



RESEARCH ARTICLE

EVOLUTION OF AGRICULTURE IN INDIA VIS-À-VIS INDIAN ECONOMY: SHIFT IN FARMING BEHAVIOUR

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ABSTRACT

Objectives: Agriculture is main source of livelihood for a majority of the population in India. It holds high importance in the people's life. While Contribution to country's GDP by other sectors have increased in a faster rate, contribution from agriculture & its associated sector is in the reducing trend and presently hold to less than 20 percent. However, gross agricultural production has grown with the increase in demand as a fall out of increased population. It helped India to become self-sufficient and emerged as a net exporter of agriculture and allied products. The study is towards finding the gap in adaptation of technology in agriculture and its degree of implementation in Indian context. **Methods:** Review of available research, book, and articles towards finding the Gap. **Results:** There are many technologies which have already been developed globally towards smart farming. However, at the field level adaptation and implementation is found limited. **Conclusion:** While government has come up with many initiatives and the sector has achieved some milestones as well, and adaptation of technologies have also helped to overcome of the challenges to some extent, there is gap in adaptation & implementation of technologies at field level on Indian agriculture context.

INTRODUCTION

India ranks second worldwide in farm outputs. In 2018, agriculture employed more than 50% of the Indian work force and contributed 17–18% to country's GDP while India ranks first in the world with highest net cropped area followed by US and China. 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 leading to the seventh largest agricultural exporter worldwide and the sixth largest net exporter. Agriculture is the primary source of livelihood for about 58% of India's population. (Agriculture in India: Information about Indian Agriculture & Its Importance, 2021) Agriculture in India is livelihood for a majority of the population. Although its contribution in the gross domestic product (GDP) has reduced to less than 20 per cent and contribution of other sectors increased at a faster rate, agricultural production has also grown substantially. This has made India self-sufficient and evolved as a net exporter of agriculture and allied products. Total food grain production in the country is estimated to be a record 291.95 million tonnes, according to the second advance estimates for 2019-20.

However, as per the estimates of Indian Council for Agricultural Research (ICAR), demand for food grain would increase to 345 million tonnes by 2030 (Sharma, 2021). Agriculture in India has evolved from a simple farming to a technology led smart farming (recent era). While the agriculture sector has witnessed huge modernization in farming operations, transportation, pesticides, customer experience, understanding of needs of productive & effective farming is yet to catch up to comparable levels

RESULTS AND DISCUSSION

India's population touched 1.38 billion in 2020 i.e 17.7 per cent of the world's population and the country's population has increased 3.35 times since Independence and it is estimated to surpass China by 2027 to become the most populated country in the world. Yet, India accounts for only 2.4 per cent of the global land with the average size of landholding per state is 1.08 hectares and farmers in half the Indian states are marginal (with land less than 1 ha); the remaining are small farmers (land holdings of 1-2 ha). Most of them have been facing several major constraints such as input supply, credit availability, proper transport, and market facility, etc. Their share nearly 60 per cent in total food grain production: 49 per cent rice, 40 per cent wheat, 29 per cent coarse cereals and 27 per cent pulses as well as over half of the country's fruits and

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vegetable production, according to Agricultural Census 2015-16 (Srinivasa Rao 2021).

Impact of Climate in Agriculture: From Himalayas to the coastal areas in India should be ready to fight against the impacts of global warming. The South Asian areas may face a warming effect of 2-6°C in the 21st century (Ravindranath, 2007). The concentrations of carbon dioxide are high, up to 410 parts per million, the key reason for global warming (Srinivasarao et al, 2019). States such as Madhya Pradesh, Karnataka, Western Rajasthan, Andhra Pradesh, Southern Gujarat, Haryana, Madhya Pradesh and southern Bihar are unceasingly facing dryness, for they are highly prone to drought (Bhadwal et al, 2019). In Bihar, millions of people were forced to stay in shelter houses because of floods in 2008. Approximately 20 million people experienced the same situation in Mumbai in 2005. In Delhi and Haryana, millions over the value of properties were demolished when the Yamuna was flooded above the danger zone in 2008. Kerala was hit by one of the worst episodes of floods in 2018. The super cyclone in Orissa in 1999 took a toll on over a million lives along, with heavy property losses reported in coastal regions. Andhra Pradesh experienced a similar ordeal during the Hud-Hud cyclone in 2014. India and its adjacent countries faced an intense heat wave from mid-May to mid-June in 2019. Churu in Rajasthan recorded 50.8°C, the highest in 2016 in India. A considerable fraction of sea-level increase is because of thermal expansion of a warmed ocean (as much as 0.3-0.8 metres over the past century). Salinity is one of the main operators of environmental variation and a steady stressor in coastal regions, frequently resulting from prolonged storm and tidal surge flooding. It is further anticipated that the unfavorable effects of soil and inland water salinity will continue to increase with the onset of global sea-level increase and further hydrological changes (Srinivasa Rao, 2021). The change in climate has a direct relation with the agriculture productivity and yield.

