



INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume3, Issue3)

Available online at www.ijariit.com

Digitization: A Paradigm Shift of Agriculture

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Abstract: *The Indian Agricultural sector provides employment to about 65% of the labour force, accounts for 27% of GDP, contributes 21% of total exports, and raw materials to several industries. Researchers show that 68% of the entire population of India is covered by the rural area and 58% of people depend on agriculture as their main source of livelihood. The fast Growing Population demands 50% of the increase in the production of the food to feed all. At the same time, the traditional inefficient practices, water scarcity for irrigation, less productive lands, double cropping, lack of crop rotation, and lack of time for soil recreation are putting pressure on fertility and yields followed by the exploitation of the middlemen preventing the farmers from getting the best price for their products. Under such circumstances, the concept of Digitization of Agricultural Sector becomes more vital. There is a necessity of empowering the rural community by creating digital Infrastructure, providing various digital services, and Promoting digital literacy. Digitization in Agriculture can be defined as ICT and data ecosystems to support the development and delivery of timely, targeted information and services to make farming profitable and sustainable. The distinct vision of our Prime Minister assures regarding several initiatives taken to provide “Protective shield” to the farmers to increase production, Improve storage and connectivity with the consumers for better supply and profit.*

This paper intends to explore the initiatives taken by Government for providing Digital Infrastructure such as Automation, agricultural robots, smart sensors and decision support systems to the farmers and also to study about how it would result in improving the income of the farmers. It mainly focuses on the three areas that encompass Digital Agriculture i.e- Data Intelligence, Smart Analysis, and Communication.

Keywords: *Digital Infrastructure, Rural Empowerment, Agriculture, ICT, Smart Analysis, Data Ecosystem, Protective Shield.*

INTRODUCTION

“No Race Can Prosper till it learns there is as much dignity in tilling a field as in writing a poem”- Booker T. Washington. Agriculture serves as the backbone or one of the important pillars of Indian Economy. It not only feed the entire population but also provide employment opportunities to millions of people in India. It is also one of the major ways to earn the foreign currency. According to S. Mahendra Devi (2011), India introduced many structural reforms and stabilization policies in 1991 which mostly focused on Industry, tax Reforms, Foreign trade and investment, banking and capital markets. This Economic reform doesn't include any specific package for the agriculture of the country. It seems as one of the major lacunae in the reforms and policies. She also focused on the various problems associated with growth and production in agriculture sector which remained untouched. This part needs to be analyzed in order to meet the upcoming challenges as well as the expectations and requirements of the nation. India exported \$39 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide and the

sixth largest net exporter. Indian agricultural processed foods are exported to more than 100 countries, primarily in the Middle East, Southeast Asia, SAARC countries, the EU and the United States. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India.

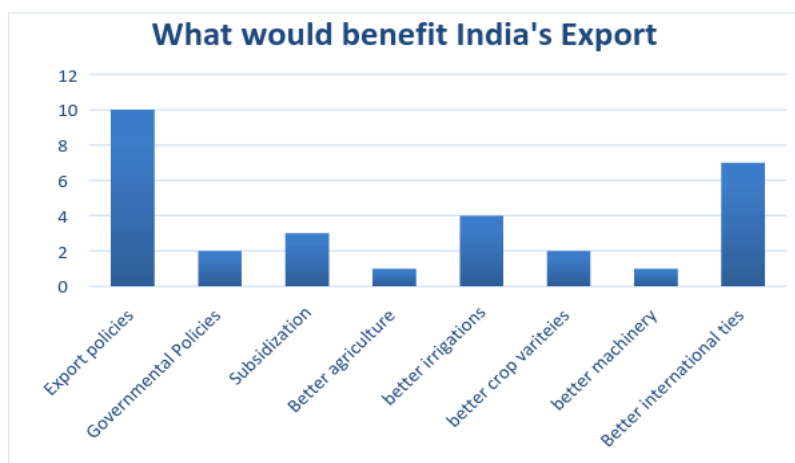
Agriculture contributes to Indian economy in several ways:

