrial sector. Agriculture with its allied sectors is unquestionably the largest livelihood provider in India more so in the vast rural geographies. It contributes significantly to the gross domestic product (GDP) of the nation's overall economy though in terms of percentage, it has been declining. This also highlights the need for increasing the size of agri-GDP (agri-GVA since 2012-13), so that per capital share of the farmers dependent on the sector improves.

Indian sector has been undergoing a structural change with respect to its farm size. Cropping pattern and share in the national GVA. It would benefit all concerned with policy formulation and implementation to recognize that sector is the largest private enterprise in the country. It is logical, therefore, to enable the spirit of private enterprise of the farmers to excel it. So for the nation's broad focus has been on achieving higher production and realize food security which has been done with satisfaction. However, it has also spawned a number of issues that challenge sustainability and one seems agrarian crisis today. In the wake of this, it is more appropriate to adopt farm income centric approach in preference to production at any cost as the basis of agricultural policy. The farmer has to be facilitated to operate his farm enterprise on the basis of profitable returns.

### **State of India's: An examination**

As per 2011 agricultural census, number of agricultural workers in the country were 26.3 crore comprising 11.87 crore of cultivators and 14.43 crore of agricultural labourers. This in terms of percentage of the total number of agricultural workers accounted for 45.1 per cent and 54.9 per cent respectively. In comparison, the corresponding figures for the year 1951 were 9.72 crore of total number of agricultural workers consisting of 6.99 crore of cultivators (71.9 per cent) and 2.73 crore of agricultural labourers (28.1 per cent). It is clear that not only has there been an increase in the total number of agricultural workers, but also relative to the total number of cultivators the numbers of agricultural labourers have increased. It is also important to learn from these statistics, that while the percentage of farmer population below poverty line in the same year was as low as 0.5, 3.2 and 4.3 in the states of Punjab, Kerala and Haryana respectively. In Contrast, the percentage below poverty line was as high as 45.3, 35.1, 33 and 32.1 in the states of Jharkhand, Chhatisgarh, Assam and Odisha respectively.

### **Farmers Income doubled in India**

The purchasing power of the farmer depends upon his average monthly income. The average monthly income of the farmer is available from the situation assessment survey of farmers conducted in 2003 (hereafter referred to as 2003 survey) and situation assessment survey of agricultural households, 2013 (hereafter referred to as 2013 survey). The comparison of these two data sets based on 2003 and 2013 surveys highlights the change in the average monthly income of the farmers. S. Chandrasekhar and Nirupam Mehrotra in their Article "Doubling of Farmers" income by 2022 what would it take? Show the ratio of changes in the real (in contrast to nominal) average income of the farmers in different states in the year 2013 as compared to the year 2003. Based on their own computation from unit level data, see the table 5.

**Table-5 Ratio of average monthly income from different sources in 2013 to the average monthly income from different sources in 2003**

Major States	Income from wages	Net income from cultivation	Net income from farming of animals	Net income from non-farm business	Total income
Punjab	1.56	1.80	2.39	0.68	1.67
Haryana	1.20	1.85	2.39	0.57	1.93
Rajasthan	1.36	1.60	3.99	1.63	1.63
Uttar Pradesh	1.00	1.38	3.76	0.99	1.31
Bihar	1.28	0.80	0.44	0.55	0.83
Assam	0.69	1.16	2.45	0.51	1.02
West Bengal	1.18	0.62	1.44	0.76	0.91
Jharkhand	1.09	0.78	5.88	0.56	1.13
Odisha	1.41	1.79	33.35	1.54	2.08
Chhatisgarh	1.25	2.05	1.58	0.00	1.57
Madhya Pradesh	1.17	1.48	1.58	0.59	1.75
Gujarat	1.34	1.18	1.84	1.30	1.36
Maharashtra	1.29	1.54	1.82	1.49	1.47
Andhra Pradesh	1.59	1.56	3.61	1.07	1.64
Karnataka	1.27	1.66	1.92	1.49	1.52
Kerala	1.21	1.43	1.58	1.62	1.36
Tamil Nadu	1.24	1.16	3.93	2.43	1.48
All India	1.22	1.32	3.21	1.00	1.34

*Note: For the sake of compatibility, the authors adjusted 2003 income to 2013 prices using CPL-AL so the comparison is in real terms and not animal terms.*

*Source: Author's computations from unit level data.*

As seen from table 5 while Odisha is the only state that was able to more than double the real income of the farmers between these two survey periods, few other states like Haryana, Madhya Pradesh, Andhra Pradesh, Rajasthan, Chhatisgarh and Karnataka were also able to achieve substantive increase in the real income of the farmers. It may be appreciated that the changes in income were in real terms in contrast to nominal income real income refers to the estimates after deflating the nominal income using an appropriate deflator like inflation rate. This shows that the feasibility that exists for doubling the real income of the farmers within a given period of time.

### STATUS OF FARM MECHANIZATION IN INDIA

India ranks second in the world as far as farm production is concerned but the economic contribution of to India's GDP is declining continuously with the country's broad based economic growth. In India 63% holdings are less than 1 ha accounting for 19 per cent of the total operated area whereas over 86 per cent of holdings are less than 2 ha accounting for nearly 40 per cent of the total area. Fragmentation of farm holdings is major concern in this respect and the average size of holdings has shrunk from 2.82 ha in 1970-71 to 1.1 ha in 2010-11.