Agriculture sub-sectors: Cultivation practices are completely based on climatic situations. An average of 30 per cent reduction in crop yields is anticipated by the mid-21st century in South Asian countries. For example, in India, an increase in temperature by 1.5°C and a reduction in the precipitation of 2 mm can reduce the rice yield by 3 to 15 per cent. High temperature causes moisture stress situation, directing to sunburn and cracking symptoms in fruit trees like apricot, apples and cherries. The temperature increase at the ripening stage causes fruit burning and cracking in litchi plantation. If the ozone concentration reaches more than 50 parts per billion / day, the yield of vegetable crops will come down 5-15 per cent (Ahluwalia and Malhotra, 2006). Keeping these challenges in view, the Government of India, Ministry of Agriculture, and Farmers Welfare and Indian Council of Agricultural Research (ICAR) has taken several proactive policies that are being implemented at the village level.

Investments in Agriculture Sector: According to the Department for Promotion of Industry and Internal Trade (DPIIT), the Indian food processing industry has cumulatively attracted Foreign Direct Investment (FDI) equity inflow of about US\$ 10.20 billion between April 2000 and September 2020. Some major investments and developments in agriculture are as follows:

- J In March 2020, F&S, the oldest large-scale fertiliser manufacturer in the country, crossed one million production and sales mark.
- J Nestle India will invest Rs.700 crore (US\$ 100.16 million) in construction of its ninth factory in Gujarat.
- J In November 2019, Haldiram entered into an agreement for Amazon's global selling program to E-tail its delicacies in the United States.
- J In November 2019, Coca-Cola launched 'Rani Float' fruit juices to step out of its trademark fizzy drinks.
- J Two diagnostic kits developed by Indian Council of Agricultural Research (ICAR) - Indian Veterinary Research Institute (IVRI) and the Japanese Encephalitis IgM ELISA were launched in October 2019.
- J Investment worth Rs. 8,500 crore (US\$ 1.19 billion) have been announced in India for ethanol production.

Government Initiatives

Government of India has also taken many major steps for encouraging the farmers and helped towards boosting the productivity of the sector (<https://www.india.gov.in/topics/agriculture>). Some of the recent major Government initiatives in the sector are as follows:

- J In November 2020, the government inaugurated a mega food park in Punjab worth Rs. 107.83 crore (US\$ 14.6 million) that will be spread across over 55 acres of land.
- J In October 2020, the Tribal Cooperative Marketing Development Federation of India (TRIFED) included 100 new Forest Fresh Organic Products sourced from tribes across India on its e-marketplace (tribesindia.com).
- J In October 2020, Agri-lender Nabard (National Bank for Agriculture and Rural Development) proposed plans to set up a subsidiary to provide guarantee for loans under agriculture and rural development.
- J In October 2020, the government announced that it is putting up a common data infrastructure for farmers in the country. PMFBY (Pradhan Mantri Fasal Bima Yojana), PM-Kisan and the Soil Health Card will be integrated through a common database, along with land record details.
- J In September 2020, the government launched the PM Matsya Sampada Yojana, e-Gopala App and several initiatives in fisheries production, dairy, animal husbandry and agriculture. Under this scheme, an investment of Rs. 20,000 crore (US\$ 2.7 billion) will be made in the next 4-5 years in 21 states.
- J In May 2020, Government announced the launch of animal husbandry infrastructure development fund of Rs. 15,000 crore (US\$ 2.13 billion).
- J In September 2019, Prime Minister of India launched National Animal Disease Control Programme (NADCP), expected to eradicate foot and mouth disease (FMD) and brucellosis in livestock. In May 2020, Rs. 13,343 crore (US\$ 1.89 billion) was allocated to the scheme.
- J The Government of India came out with Transport and Marketing Assistance (TMA) scheme to provide financial assistance for transport and marketing of agriculture products in order to boost agriculture exports.
- J The Agriculture Export Policy, 2018 was approved by the Government of India in December 2018. The new policy aimed to increase India's agricultural export to US\$ 60