- **Largest employment providing Sector**-1.21 billion population of the entire nation depends on agricultural outputs for the fulfillment of their food requirements. India produces a lot of food grains such as millets, cereals, pulses, etc. It provides occupation to most of the people resulting in improving the financial status of the citizens. Agricultural growth has a direct impact on poverty eradication.
- **Feeds the expanding population**- A major portion of the foodstuffs produced is consumed within the country. Agriculture continues to play a dominant part in the overall economic scenario of India.
- **Major role in GDP**- Indian Agriculture contributes to the country's GDP. The following Graph shows its Contribution in last few years.



Source: trading economics.com, Central Statistical Organization, India

- **Contributes in National Economy**- India exports the agricultural products, such as jute, tea, tobacco, coffee, spices, and sugar. It helps in increasing the foreign exchange. India is ranked seventh in terms of agricultural exports. The contribution of agriculture to the nation's Forex (foreign exchange reserve) is also quite significant. Agriculture accounts for about 18 percent share of the total value of India's export. Export again has different Ares which provide benefit. This needs to be taken into Consideration.



Source: tradingeconomics.com, Central Statistical Organization, India

- **Provide raw materials to industries**-A number of industries are agro-based industries, such as jute, cotton, sugar, tobacco, etc. Raw materials for such industries are supplied from agricultural produce. Agriculture supplies bulk of wage goods required by the non-agricultural sector. It provides raw materials for a large section of industries. Sugar, tea, cotton textiles, jute goods, vegetable oil, etc. industries are regularly fed by agricultural producers.
- **Importance in national Trade**- there are three agricultural based exports of Indian –Cotton textiles, Jute and Tea-account for more than 50% of export earning of the country.

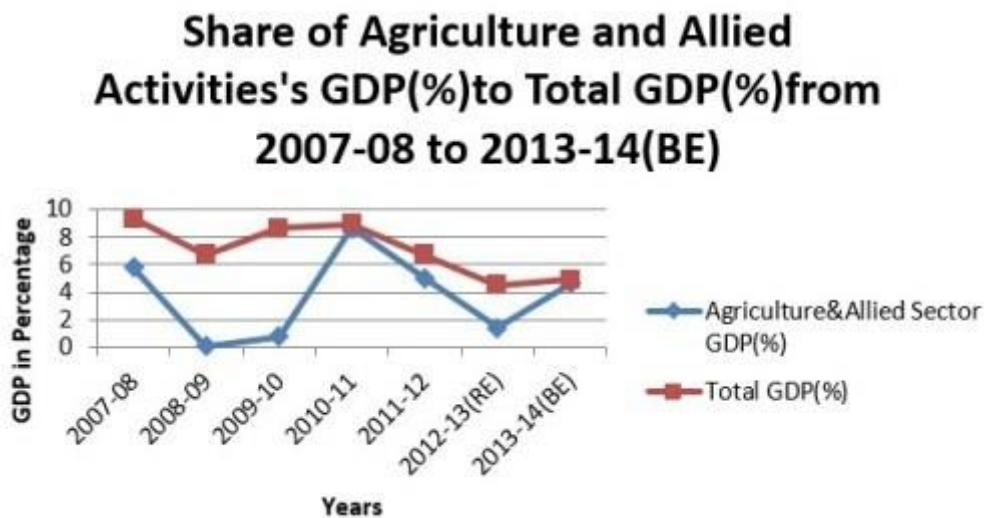
Keeping in mind the contribution Agricultural sector has upon Indian economy, Vishavjeet Chaudhury and Gursharan Singh (2016) viewed that the shift from Country's Food Security to the farmer's income security is mostly needed to boost the agriculture. It is now time to be more conscious regarding the way we need to strengthen it for better future growth.

OBJECTIVE

- To identify the problems existing in the Agricultural economy in India
- To analyze the impact of Digitization on Agriculture
- To study the digital Initiatives by the government to address farmers problem.
- To Study the Future impact on digitization on Agriculture.