India ranks second in production of wheat and rice and third in pulses, Sugarcane, Vegetables, root and tuber crops, coconut, dry fruits, -based textile raw materials, inland fish and eggs (Singh et al., 2005). India produced 275.11 million metric tons (MT) of food grains during 2016-17 breaking all the earlier records. Table 6 shows the production achieved in different crop from 1950-51 to 2017-18.

**Table-6 Production of crops (million tons)**

Year	Rice	Wheat	Coarse cereals	Pulses	Total food grains
1950-51	21	6	15	8	51
1960-61	35	11	24	13	82
1970-71	42	24	31	12	108
1980-81	54	36	29	11	130
1990-91	74	55	33	14	176
2000-01	85	70	31	11	196
2010-11	96	87	43	18	244
2016-17	110	99	44	23	275
2017-18	112	99	45	25	280

Source: Agricultural Statistics at a Glance, 2016, Ministry of agriculture and Farmers Welfare.

The motivation to mechanize farming activities is primarily driven by a wish to increase a family's food security, increase household income or improve the quality of life. Farmers may fully use custom hiring services and reap significant economic and social benefits. The economic benefits will include increasing the efficiency of man power, reduction in input costs, increasing the net cultivated area, area undertaking timely operation, improving the quality of cultivation, increasing farm output, adopting crop diversification, reduction in harvesting and post harvesting losses and earning income through hiring farm poser services to others.

The agricultural sector has witnessed a substantial decline in use of animate power (animal and human power) in activities. The role of tractors in India reveals the increasing trend of tractorization in the country custom hiring of farm equipment is a prevalent practice in India particularly among small farmers for whom ownership of large equipment is expensive and uneconomical. Given the agricultural worker scarcity and the launch of several government programmes the adoption of farm mechanization is going to increase in future.

**Table-7 Aspects of Indian (1960-2010)**

Particulars	1960	1970	1980	1990	2000	2010
Agricultural land (Mha)	133	140	140	143	143	142
Irrigation pumps (million)	0.4	3.3	6.2	12.9	19.5	25
Irrigated area (%)	19	22	28	33	34	35
Cropping intensity	1.15	1.18	1.23	1.30	1.33	1.39
Fertilizer use (kg/ha)	2	15	39	88	125	150
Grain yield (Kg/ha)	700	860	1000	1300	1600	1900
Tractors (000s)	37	146	531	1200	2600	4000
Area per tractor (ha)	3600	960	260	120	55	36
Power tillers (000s)	0	9.5	16	31	100	155
Craft animals (million)	80.4	82.6	73.4	7.9	60.3	50

Source: Singh, 2015.

It is clear from the table that, details of Indian during the period from 1960 to 2010. The land increasing to 142 mega hectare in 2010 from 133 mega hectare in 1960 and irrigation pumps increasing to 25 million in the above said period. Further, as fare irrigated area is concerned also increasing to 35 per cent from 90 per cent in the same period. Cropping intensity fertilizers use also registered 1.39 from 1.15 and kg/hectare from 2 in the above mentioned period from extend grain yield increased to 1900 from 700 kg/hectare. Tractors 4000 from 37 and area per tractor declined to 36 hectare 3600 during the same period

and power tillers increased to 155 in 0. In craft animals declining to 50 million from 80.4 million during the period.

**Table-8 Percentage share of different farm power sources in Indian**

Year	Agricultural workers	Drought animal	Tractors	Power tillers	Diesel engines	Electric motors	Power (Kw/ha)
1971-72	10.64	52.86	8.45	0.11	17.16	10.79	0.424
1981-81	9.20	33.55	18.46	0.11	22.85	15.82	0.592
1991-91	7.22	20.50	26.14	0.16	21.14	24.84	0.907
2001-02	5.70	11.76	36.77	0.36	19.10	26.31	1.352
2005-06	5.39	9.097	38.45	0.44	20.09	25.66	1.498
2009-10	5.12	8.55	41.67	0.52	19.01	25.13	1.658

Source: Ministry of Government of India. State of Indian, 2011

Table 8 shows the increasing importance of mechanization in Indian in the last about four decades as indicated by changing relative shares of different types of power sources in Indian. The share of animal power has declined from 52.86 per cent in 1971.72 to only 8.55 per cent by the year 2009-10. Similarly, the share of agricultural workers has also declined from 10.64 per cent to hardly 5.12 per cent declining share of animal power has to be compensated by tractors power and also by electric motors.

The farm mechanization has been well received throughout the world as one of the most important elements of modernizing. The level and appropriate selection of agricultural machinery has direct impact on land and labour productivity, farm output and income, environmental safety and the quality of life of farmers in India. Agricultural machines also ensure timeliness of farm operation and increase work output per unit time suitability to small and medium farms, simple design and technology, versatility for use in several farm operations, affordability in terms of cost and profitability and most importantly repair and maintenance services are the basic requirements for the expansion of farm mechanization.

### CONCLUSION:

Having presented the background and relevance of the study with fairly exhaustive review of studies in the present article efforts are made to provide conceptualization of the impact of New Agricultural Technology on Employment and Income of Farmers in India – An Overview in the ensuing article.

This article discusses the new agricultural technology in India. Overview in this nodule covered, agricultural importance in the Indian economy, income of farmers, employment of farmers and new agricultural technologies in Indian overview.

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