- billion by 2022 and US\$ 100 billion in the next few years with a stable trade policy regime.
- J The Government of India is going to provide Rs. 2,000 crore (US\$ 306.29 million) for computerization of Primary Agricultural Credit Society (PACS) to ensure cooperatives are benefitted through digital technology.
 - J The Government of India launched the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) with an investment of Rs. 50,000 crore (US\$ 7.7 billion) aimed at development of irrigation sources for providing a permanent solution from drought.
 - J Government plans to triple the capacity of food processing sector in India from the current 10% of agriculture produce and has also committed Rs. 6,000 crore (US\$ 936.38 billion) as investments for mega food parks in the country, as a part of the Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters (SAMPADA).
 - J The Government of India has allowed 100% FDI in marketing of food products and in food product E-commerce under the automatic route.

Achievements in the Agriculture sector

Agriculture sector in India has recorded number of achievements as well (<http://dare.nic.in/media/major-achievements>) and some of the major are:

- J In November 2020, the planting of winter crops exceeded by 10% compared with the last year and witnessed 28% increase in area under pulses. The total area acreage under pulses increased to 8.25 million hectares from 6.45 million hectares last year.
- J Out of the total 37 mega food parks that were sanctioned, 21 mega food parks are operational, as of November 2020.
- J The Electronic National Agriculture Market (e-NAM) was launched in April 2016 to create a unified national market for agricultural commodities by networking existing APMCs. It had 16.6 million farmers and 131,000 traders registered on its platform until May 2020. Over 1,000 mandis in India are already linked to e-NAM and 22,000 additional mandis are expected to be linked by 2021-22.
- J Sale of tractors in the country stood at 804,000 units in 2019 with export of 80,475 units.
- J During FY20 (till February 2020), tea export stood at US\$ 709.28 million.
- J Coffee export stood at US\$ 742.05 million in FY20.

Constraints in Indian Agriculture: India is blessed with large arable land with 15 agro-climatic zones as defined by ICAR, having almost all types of weather conditions, soil types and capable of growing variety of crops. India is the top producer of milk, spices, pulses, tea, cashew and jute, and the second-largest producer of rice, wheat, oilseeds, fruits and vegetables, sugarcane and cotton. In spite of all these facts, the average productivity of many crops in India is quite low. The country's population in the next decade is expected to become the largest in the world and providing food for them will be a very prime issue. Farmers are still not able to earn respectable earnings. Even after over seven decades of planning since the independence, majority of the farmers are still facing problems of poor production and/or poor returns (Ramamamy, 2004),

(Suman Sanket, 2019). Major constraints in Indian agriculture are:

- J According to 2010-11 Agriculture Census, the total number of operational holdings was 138.35 million with average size of 1.15 hectares (ha). Of the total holdings, 85 per cent are in marginal and small farm categories of less than 2 ha (GOI, 2014).
- J Farming for subsistence which makes scale of economy in question with majority of small holdings.
- J Low-access of credit and prominent role of unorganised creditors affecting decisions of farmers in purchasing of inputs and selling of outputs
- J Less use of technology, mechanisation and poor productivity for which first two points are of major concern
- J Very less value addition as compared to developed countries and negligible primary-level processing at farmers level.
- J Poor infrastructure for farming making more dependence on weather, marketing and supply chain suitable for high value crops.

