Key Initiatives taken by Indian Government for Agriculture 4.0

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The foundation of the Indian economy is the agriculture sector, which generates roughly 20.2 percent of GDP (gross domestic product), compared to 19.9 percent in 2020–21. More importantly nearly half of India's population depends heavily on agriculture and related industries for a living. Over time, the agriculture sector's contribution to GDP has decreased while other sectors especially the services sector have seen an increase. The nation is expected to produce a record 308.65 million tons of food grain, 11.15 million tons more than in 2019–20. On the other hand, small and marginal holdings make up 85% of all operational holdings, or 44% of all operated land, with 157.35 million ha of small holdings farming.

Despite more than 70 years of planning after independence, the majority of farmers continue to struggle with low yields and low profits. The Indian Council for Agricultural Research (ICAR) projects that by 2030, there will be a 345-million-ton demand for food grains. India's average income, growing population, and the effects of globalization will drive up demand for nutritious, high-quality food. As a result, demand to produce more food in greater quantities and of higher quality will keep rising on a decreasing amount of cultivable land. Digital precision agriculture technology makes this possible.

The agriculture sector is undergoing amazing transformation because of drones, sensor-equipped satellite imagery, and digital learning technologies. With the use of digital technology and agricultural modernization, new ideas have emerged, such as digital agriculture with the help of digital education. In order to make farming profitable and sustainable while providing everyone with healthy, nutritious, and reasonably priced food, digital agriculture uses information and communication technologies (ICT) and data ecosystems to assist the development and delivery of timely, targeted information and services.

Agriculture 4.0

The arrival of digital technology in the early 2010s, including low-cost microprocessors, high-bandwidth cellular connection, cloud-based ICT systems, cheap and better sensors and actuators, and big data analytics, set off a new evolution in the agricultural area. With platforms combining data from multiple sources, including sensors and equipment in the field or farm or external sources, these technologies led to the emergence of agricultural eco-systems (FAO, 2017). This allows farmers to monitor their operations from a dashboard with real-time (or nearly real-time) information and make decisions based on quantified hypotheses to increase the outcome. As a result, the agricultural development entered a new phase known as Agriculture 4.0.

The term "Agriculture 4.0" refers to the fourth industrial revolution in farming, which is a significant component of the primary industry. This revolution occurs simultaneously with the similar change in the entire industrial sector, which is known as "Industry 4.0." A growing population—which is predicted to reach 9 billion people by 2050—can be fed by increasing global food production, which is possible with the help of agriculture 4.0. In fact, the use of digital technologies in agriculture raises farming operations' productivity. Simultaneously, the progression towards Agriculture 4.0 benefits both farmers and the sustainable growth of the primary sector. India's National Strategy on AI also aims to realize the potential economic and social benefits the technology offers. Further, the National Strategy on AI recognizes agriculture as one of the priority sector areas for implementation of AI driven solutions. (Niti Aayog, 2019)

The World Government Summit launched a report called Agriculture 4.0–The Future of Farming Technology, in collaboration with Oliver Wyman for the 2018 edition of the international event. The report addresses the four main developments placing the

pressure on agriculture to meeting the demands of the future:

- ♣ Demographics
- ♣ Scarcity of natural resources
- ♣ Climate change and
- ♣ Food waste.

Novel Digital Technologies of Agriculture 4.0

- **Digital Agriculture Mission (2021)**

The Digital Agriculture Mission 2021–2025 was established by the Union Minister of Agriculture and Farmers Welfare. Its goal is to support initiatives based on emerging technologies like artificial intelligence (AI), blockchain, remote sensing, and geographic information systems (GIS) and to advance digital agriculture through experimental projects. Drones and robots are employed in these projects.

- **National e governance Plan for Agriculture (NeGPA)**

To accommodate new and developing digital agriculture technology and release funds to the States/UTs only for projects involving the use of modern information technologies such as Artificial Intelligence & Machine Learning, Block Chain Technology, Internet of Things, Robotics, and so on.

The Department developed the Farmers Portal (www.farmer.gov.in) as part of the NeGPA initiative to share knowledge on a wide range of agricultural topics, including seed variety, storage facilities, pests and plant diseases, best agricultural practices, watersheds, mandi data, and so on.

- **Mobile Applications for Farmers**

To assist farmers in obtaining information on critical topics such as weather, market pricing, plant protection, agro-advisory, extreme weather warnings, and input dealers (of seed, pesticide, fertilizer, and farm machinery), soil health card, cold storage and godowns, soil testing laboratories, veterinary centers and diagnostic labs, crop insurance premium calculator, and the government scheme, there are various apps available such as Kisan Suvidha, Farm Mech' App, Farm Safety App, and Water Balance Simulation Model for Roof Water Harvesting (Mobile App).

