



## DIGITAL AGRICULTURE- CHALLENGES AND OPPORTUNITIES

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**ABSTRACT** India's economy is heavily reliant on agriculture. More than 58% of rural households rely mostly on agriculture for their subsistence. Information and communication technology advancements promise a "next generation" of agricultural technologies that will boost productivity and efficiency while lowering risks and adverse effects. Digital transformation in agriculture refers to these technologies. Digital agriculture has considerable socio-ethical difficulties. One conceptual framework for addressing these issues is responsible innovation (RI), which acknowledges the ability of research and invention to shape the future and asks what kinds of futures communities wish to promote or forgo. Using digital technology to manage crops, livestock, and other activities involved in growing and managing food resources is known as "digital agriculture." The phrase is frequently used to indicate the various applications for the variety of data gathered in this industry. However, it also pertains to how technology functions and is integrated throughout the entire supply chain, from seeds or farm animals to the final consumer. Agricultural value chains are being transformed and brought up to date by artificial intelligence, machine learning, and the Internet of Things. While other nations have successfully integrated and used digital technologies to revolutionise agriculture, India is still in the early stages of digital adoption.

**KEYWORDS :** Digital farming, Benefits, Opportunity and Challenges

**INTRODUCTION:-**

India's economy is heavily reliant on agriculture. More than 58% of rural households rely mostly on agriculture for their subsistence. According to the Central Statistics Office's (CSO) 2nd advanced estimates, the Gross Value Added (GVA) for the agricultural and related sectors—which include cattle, forestry, and fisheries—was 17.3% in 2016–17 at prices from 2011–12. (Indian Agriculture, 2017)

Information and communication technology advancements promise a "next generation" of agricultural technologies that will boost productivity and efficiency while lowering risks and adverse effects. Digital transformation in agriculture refers to these technologies. Here, we talk about the Digiscape Future Science Platform, a project that aims to help Australia's agricultural and land sectors undergo a digital revolution. One prominent multinational initiative to actualize the revolutionary promise of digital agriculture is Digiscape. Digital agriculture is accompanied by large socio-ethical challenges, nevertheless. One conceptual framework for addressing these issues is responsible innovation (RI), which acknowledges the ability of research and invention to shape the future and asks what kinds of futures communities wish to promote or forgo. The world of today is in no manner comparable to that of six to eight decades ago. Prior to this time, no one understood how to use a cell phone, a laptop, or an internet connection. Today, on the other hand, everyone—from children to adults—is aware that if they have a reliable cell phone and an internet connection, they can get through any scenario. The digitization process has been ongoing for a while, with the goal of creating a world that is entirely digital in the future. This article on Digital India will rivet on the emergence and significance of digital transformation around the world, especially in India.

**The major challenges of the agriculture sector are:**

a) Food Sufficiency but Nutrition Deficiency.	e) Inadequate market infra/linkages.
b) High import of edible oil and oilseeds.	f) Unpredictable, volatile prices.
c) Yield plateaus.	g) Post-harvest losses, wastages.
d) Degrading soil, Water stress.	h) Lack of crop planning due to information asymmetry

**OBJECTIVE & METHODOLOGY:-**

This paper focuses on comprehending the idea of digital agriculture and how it helps Indian agriculture advance. Numerous software businesses have partnered with the Indian government and continue to do so in order to construct and support the agriculture industry during this Digital Transformation. The strategy used by these businesses to determine how future supply-chain demand would be satisfied is also examined in this article. The research is primarily descriptive. The conceptual analysis is built on secondary information gathered from newspapers and journals. The study's focus is solely on the agricultural industry.

**MEANING OF DIGITAL AGRICULTURE**

Digital agriculture is the integration of digital technology into livestock and crop management and other processes related to cultivating and managing food resources. The term is often used to describe the different uses for the variety of data collected in this sector. But it's also about how technology integrates and works throughout the supply chain, from seeds or farm animals to the consumer.

**DIGITAL FARMING**

Digital farming can be defined as the use of technology by farmers to integrate financial and field-level records for complete farm activity management.

Digital farming gave way to linked, knowledge-based farm production systems as part of the growth of agriculture and agricultural engineering, which is referred to as digital farming. Precision farming technology is used in digital farming, but it also makes use of intelligent networks and data management systems. The goal of digital farming is to enable the automation of sustainable agricultural processes by utilising all knowledge and resources at our disposal.

Information and expertise to enable the automation of sustainable processes in agriculture.