Identified Problems in the Agriculture Sector

Agriculture, in spite of having a great significance to the Indian economy, the share of agriculture and its allied activities in India's GDP is continuously declining over the years. In 2009-10, it was 14.6% which declined to 13.9% in 2013-14 (Agriculture 2013). The following figure depicts the trend in the agriculture growth from 2007-08 to 2013-14 as compared to the overall GDP growth.



Indian Agriculture is a high-risk activity. The risk again can be seen in several ways. Agricultural risk emphasizes all the problems associated with farming which demands to be identified to find the proper solution.

Some of the identified Problems are as follows:

Agricultural Risk can be broadly divided into 4 major areas.

1. Production Risk- It mainly emphasizes on the various problems associated with the area of producing the food materials.

- **Whether or Climatic Condition**- the complete dependence on rain creates the problem. Moreover, unavailability of the proper information regarding natural disasters makes the situation worst.
- **Lack of Infrastructure in agriculture**- traditional techniques used in agriculture fail to maximize production, lack of storage system, newly developed machinery, knowledge regarding their usage.
- **Lack of Farm labour**- Industrial Sectors that provide more employment are mostly preferred by the people whereas people

lose interest in utilizing their time and labour in tilling the land which does not have a promising wage. Lack of availability of required labour is another major challenge for agriculture. The uncertain output is also another reason behind the indifference of labour in farming.

- **Irrigation problem**-The problem here is of proper management of water or the lack of it.
- **Lack of financial stability**- lack of required investment in farming fail to give the farmers expected results
- **Illiteracy**-lack of awareness in the current technological advances, the proper quality to use fertilizers and pesticides sometimes results negatively in destroying the entire cultivation. According the analysis given by *Reuters Market Light*, 2015,94% of farmers in India depend upon 'fellow farmers' as the preferred source of information, followed by 10% on agri-retailers, 4% of TV/Radio and only 3% of agri-extension officers Information provided by extension services are perceived to be either biased (e.g. agri-marketing companies) or less actionable due to lack of consistency, accuracy and personalization.
- **Seed problem**-Farmers depend upon the seeds available in the market which claim high yields which sometimes prove to be a falsity.
- **Sustainability**-Lack of proper understanding of the need to grow crops sustainably will push farmers into a vicious circle – of debts, heavy use of fertilizers, water mismanagement, low productivity and thus more debts for the next cycle.crop yields in India are still just 30% to 60% of the best sustainable crop yields achievable in the farms of developed as well as other developing countries.

2.Post-Harvest Risk-It emphasizes upon the problems that the farmers face after harvesting the food grain. The assessment of RML Shows that India's post-harvest losses exceed 25% every year, impacting India's food security and food inflation.

- **Lack of cold storage system**- Improper storage channel leads to poor agriculture export and the wastage of the product comes around thousands and crores of rupees where millions spend their life empty stomach with hunger strived life.

3.Market Risk- This area focus the difficulties that the farmers encounter while selling their product in the market.

- **Lack of Proper marketing Channel**- The farmers fail to reach their consumers directly as the major profit is eaten up by the middlemen due to lack of infrastructure which makes the farmer suffer in the hands of the middlemen and unable to get the reserve price for the hard toil. Small and marginal farmers suffer due to small tradable quantities and socio-economic conditions, which force them to deal with multiple layers of middlemen. One of the Example is- 85% of wheat and 75% of oil seeds in UP, 70% of oil seeds and 35% of cotton in Punjab, and 90% of jute in WB is sold by farmers in the village itself. These middlemen take away about 47% of the price of rice, 52% of the price of groundnut and 60% of the price of potatoes. On average Indian farmers realize only 20% to 25% of the value paid for by end consumers, while farmers in developed countries get 40% to 45% of the final value.
- **Lack of Transportation**- India has very poor rural roads affecting the timely supply of inputs and timely transfer of outputs from Indian farms. Farmers couldn't reach the desired destination due to poor transportation. Many products are destroyed on the way which is a loss to the farmer.

