

Technology-Enabled Rural Transformation in India: a Post-COVID-19 Scenario

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Abstract—COVID-19 has resulted in a society that is steadily more dependent on information and communication technologies (ICTs) than ever before. In the Indian context, this offers us an opportunity to extend the benefits of the proliferation of ICTs to one of the hitherto most under privileged sections of rural society in India – the small scale farmer. This outreach will result in a transformation of rural agriculture, and foster the sustenance and uplift of the small scale Indian farmer – in spite of the devastation caused by COVID-19. This paper discusses some reforms and recommendations towards that goal. A brief discussion on precision agriculture in India is also featured.

Keywords— *precision farming, drone, OVID (key words)*

I. INTRODUCTION

There is a glaring imbalance of in the share of income generated through agriculture in the Indian gross domestic product (GDP) vis-a-vis the percentage of the Indian population that is employed in agricultural activities. Indian agriculture sector accounts for 18 per cent of India's GDP, but provides employment to 50% of the countries workforce [1]. There are deficiencies in the way that Indian agriculture adopts technology. The 'business' of Indian agriculture is thus plagued with many issues – these include low levels of integration with peripheral business activity, as well as the lack of an effective information system on the crop production, harvesting and sale to the farmers [2]. The aim of the paper is to suggest some technology updates that that will make Indian agriculture more productive – as well as enhance the income of the small scale Indian farmer.

II. ISSUES FACED BY INDIAN AGRICULTURE

Though the many problems and issues that are faced by the Indian farmer - inhospitable weather, crop failure due to disease, floods, vulnerability to the greed of middlemen - this paper will highlight

only those issues for which technology can offer viable solutions [3]. Some of these are:

A. Water Scarcity

Water is an essential agricultural input for farmers. This is especially relevant in India, where the rain water is seasonal. There are rivers however, which irrigate most of the cropped area. The right amount of water required and the actual water availability however, remain uncertain. Stability cannot be achieved till the farmer is assured of water for his cultivable land.

B. Seeds

Seeds are fundamental to farm yields. Improved quality is mandatory for agricultural output. Biotechnology improvement must be made available to the small scale farmer. The must be made economically viable for all farmers.

C. Adequate amount of pesticides and fertilizers

Soil analysis is rarely carried out to ascertain the optimal type and quantity of pesticide and fertilizers to be added to the soil mix. The soils are depleted from extended use. To worsen the situation, the fertile soil has been subjected to toxic pesticides which have further eroded the fertility of the soil. Furthermore, many farmers are ignorant about the type of crop mix thjat is best suited to their soil, as well as the most potent organic treatment to be help their land regain fertility.

D. Sale / Distribution Outlets

Even if the farmer is able to reap a sizable harvest, the farmers, especially the small scale farmer has to undergo a lot of hardship in taking his produce to the suitable market place, as well as get a suitable price for his produce. Reforms are needed. When reforms are legislated, they are often resisted. This makes the farmer prey to local agents who fleece and exploit them. They have to accept whatever price is decided by the market.

*E. Lack of Suitable Places to Store / Buffer
Agriculture Produce*

There is a severe dearth of place where a farmer can store his produce against the wrath of natural elements. This makes it necessary for the farmer to sell the harvest as soon as it is cut to the nearest available buyer. The farmer thus does not get a proper price for his harvest and is again exploited and deprived of his due.

III. THE ROLE OF TECHNOLOGY

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar Technology in general and digital technology in particular can enable farmers to access technologies and focus on bespoke insights vis-a-vis agricultural activities. Since this information is available in real time, this could impact the farmers to optimize their activity. The correct intervention involves the correct technology investments. By means of online access, market information can be provided to the under privileged populace. This is especially relevant and helpful during the pandemic caused by COVID-19. This will result in higher crop output, and enhance the level of basic food availability in the system. Furthermore, it raises the income levels of farmers – which can enhance farm output in the long run as the increased returns start to take effect. Farmers, due to these implementations are able to communicate their issues – enabling regulating authorities to direct their efforts for maximal impact in a lesser time frame. Some technologies that will positively impact farmer incomes and their productivity are discussed below.

A. Information (Agri-MIS) for Agriculture

There is a need for providing the Indian farmer with correct information in a time frame that enables completion of his tasks in time. To this extent their information system need are the same as any small scale enterprise. A dedicated Agri-MIS can be designed and implemented that provides them the information they require in real time. Many small-scale farmers, including those in India's remote places have mobile phones, and thus are equipped to receive targeted agricultural advice through simple text or voice messages, even without access to the Internet. That is why the Indian Government governments in developed and developing countries have for decades supported farmers with public information campaigns. In Orissa, India, this kind of Agri-MIS delivers customized, crop-specific, free agricultural advice to almost 800,000 farmers through their mobile phones.