Future of agriculture is a very important question for the planners and all other stakeholders. Government and other organisations are trying to address the key challenges of agriculture in India, including small holdings of farmers, primary and secondary processing, supply chain, infrastructure supporting the efficient use of resources and marketing, reducing intermediaries in the market. There is a need for work on cost-effective technologies with environmental protection and on conserving our natural resources. The reforms towards privatisation, liberalisation and globalisation affected inputs market at a faster pace. Agricultural marketing reforms after 2003 made changes in marketing of agricultural outputs by permitting private investment in developing markets, contract farming and futures trading, etc. These amendments in marketing acts have brought about some changes but the rate is less (Sharma, 2021).

Technology Impact in Agriculture: The information technology revolution in India, new technologies in agriculture, private investments especially on research and development, government efforts to rejuvenate the cooperative movement to address the problems of small holdings and small produce etc are changing face of agriculture in India. Many startups in agriculture by highly educated young ones show that they are able to understand the high potential of putting money and efforts in this sector. Cumulative effects of technology over the next decade will change the face of agriculture. Precision farming with soil testing-based decisions, automation using artificial intelligence will be focused for precise application inputs in agriculture. Sensors and drones will be used for precision, quality, environment in cost effective manner. Small and marginal farmers will also be using these technologies with the help of private players, government or farmer producer organisations (FPO). Use of GPS technology, drones, robots etc controlled by smart phones etc can make life of farmers easy and exciting with good results. These advanced devices will make agriculture be more profitable, easy and environmentally friendly. (Sharma 2021). Use of nano-technology for enhancement of food quality and safety, efficient use of inputs will be in near future. Nano-materials in agriculture will reduce the wastage in use of chemicals, minimise nutrient losses in fertilisation and will be

used to increase yield through pest and nutrient management. IFFCO has already done successful tests in nano-fertilisers. India has improved remarkably in its digital connectivity and market access has become very easy. The number of internet users is projected to reach 666.4 million in 2025. Farmers will be behaving more smartly with mobiles in hands and would be able to be more aware and connected with different stake holders. Government will be making wide use of digital technology for generating awareness among farmers, information sharing, government schemes using digital technology for direct transfers of money. Some technologies will be frequently and widely used in future and some will become common in a short time while some will take time to mature. For producing the same products in other way so as to use resources judiciously and using new resources also like hydroponics, use of plastics and bio-plastics in production. There will be more of vertical and urban farming and there will also be efforts in long term to find new areas for production like barren deserts and seawater (<https://www.precisionag.com/digital-farming/the-impact-of-reshaping-agriculture-with-technology/>)

Going Ahead: India is expected to achieve the ambitious goal of doubling farm income by 2022. The agriculture sector in India is expected to generate better momentum in the next few years due to increased investment in agricultural infrastructure such as irrigation facilities, warehousing and cold storage. Furthermore, the growing use of genetically modified crops will likely improve the yield for Indian farmers. India is expected to be self-sufficient in pulses in the coming few years due to concerted effort of scientists to get early maturing varieties of pulses and the increase in minimum support price. (Internet of Things Now a Growing Trend in India's Agriculture, 2018). In the next five years, the central government will aim US\$ 9 billion in investments in the fisheries sector under PM Matsya Sampada Yojana. The government is targeting to raise fish production to 220 lakh tonnes by 2024-25. Going forward, the adoption of food safety and quality assurance mechanisms such as Total Quality Management (TQM) including ISO 9000, ISO 22000, Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP) by the food processing industry will offer several benefits. The agri export from India is likely to reach the target of US\$ 60 billion by the year 2022 (<https://www.ibef.org/industry/agriculture-india.aspx>)

CONCLUSION

Farming will play vital role in next few years in country's economy and sustaining the livelihood of the people. With the growing demand of food in line with the increased population and decrease in agricultural land challenges are getting enhanced in many folds. At the same time latest technologies have also been used for maximizing the productivity of farming leading the shift in farming behavior. With the above backdrop of advancement of technology, government initiative, preferences and practices, the methodologies of agriculture have taken an evolution path and are still evolving.

While agriculture sector has made some significant technology-led advances in the past few years, the adaptation at the ground level is yet to be visible. Thus a clear gap seems to exist between availability of technologies, government policies and adaptation at ground level. This definitely merits further study.

Declaration: Authors wish to declare that there is no conflict of interest with the submission

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