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An Analytical Review on Traditional Farming and Smart Farming: Various Technologies around Smart Farming

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Abstract
The main source of income in India is the agricultural industry. A primitive form of food production, traditional farming relies largely on local knowledge, land utilization, traditional equipment, natural fertilizers, manual labor, field-spread pesticides, cow grazing, lack of technology, and cultural beliefs of the farmers. Many agricultural regions may see losses in crop and livestock yield as a result of increased stress brought on by weeds, disease, insect infestations, and other pressures produced by climate change. Over the past 40 years, in the absence of technology in traditional agriculture, the creation of agricultural disruptions has increased, and this trend is anticipated to continue. Agriculture that is both rainfed and irrigated will continue to encounter challenges unless innovative conservation measures are used to stop the current loss and degradation of vital agricultural soil and water assets. This study paper reviews and analyzes the work of numerous scholars in order to provide a rapid assessment of the various drawbacks of traditional farming and the advancement of smart farming.

INTRODUCTION

One of the greatest sectors in the world, agriculture or farming is the primary source of income for almost 58% of India's population. Agriculture and forestry have a big effect on property development and food security. In addition to having the greatest herd of cattle (buffaloes), wheat, rice, and cotton-planted land, India is the world's largest producer of milk, pulses, and spices. Wheat, rice, sugar, cotton, farmed fish, cotton, vegetables, fruits, and tea are among the products it produces that are second in size. From 1991 to 2021, India's agricultural output grew on average by 86.14% INR billion. More than 120 countries import processed Indian farm food. In terms of agricultural industries, India is ranked 74thout of 113 nations in 2020, according to the resources. The Indian food and grocery store was ranked sixth in the entire world. The issue of wise resource use is brought on by the global population's constant rise along with a reduction in available resources. Because the conventional procedures are no longer successful, good agricultural and farming applications have grown in importance and are now utilized more frequently. Farming is the practice of cultivating plants and livestock. Indian people have different necessities and surrounded with various climatic conditions. Depends upon that there are different types of farmers and Farming types are there.

This essay is organized as follows: The background information on traditional farming is presented in Section II. Section III presents background of smart farming.
Section IV presents advantages and disadvantages of smart farming. Section V presents summary report of referred papers. Section VI presents conclusion and future scope.

Background of Traditional Farming

The wide term "agriculture" refers to anything involved in cultivating plants and rearing animals for food and useful products. It entails processing plant and animal products before delivering them to markets for human consumption. Low-tech equipment like the axe, hoe, lawn rake, hand fork, pruners, spade, long-handled shears, etc. was widely used when people first started growing crops.

Role of Farmer in India

The backbone of India is a farmer. Agriculture is the industry in which farmers operate, providing a wide range of food items for both human and animal consumption. Farmers come in a variety of rams, from those who raise livestock to those who cultivate crops. Farmers are the ones who cultivate all the livestock and crops needed for human life. Without food, the world would slowly perish, thus farmers work in credibly hard every day to maintain an abundant supply of crops and animal products on the market. Consumer expenditure in India will rebound in 2021 following a pandemic-related decline; increasing by as much as 6.6%.32% of India's overall food market is made up of businesses in the food processing sector.

Farming Types

As shown in Figure1, there are various farming methods: (i) Primitive Subsistence Small, scattered land holdings, the use of simple tools, and farming are hallmarks. The farmer doesn't use fertilizers or seed varieties that produce a lot of crops. Where there is heavy population pressure on the land. (ii)Intensive subsistence farming is practiced. A number of machines, together with irrigation, fertilizers, and pesticides, are introduced to maximize production in small spaces. (iii)Commercial farming is defined as the practice of using ever bigger dosages of modern input to increase output.

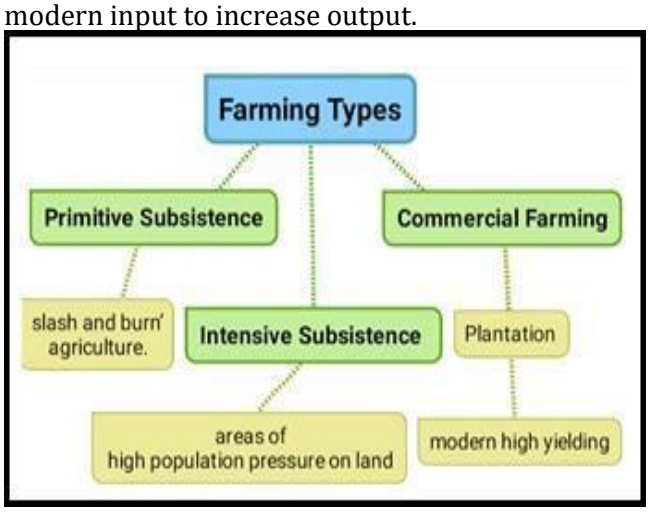

Figure 1: Farming Types

Types of Farmers in India

As depicted in Figure 2, a farmer may be the owner of the farmland or may work as a work cropland that belongs to others. Farmers come in a variety of forms. Who in India encourages or improves the growth of plants, land, crops, or animals through work and care is highlighted in Table 1.MarginalFarmers, or those with less than 1 hectare of land, come first. Second, small farmers with land sizes of 1 to 2 hectares. Third, small-to-medium farmers with land sizes between 2 and 4 hectares.