4.Ecological Risk-It is associated with the lack of availability of the resources which is needed and utilized in farming.

- **Lack of fertile land** soil erosion and small land holding are the problem areas which restrict the farmer of using modern techniques. Inappropriate use of fertilizers and pesticides also causes lack of nutrients in the soil that are necessary for healthy agricultural productivity.
- **Water Scarcity**- Agriculture in India basically is dependent upon monsoon which decides the rise or fall of the economy in the agriculture sector. The excess need of water in the industrial area and for irrigation purposes creates the scarcity of water.56% of the country depends on snow-fed rivers for its water and in such a situation even marginal fluctuations can have devastating effects. The need for distribution of water resource between industry, agriculture and drinking purpose gives rise to the scarcity.
- **Limited land access**- Farmers have fewer acres of land for cultivation and repetition of multi-cropping along with the use of fertilizers and pesticides make the soil less fertile. The farmer is left with no other option to find a solution.

Government Initiatives for Digitization of Agricultural Sector

Government initiatives are the rescue points for the farmers for their upliftment and strengthening the backbone of Indian economy through the development of agricultural Sector. The vision of our Prime Minister Narendra Modi clearly defines that the changes and the development of India somehow lies in the development of the Agricultural Sector .with the Underlining vision of doubling the income of farmers by 2022, the 75th independence of the country, Modi said, “From this land of Uttar Pradesh, I urge all the states to give priority to agriculture and then see the changes”. PM has also asked the agricultural Scientists from all over the country to speed up the lab to land approach in order to provide new technologies to farmers. It will lead to a quantum jump in the production. He intends to focus on the overall development of the rural economy by setting broader goals. He emphasized the importance of the food processing sector, warehouse development and technology inputs. These developments couldn't be visualized without accepting the technological advancement. According to Ran Maidan, Drip irrigation has helped farmers minimize the time they spend on fields, which in turn they invest in their personal development, learning new skills, participating in village activities and forums, and take care of their family in a better way.

The government has expanded its Digital India program, launching new initiatives and broadening the scope to touch the agricultural sector too.

Ran Maidan,(2017) President & CEO of Netafim, a global leader in smart irrigation solutions, asserts that farmers can now control their fields remotely from the palm of their hands using their mobile phones.

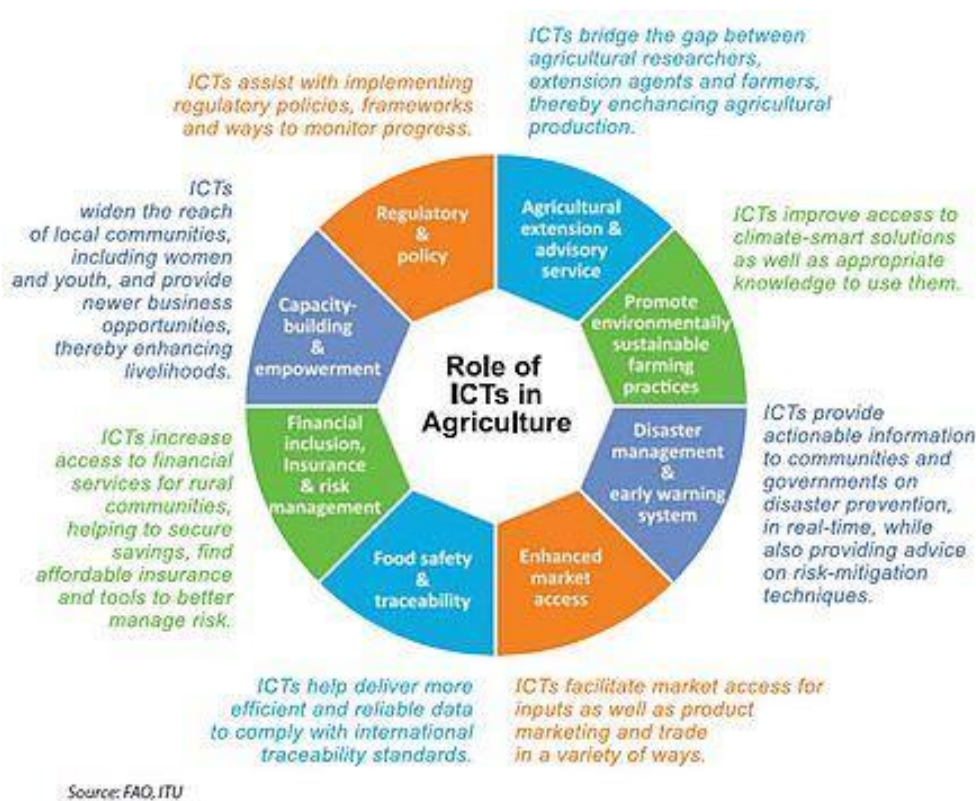
Agriculture is getting more and more digital, and its future lies in leveraging real-time analytics and automated systems. Digital technologies available over the past few decades have transformed virtually every sector of the global economy, and agriculture is no exception. Information and communications technologies (ICTs) such as mobile phones and SMS messaging are changing the way farmers track weather patterns, access market information, interact with traders and government agencies, and get paid for their crops. According to a recent World, Economic Forum article, (IFPRI Blog) growth in the agricultural sector can be at least twice as effective in reducing poverty as growth in other sectors, and interventions that incorporate new digital technologies have been shown to accelerate agricultural growth. Dr.P.K.Joshi (2014) emphasized that both the Central and state government need to take appropriate initiatives to increase investment in agriculture research and to create a favourable business environment through enabling policies towards high-value agriculture.