**ADOPTION OF DIGITAL FARMING**

McKinsey analysts have described the world's food producers as the "least digitized industry." But some would argue this means the agricultural industry is ripe for disruption. Here are just a few of the ways digital innovation is beginning to transform the agricultural industry.

1. **Robotics:-** Modern farmers are increasingly using robots to feed and butcher cattle as well as grow and pick crops. Over \$5 billion is being spent on agricultural robots, and during the next five years, that industry is anticipated to treble.

2. **Internet of Things and Sensors:-** Farmers may monitor live animals and products while also assessing environmental conditions and livestock health using the Internet of Things (IoT) and sensors. This gives farmers and their partners real-time visibility into every aspect of their business.

3. **Artificial Intelligence :-** Up until now, much of farming has been learned by trial and error or through those who have a profound grasp of the sector. This presents difficulties for recent industry entrants, who must make a lot of expensive mistakes. For both experienced and beginning farmers, artificial intelligence (AI) can be a tremendous tool. It can aid these experts in avoiding inefficiencies and obtaining the information they require fast.

4. **Drones:-** In the agricultural sector, drones are now extremely prevalent. 20 million hectares of cotton fields are being surveyed in China using them to observe details that people on the ground would not be able to perceive. Drones can offer information on a variety of topics, including irrigation, pest control, and harvest timing.

**5. Cloud Connectivity:-** Farmers can benefit from more flexible digital solutions and economies of scale thanks to cloud-based connectivity, which uses a real-time internet connection. Many farmers lack any kind of connection. Adopting cloud connectivity is a huge improvement since it allows farmers to observe and do more in real-time.

**6. Data Analytics:-** There will be 175 zettabytes of data stored worldwide by 2025. That is a lot of data to process. Fortunately, several pioneers are developing reliable solutions that assist individuals working in the agriculture sector in gathering, storing, and making sense of data.

### **BENEFITS OF DIGITAL AGRICULTURE**

A digital farm is far more sustainable and efficient than a traditional one. Bringing technology into the agricultural sector involves a wide range of strategies, including artificial intelligence, the Internet of Things, mobile technologies, and other digital solutions. Some of the many benefits that come with digital agriculture include:

**1. Streamlined Communication:-** Teams in the agricultural sector have come to rely heavily on automated procedures. Data had to be manually gathered, distributed, and processed using paper forms and outdated spreadsheets. Agricultural data may be easily collected in the field and communicated promptly to management and other supply chain partners with the help of automated data collection technology from RFID tags and other mobile computing solutions. This increases operational effectiveness and raises visibility across the whole food supply chain.

**2. Effective Monitoring:-** Farmers may be able to better monitor the health of their crops and livestock thanks to technology. Wearable sensors can be used to monitor temperature in cattle, while drones are increasingly being used to survey fields, evaluate soil quality, and arrange seeding schedules. Animation can be used by farmers to forecast the effectiveness of certain tactics. Additionally, these technologies aid companies in managing and keeping an eye on pest and weed activities across their entire operation.

**3. Better Documentation:-** Farmers are required to keep detailed records of everything they do when growing food that people eat. This industry is very tightly regulated. However, since digital attachments cannot be used with manual forms, the procedure is unnecessarily laborious and time-consuming. Farmers can fill up and submit needed forms immediately from their mobile devices by digitising their business processes. GPS coordinates can be recorded on forms, as well as the ability to attach pictures and videos and even digital signature fields.

**4. More Informed Decisions:-** Making the right decisions regarding when to grow crops, how to plant them, when to harvest them, who to partner with, what pricing to charge, etc. is the foundation of successful agriculture. Farmers now have access to extensive information about their performance and the data they need to make better decisions thanks to digital technologies. It's also crucial to remember that there is now an unprecedented amount of data available, making it nearly impossible to evaluate the data acquired without assistance. Nowadays, agricultural businesses can use big data to address a wide range of challenges or avoid issues with planting, harvesting, selling, and shipping products.

**5. Save Time and Money:-** Saving farmers time and money is one of the main reasons for embracing digital agriculture. A farmer may be able to enhance yield and complete the task more quickly while lowering costs by better planning a field using GPS technology and cutting-edge insights. Of course, the majority of technological solutions have a cost. But once farmers start to see the time and money benefits connected to higher productivity and better visibility, those upfront expenses can be swiftly recovered. Although digital agriculture is still in its infancy, several businesses involved in this sector have started to take notice. Businesses have been investing in digital enhancements including automation, RFID monitoring, mobile computing, and wireless infrastructure as a result of supply chain issues during the past few years. These investments will raise overall performance by enhancing efficiency and supply chain visibility.