- **India Digital Eco-system for Agriculture (IDEA)**

IDEA, or the India Digital Eco-system for Agriculture, is a project being developed by the Digital Agriculture Division of the Ministry of Agriculture & Farmers Welfare. A framework connecting digital land records to publicly available data from various initiatives is being built to provide the architecture for the federated farmers' database. The IDEA would assist in building the nation's Agri-stack architecture, which would act as a basis for the creation of creative Agri-focused solutions utilizing cutting-edge technologies in order to effectively contribute to the improvement of India's agricultural environment. The government will be able to create more efficient plans with the help of this ecosystem, which will raise the income of farmers in particular and the sector's general efficiency.

- **Sub Mission on Agricultural Mechanization (SMAM),2014.**

By bringing small and marginal farmers into the center of farm mechanization and providing them with the benefits of it, the scheme seeks to "reach the unreached." It does this by promoting "custom hiring centers," establishing hubs for high-tech and valuable agricultural equipment, distributing a variety of agricultural equipment, raising stakeholder awareness through demonstration and capacity building activities, and guaranteeing performance testing and certification at specially designated testing centers spread throughout the nation.

- **National Agriculture Market (e-NAM)** is an electronic trading portal that covers all of India, connecting the current Agricultural Produce Market Committee (APMC) mandis to establish a single, nationwide agricultural commodities market on the web at https://www.enam.gov.in. Provide users access to the current commodity price via a mobile app. Include a GPS-based function that records e-NAM mandis and mandi prices within a radius of around 100 km, along with a route map. Through digitalization, e-NAM is enabling citizens to make better decisions about prices for farmers by improving

accessibility, simplicity of use, transparency, and operational efficiency.

- Direct Benefit Transfer allows funds from the **PM KISAN Scheme** to be transferred directly into the bank accounts of eligible farmers. The PM-KISAN Mobile App was introduced to increase the program's reach. It allows farmers to check the history of credits to their bank accounts, update or modify their name based on their Aadhaar card, and monitor the status of their application.

- **Integrated Scheme for Agricultural Marketing schemes (AGMARKNET)** portal is a govt. of India portal on agricultural marketing backed by a wide area information network connecting agricultural markets, State Marketing boards/Directorates and also providing linkages to the websites of the important National and International Organizations.

- Over **1,000 agri-tech start-ups** are based in India, and various venture capital funds, loan funds, and angel investors have long supported the sector.

- To provide farmers with real-time data and the necessary advice, **NITI Aayog has teamed up with International Business Machines (IBM)** to create a crop production forecast model supported by AI. It aids in enhancing crop output, soil quality, agricultural input control, and early disease outbreak warning.

- **Kisan Credit Card (KCC):** In order to make loan facilities easily accessible to farmers, the KCC scheme adopted technology. For farmers, the KCC card serves as a credit line. They can take out money based on what they need. Farmers may obtain loans more quickly, skip laborious paperwork, and improve their financial management by digitizing this process.

- **Cross-industrial Collaborations:** Together, IBM and NITI Aayog have developed an AI-based crop production prediction model that will help with early disease outbreak detection, crop productivity, soil quality, and agricultural input control. Data from ISRO, the current soil health card database, the Indian Meteorological Department's weather prediction, and other sources will be gathered in order to give farmers accurate and timely recommendations.

- In order to empower farmers, the **Jio Agri (Jio Krishi) platform** was launched in February 2020 and digitalized the agricultural ecosystem throughout the whole value chain. The platform gathers information from multiple sources, feeds it into AI algorithms, and then provides targeted, accurate advice.

- **Climate-smart farming techniques** are being progressively adopted by India, helping to reduce greenhouse gas emissions from agricultural activities and change the nation's ecosystem. For example, farmers in the village of Dhundi in Gujarat have started using solar power and other renewable energy sources for irrigation.

- In order to assist India's small-holder farmers, Microsoft and the Indian government have partnered to launch the **"Unified Farmer Services Interface"** pilot initiative. The collaboration wants to raise agricultural productivity using AI sensors and manage prices better to increase farmers' incomes. The partnership would hasten the application of AI in agriculture.

- The **SENSAGRI program**, which stands for Sensor-based Smart Agriculture. In this design, drones would be used to survey over land tracts effectively, gather invaluable information, and provide the data to farmers promptly.

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