- 1. Virtual Agricultural Market**-The Government wants to make a common electronic platform which will allow farmers to sell their produce to buyers, anywhere in the country. The Centre has set aside Rs. 200 crore for the creation of this National Agriculture Market online trading portal. The platform will be launched on April 14 and will tackle the problem of distress selling. It aims to connect 585 and is in the country.
- 2. Rashtriya Krishi Vikash Yojna**- It is intended to encourage the states to allocate more funds and agriculture and allied sector and to incentivize the states to generate additional growth in agriculture and allied sectors by planning and undertaking appropriate growth-oriented projects.
- 3. Crop Insurance Scheme**-Government has approved the Pradhan Mantri Fasal Bima Yojana. In this scheme, a premium of 2% of the sum insured will be charged from farmers for all Kharif crops and 1.5% for all Rabi crops. The Government will cover the remaining insurance premium.
- 4. Prime Minister Krishi Sinchai Yojna**-The Government's also had plans to expand irrigation. In order to reduce dependence on the monsoon, the Government had approved a sum of Rs. 50,000 crore to be spent on setting up irrigation projects in rural areas. The major objective of the Pradhan Mantri Krishi Sinchai Yojana is to achieve convergence of investments in irrigation at the field level. With the Direct Benefit Transfers system and the unique identification number, Aadhaar, to support the transfer of government subsidies to citizens, India is uniquely positioned to leverage these platforms to support the earlier interventions around soil health, Prime Minister Krishi Sinchayee Yojana, national markets, and weather-indexed insurance.
- 5. Institutions**: State government's department of agriculture, state agricultural universities, Krishi Vigyan Kendras, regional research institutes, farmer- producers organizations, corporate/industrial/business houses and multinational companies engaged in manufacturing/production and distribution of farm inputs, farm equipment & machinery, rural financial institutions, insurance companies, among others, have a significant role and added responsibility to contribute their professional knowledge to develop digital ecosystem for agriculture and make available to farmers.

6. Use of Modern technology and Equipment- the use of modern equipment and improvised machines would show better results in production and storage.

7. Increase soil fertility- The regular information through Mobile phones regarding the type of techniques needed to maintain the fertility of the soil and increase production has proved beneficial. The farmers are also provided kisan call center services where they can directly interact with the executives regarding their queries.