### **OPPORTUNITIES IN DIGITAL AGRICULTURE**

Digital agriculture presents several opportunities for various stakeholders in India, such as:

**Farmers-** In order to help farmers make better decisions about when to

plant, fertilise, and harvest crops, digital agriculture gives farmers access to real-time information on weather, soil health, and crop growth. Input costs may be decreased, yields can be increased, and profitability can be increased for farmers with the aid of digital technologies.

**Agribusinesses-** Agribusinesses can access a variety of data on crop yields, market trends, and consumer preferences thanks to digital agriculture, which enables them to create more specialised marketing campaigns and enhance supply chain management. Agribusinesses can benefit from using digital technologies to cut expenses, boost productivity, and increase profitability.

**Government-** The government can use digital agriculture as a platform to inform farmers, track and assess agricultural programmes, and support sustainable agricultural practises. Digital technologies can also assist the government in strengthening its ability to respond to crises like pandemics and natural catastrophes.

**Technology companies-** As the use of digital technologies in agriculture continues to rise in India, digital agriculture offers technology businesses a large market opportunity. Government agencies, agribusinesses, and farmers can all benefit from a wide range of digital solutions that technology companies can create and market.

**Investors-** Investors have a large chance to make investments in a sector that is fast expanding and potentially transformational thanks to digital agriculture. The creation of cutting-edge digital solutions, the growth of the digital infrastructure, and the use of digital technology by farmers and agribusinesses can all be supported by investments in digital agriculture. In India, digital agriculture offers a number of opportunities, and stakeholders in the agriculture industry can gain from the use of digital technologies in farming.

### **CHALLENGES OF DIGITAL AGRICULTURE**

While digital agriculture presents several opportunities, several challenges must be addressed to fully realize the potential of digital technologies in agriculture in India. Some of the key challenges include:

**Limited digital infrastructure-** The poor availability of digital infrastructure, such as internet connectivity and cell networks, particularly in rural areas where the bulk of farmers are located, is one of the largest problems facing digital agriculture in India. The effectiveness of digital agriculture is constrained by farmers' inability to use digital tools and services.

**Low digital literacy-** Low levels of digital literacy among farmers, especially elderly farmers who could be less accustomed to digital tools, present another difficulty. As a result, it might be harder for farmers to take full advantage of digital agriculture and limit the use of digital products and services.

**High cost of digital technologies:-** The high cost of digital tools and services can be a deterrent for many farmers, especially smallholder farmers who may have little financial means, from adopting new technology.

**A lack of localised and pertinent content;** Another issue is the dearth of locally relevant digital content, especially when it comes to data on markets, crops, and weather. Farmers may find little use for information that is not pertinent to local circumstances or that is not offered in their own tongue.

**Privacy and security concerns:-** There are worries regarding the security and privacy of this data because digital agriculture depends on the gathering and storing of vast volumes of data. The promise of digital agriculture may be restricted if farmers and other stakeholders are hesitant to disclose sensitive information.

**Limited coordination among stakeholders:-** The use of digital technologies in agriculture might also be hampered by a lack of collaboration among players. In order to make sure that digital agriculture is efficient, sustainable, and inclusive, cooperation between farmers, agribusinesses, governmental organisations, and technology companies is crucial. In general, overcoming these obstacles will be essential to ensuring that digital agriculture in India achieves its full potential and benefits farmers and rural people all across the nation.

### **Future of Indian Digital Agriculture**

Remote sensing, soil sensors, drones, market insights, and other technological advancements enable farmers to gather information, visualise conditions, and make cost-efficient assessments of crop and soil health at various stages of production. By putting these specialised solutions into practise, farms may be reliably managed and watched over. When farmers receive a thorough digital analysis of their farms in real-time, they may take appropriate action. The following list contains a few noteworthy advantages.

- Increases agriculture productivity and lowers production cost
- Constrains soil degradation
- Reduces chemical application
- Promotes adequate and efficient use of water resources
- Uplifts socio-economic positions of farmers
- Reduces environmental impacts

### **CONCLUSION:-**

Rapid technology advancements in robotics, artificial intelligence, and remote sensing have fueled the growth of digital agriculture. These systems give farmers the ability to generate thorough, accurate, and transparent crop and livestock products at the national and regional levels, as well as to boost yield and quality while reducing their impact on the environment. However, in order to effectively deploy these technologies and achieve widespread digital transformation of agriculture, a number of issues and limits, including accuracy, interoperability, data storage, compute power, and farmers' resistance to acceptance, must be solved.

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