These advisories have been shown to be beneficial and formalized evidence has proved that information and advice – delivered at scale and at low cost – can bring a positive change to Indian farmers' practices. Farmers having access to digital information will have enhanced yields as well as greater resilience against natural calamities and shocks. It is claimed in a recent study that demonstrates that farmers who received digitally delivered recommendations were substantially more likely to adopt the recommended agricultural inputs. Moreover, as farmers rely on mobile phones as a convenient method of communication, they can receive timely updates on market information, bank account status, and weather updates.

Improved information makes farmers more viable for bank loans, as well as allowing them to easier access to credit, insurance, and other financial tools. These will catalyst greater robustness against future adversity. The MIS also offers protection against unscrupulous middlemen.

B. Farm automation

This is a term is synonymous with 'smart farming'. Routine jobs can be transferred to machines – which should be the primary goal of farm automation. The implied technology injects efficiency in the crop planting and harvesting life cycle. Technology advancement in robotics have resulted in drones, harvesters, automated tractors, remote control of irrigation watering, and automated seeding. Technology adoption and innovation by companies have proved the efficacy of scale. Computer vision and machine learning (ML) have the potential to transform agriculture. Completion of mundane is facilitated by machines. Farm automation technology addresses major issues like a rising global population, farm labour shortages, and changing consumer preferences. The benefits of automating traditional farming processes are monumental by tackling issues from consumer preferences, labour shortages, and the environmental footprint of farming.

C. Bio-fortification

Agri-researchers can complement conventional plant-breeding methods with biotechnology to bio-fortify the crops prevalent in current diets. Nations with relatively poorer populations may develop nutrient-rich variants through selective crossbreeding. Genetics may be deployed to develop plant variations mutated from the place of their origin. Robust and long lasting seeds will be an especially critical in the life cycle of this transition.

Innovations in digital agriculture also can help farmers increase their yields and incomes by adopting locally suited organic fertiliser, protecting crops from diseases and. Farmers must also be explained how to adapt to climate change. They must be trained in maximizing selling at the most competent price. All farmers have to learn how to expand biotechnological innovations and reduce risk.

IV. THE EFFECT OF COVID-19

The mal-nutrition havoc created COVID-19 pandemic will like catalyze changes in the strategy of global food chains. Healthier diets will be encouraged with a greater range of food choices. All stake holders - farmers, the general public, and public health regulation agencies should collaborate for nutritious diets to ensure long-term measures to promote healthier diets, encourage farmers to produce a wider range of food. Research in agriculture and biotechnology can re-vitalize food systems while simultaneously enhancing resilience and sustainability [4].

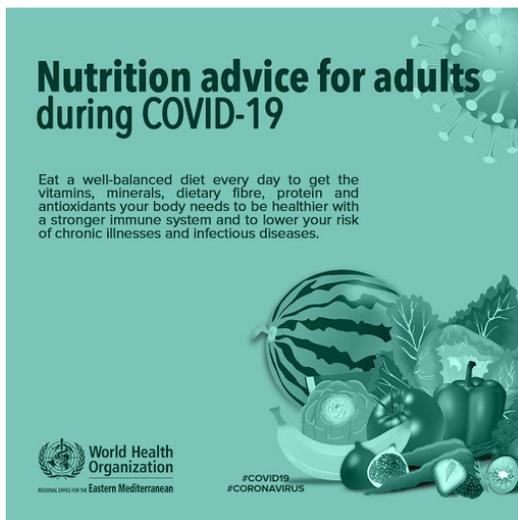


Fig.1: Nutrition during the time of Covid

- The COVID-19 crisis has highlighted the risks of unhealthy diets and the extreme fragility of the global food system.
- It disproportionately affects people who are overweight, diabetic, or suffer from cardiovascular disease – all of which are linked to poor diets.
- The economic reconstruction that will follow the pandemic is an opportunity to provide better nutrition and health for all. This crisis has also exposed the extreme fragility of the global food system.
- The pandemic has resulted in reduced incomes and reduced global consumption and demand. Social-distancing and

lockdown measures to curb the virus's spread have further reinforced the trend.

- The resulting decline in food prices between January and May 2020 will significantly impact the sustenance and livelihoods of thousands of small farmers in India.
- The pandemic has underscored the urgent need to transform agriculture [5]. And the economic reconstruction that will follow it represents a perfect opportunity to provide better nutrition and health for all.