ICT-Information communication Technology has the potential to revolutionize Indian agriculture in terms of raising crop productivity and profitability per unit area and resources. The mobile connectivity has become a basic service in rural areas. The rural mobile subscriber base is growing twice as faster compared to the urban subscriber base. As of March 2015, the national teledensity was 79% and rural teledensity 46.5%. Telecom Policy aims to increase rural teledensity to 60% by 2017 and 100% by 2020. Study of the IAMAI revealed 80% using it for communications, 67% for online services, 65% for e-commerce and 60% for social networking. e-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (IT) in the rural domain, with a primary focus on agriculture. Mobile phones can be effectively utilized for purposes including generating, processing, transmitting, disseminating, sorting, archiving and retrieving critical information and data relating to agriculture. Mobile phones are omnipresent and cost effective means to revolutionize agriculture in India. Several apps are now available and much more can be developed to meet farmers' following specific needs.



Source: FAO, ITU

8. Mobile Apps and internet facility to farmers- the Mobile phone is the preferred delivery medium under Digital India with a focus on mGovernance and mServices. The greatest need is to deliver targeted and timely information to farmers based on their needs. The empowerment that comes from providing farmers with informed option is transformational. Mobile devices and the internet facility keep the farmers updated with all the relevant information related to farming. The call centers are also opened to help with the queries of the farmers instantly for the entire year.

According to the report of Reuters Market Light, (2015) since 2007, RML's UNDP and NABARD Rural Innovations award winning agri information service (market prices, weather forecasts, and crop advisory and agri news) in 9 Indian languages has reached 1.4 million registered farmers in 50,000+ villages across 17 states of India. RML covers 450+ crop varieties and 1300+ agri market in India. More than 7 million farmers have benefited from RML service through sharing of information. In 2014, RML launched agri

e-commerce services - Krishidoot, in partnership with Small Farmers Agri-Business Consortium (Ministry of Agri, Govt of India) connecting 10,000+ Farmer Interest Groups associated with 300+ Farmer Producer Organizations (FPOs) and 8,000+ agri market players (traders, processors, exporters, banks etc).

9. Other Initiatives: Government has initiated several other measures viz.

- a. The government has put in operation three portals viz. farmer portal, kisan call center, and mkisan portal to help farmers take informed decisions for efficient farming under varying agro-climatic conditions.
- b. Under the eGovernance program, soil health card software has been standardized and web-based software developed to provide integrated nutrient management recommendations using soil test-crop response method for eight states.
- c. Under National e-Governance Plan in Agriculture [NeGP-A] information is provided to farmers through multiple channels including Common Service Centres Internet Kiosks and SMSs. Currently, 12 identified clusters of services provide information on weather; soil health; seeds, nutrients, pests; irrigation; crops, good agricultural practices, farm machinery; marketing infrastructure; farm commodity prices, arrivals, procurement points; electronic certification for export & import; drought relief & management; livestock, fisheries management; training; monitoring implementation and evaluation of schemes. The first phase of the project is under implementation in seven states out of 28 in the country.
- d. National Bank for Agriculture and Rural Development has also designed agricultural portals for farmers.

Involvement of the entrepreneurs in the revolution of digitizing Agriculture

In the Current dawn of digitization, the Indian Government has a distinct vision to keep the sun shining. Under the digital India initiative, the government intends to provide digital infrastructure to empower the citizens by using IT as a tool. A remarkable contribution can also be visualized within the entrepreneurs who have come forward and started to explore the opportunities in the agricultural sector. They believe that Development of Technology enables everything around us but the setback lies within the technologists who so far lacked their interest in the agricultural sector. The start-ups are now in search of opportunities in the field of automation, cloud integration and communication.

Vijay Pratap Singh Aditya, the founder of Ekgaon has extended his helping hand towards the farmers. Ekgaon used mobile phones to provide tailored farm advisory services to farmers depending upon their farm size, geography, crop, Soil etc. They work on real-time data sets, advice the farmers regarding the time and quantity of using fertilizers and they claim to have reduced the input cost to INR 5.30 per acre i.e- saving INR 1000-2000 per acre.