V. PRECISION AGRICULTURE

Precision agriculture (PA) may broadly be defined as a method of farming and tending of livestock that is more accurate and controlled than hitherto fore. A key component of this farm management approach is the use of information technology and a wide array of items such as GPS-based soil sampling, control systems, sensors, robotics, drones, autonomous vehicles, variable rate technology, automated hardware and telematics. Over exploitation of land and excessive use of chemical fertilizers and pesticides has degraded the fertility of the soil of these areas. Land fragmentation is serious obstacle to mechanization. Furthermore, specially nominated centres to build relevant databanks are essential for the efficacy of PA [6].



Fig. 2: Smart Drone in Precision Agriculture

Application of PA technologies is presently at the nascent stage in India. Some discrete initiatives have been started towards the application of this technology. It is expected that PA research will be an important part of the recently launched ambitious agricultural research program. Though India is currently producing more than 200 Mt of food grain which makes it self-reliant for food, quantity alone is not enough. Quality is essential for high productivity. Productivity is the key; PA techniques are especially effective in ensuring farmer productivity. Studies forecast that soil testing followed by appropriate use of fertilizers based on sodium, potassium and phosphorous can more than double the productivity of the Indian farmer. Remote sensing GIS techniques can enable more economic testing of soil have the potential to

establish the efficacy of PA. The preliminary initiatives are already under way. The Tamil Nadu State Government has sanctioned a scheme named 'Tamil Nadu Precision Farming Project' to be implemented in Dharmapuri and Krishnagiri districts covering an area of 400 ha. Hybrid tomatoes, onions, baby corn, cabbage etc – which are high crops are to be cultivated. Project Directorate for Cropping Systems Research (PDCSR), Modipuram and Meerut (Uttar Pradesh state) has collaborated with Central Institute of Agricultural Engineering (CIAE), Bhopal to deploy the variable rate input application in cropping systems. Remote sensing techniques are being explored by ISRO, Ahmedabad in collaboration with Central Potato Research Station farm at Jalandhar, Punjab, to study the effects of variability in space and time.

Precision Farming Development Centers (PFDCs) have been located in various different parts of India. PFDCs are working for the popularization of PA and hi-tech applications to achieve increased production in addition to imparting training to a large number of farmers. Irrigation and precision in water management is the main focus of activity of these PFDCs. The National Bank for Agriculture and Rural Development (NABARD) is funding the collaborative effort of private and government agencies – for example a new precision farming centre has been established by MSSRF (M.S. Swaminathan Research Foundation – a non-profit trust) at Kannivadi in Tamil Nadu with the agriculture department of the Government of Tamil Nadu.

VI. THE CHANGING ROLE OF FARMER

Automation and digitization will lead to a change in the work functionality of the farmer on the ground. Farmers will become more tech-savvy. They will have to oversee the proper functioning of the technology-based instrumentation that they are using. Even though manual labour will decrease, farmers will still have to visit the fields and to check up on the situation - to validate and ensure system recommendations and correct functioning.

In the short term, farmers will require government support. This is especially true of those affected by the pandemic. The government and regulators have to encourage trade. The communication and coordination between farmers and consumers should be facilitated. Government policies should facilitate this, and improve coordination and information exchange between food producers and buyers, especially at the local level.

For the long-term, measures must include promoting healthier eating. More than 11 million people die each year as a result of unhealthy diets. Rice, maize, and wheat provide more than half of

the calorific value obtained by humans from plants. Not only people in general, but specifically those from the weaker section of society must be encouraged to eat high nutrition foods fruits, nuts, and whole grains. With increasing globalization, diets have become more homogeneous – and should move towards high energy, staple foods.

An important, critical issue is that the focus of current agricultural research has to shift from not only boosting productivity but also sustainability. Governments have encouraged this with legislation, and subsidies, as well as financial support. World trade agreement further reinforces this trend. The need is to focus research into developing crop yields and products that sustain diversity as well as healthier diets. These should be made viable for the farmers of under-developed and developing economies. The role of the policy makers - as well as that of the regulator is to promote bio-diversity; while simultaneously improve soil and water quality, to be able to adapt to climate change. This must be made part of the research agenda and must be made known to scientific research establishment, governments and international organizations.

VII. THE ROAD AHEAD

Digitization has the potential to transform the agricultural sector in developing countries [7]. But doing so will require further innovation and strong partnerships between governments, businesses, and farmers, as well as a regulatory environment to ensure that technology remains affordable and accessible to all. This has to be done with immediate effect – else the environment will cease to be sustainable for the generations to come.

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