Reihem Roy, VP- Omnivore Partners emphasized that the use of appropriate technology for the different stages of farming is needed and the entrepreneurs can find their way here.

Similarly, there is Digital Green, an online platform which leverages ICT and technological tools to reach out to the small farmers. They create videos on the topics that are relevant to local farmers, featuring farmers as actors. Vinay Kumar, COO of the Organization believes that new innovations in technology cannot help the farmers without understanding their need and requirement. So, Suggesting solutions also come after knowing and understanding the problems. M.I.T.R.A, Stellaps are some other farms working for optimization services in order to extend a helping hand towards Indian Economy.

The emerging Entrepreneurs showing their interest in the progress and growth of Indian Agriculture is a positive sign for the Government sector and Private sector working together with joining hands with a single goal may definitely make the sun of digitization shine in the sky of Agriculture.

The Future of Indian Agriculture

Reihem Roy, VP-Omnivore Partners seems to be extremely hopeful regarding the future of Agri-tech in India as he said, "the world is an Oyster in terms of opportunity. Either you can moan and groan or choose to take it up and build solutions. It's our Choice".

The future is going to be more challenging with the rise of population and the growing demand for food. Mr. Rajesh Agarwal, MD, Insecticides India Ltd in his report on "Future of Agriculture in India: Is the nation ready" emphasized that, on the basis of the several researches on the rising food price and the cascading effects on the economy has evidently proved that the dream of India to see two digit growth rate unless the rural economy is freed and speeded up.

The union Budget of 2016-17 took cognizance that farm sector and rural economy are intertwined which demands more budget allocation and long-term policy approaches to sustain the agricultural sector. With a considerable budget allocation of Rs 35,984 crore, along with the Digital India Scheme the govt. has already taken few steps ahead to see the overall development of the agricultural Sector. With these developments, India is expected to compete with the world in IT interface with e-Governance and e-services getting maximum exposure. It would take the agricultural Sector to the peak of growth by transforming its structure and reshaping it with the modern equipment and techniques. Driven by such digital engagement, Indian firms are expected to make a major contribution in empowering the backbone of the country i.e-agriculture with their IT expertise. It is again not free from the challenges such as:

- Development and Up-gradation of agricultural content from time to time.
- Ownership issues of public and Government generated Data.
- Inadequate use of Public-private partnership.
- Making the farmers of every remote place aware regarding the modern technology and training them to use them for their purpose.
- Monitoring of the farmers regarding the instructions provided.
- The expenses to adapt and maintain the automated systems, robotics, and other modern equipment.
- The expertise to use the modernized machines.

Nitin Gupta, Co-Founder, and CEO, PayU (India) viewed Digital India as an Idea to ‘Cradle to grave identity’ to grave identity’ which will be unique, lifelong and online. His words really seem to be correct as we see the authorities giving priority to equip India for the future and making Technology to be the center of the entire transformation. This project seems to follow the equation of $IT+IT=IT$. It means India Today+ Information Technology=India Tomorrow.

Government initiatives under Digital India have already solved many of the above-mentioned challenges and initiated the task of increasing the awareness among the working mass. Technology has really proved to be a better solution to the problems associated with the agricultural sector. It leaves us with an expectation to find the agricultural sector of India Getting stronger with the passage of the years facing all the upcoming challenges with the help of ICT and transforming India as the Leader of the developed Countries.

CONCLUSION

Therefore, it can be concluded that in the upcoming years Indian Farmers would feel the compulsion of improving food and nutritional security along with keeping in mind the all the other aspects discussed earlier. ‘Digital India’ is all set to transform the interface of the country’s socio-economic dynamics. It is deemed to bring systems and infrastructure up to speed and leverage the country’s workforce, establishing a firm foundation towards sustainable practices and eventually progress. Michael Stern truly said- “We are on the cusp of the next innovation wave of digital agriculture”. The Scenario opens the scope for new innovations and opportunities as the Country is no doubt going to witness a drastic change leading to a transformation in the next 10/20 years than we have seen in the last 60 years.

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