TypesofFarmer TypeofProduction
s

Organic Farmer	Without the use of pesticides, herbicides, or chemical fertilizers, produces fruits, vegetables, cereals, or cattle.
Grain and Forage Crop Farmer	Cultivates forage crops as well as grains like wheat, barley, canola, oats, rye, flex, and peas.
Dairy Farmer	Owns or manages a farm where cows are raised for milk and other everyday needs.
Poultry Farmer	Rears domesticated birds, such as chickens, turkeys ,ducks ,or geese.
Rancher	Raises both common livestock likes heap or cattle as well as unusual ones like bison, ostriches, emus, or alpacas.
Bee Keeper	Produce honey ,pollen ,royal jelly, and beeswax by keeping honey bees.
Vermi Culturist	Raises worms and uses them to transform waste materials such uneaten food, garbage, grass clippings, damaged fruit ,nutrient- rich soil, and organic fertilizer.

Table 1: Types of Farmers in India.

Figure 2: Categorization of Farmers in India

Traditional Farming Methods in India Traditional farming is a time-honored practice that has been applied since ancient times, as indicate din Table2. These techniques have assisted farmers in providing ecological and cultural services to humanity throughout he ages .Figure 3 shows how maintaining traditional farming practices has improved food security, preserved biodiversity, and safe guarded the planet's natural resources.

Name of the Farming Method	Type of Production and Benefits
Agro forestry	Food, firewood, and key food crops area ll produced there .It offers local communities significant social and Economic advantages.
Crop Rotation	Depending on the season, growing various crops on the same ground. It helps to maintain soil productivity ,lessen pests ,use fewer chemicals, increase yields, and lessen dependency on a single set of nutrients.
Intercropping	More than two crops are sown at once. Excellent approach to increase

	yields and harvest diversity on a single piece of land while Maximizing the usage of resources.
Poly Culture	It is a mechanism for growing several plants of various species in one location. Without the use of chemicals, it can control weeds, pests, and illnesses. It aids in lowering soil erosion and raising consistent production. It raises the soils quality .
Water Harvesting	Rain water is typically collected from roofs and used on crops or stored for later use by individuals or other agricultural uses. It offers portable water and lessens the demand on wells.

Table 2: Traditional Farming Methods in India

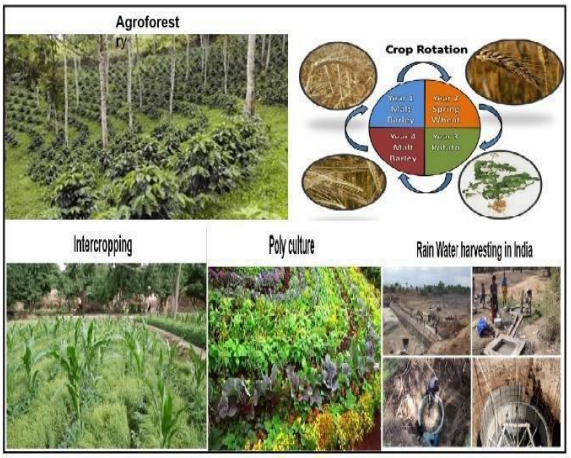

Figure 3: Traditional Farming Methods in India

Characteristics, Advantages and Disadvantages of Traditional Farming Traditional agriculture is a basic method of food production nand farming, asdepictedinFigure4,thatheavily utilizes local expertise, land use, customary equipment, natural resources, organic fertilizer, and farmer cultural beliefs.

Characteristics of Traditional Farming:

Cattle are used to create fallow ground in traditional farming.
Alto flow-tech tools are used.
Using techniques like "slash, burn," and "shifting cultivation."
Absence of accountability of responsibility to the environment. No way to predict weather.
Zone identification and geo tagging are not possible.
The same sets of procedures are used throughout the region for agricultural cultivation.

Figure 4: Characteristics of Traditional Farming

Advantages and Disadvantages of the Traditional Farming

These days, farming can take on an unlimited number of sophisticated, high- tech ways, each with countless advantages and disadvantages of traditional farming are shown in Table 3.

Advantage and Disadvantage of Traditional Farming

Advantages	Disadvantages
1) No need of the Artificial fertilizers, the we can use natural manures like vermin compost, cow dung manure.	1) Compared to high- tech farming, traditional farming enquires farmers to spend mostly approximately 15 hours harvesting the crops.
2) Because they are pure, they can Be sold for more money.	2) More number of labors need to Involve in harvesting.
The cultivatable land is easily suitable for the multi crop method, as we only using the natural fertilizers.	The majority of the time is spent in decomposition. Additionally, these increase the like hood of soil disease affecting the crops.
The spending cost to grow the crop is low in traditional method.	More num be or flavors Need to involve in harvesting.
After decomposing, the crop waste can be used as fertilizer for the soil .	Wastage of water affects the environment as Depletion of soil nutrients, Deforestation, Soil erosion.

Table 3: Advantages and Disadvantages of the Traditional Farming. Back ground of Smart Farming.

The output of ancient agriculture is deficient in the use of information and technology, which have become pervasive in business and many areas of life. Quick action is required to protect the crops from pests, a lack of nutrients, an abundance of water, the need for fertilizers and light, etc. Together with rising chemical prices and growing concerns over agriculture's impact on surface and groundwater quality. Additionally, they must be forced to use limited resources

to meet a 50–70% increase in the demand for food on a global scale. Also necessary is the transformation of agricultural systems into highly profitable and resource-efficient ones.

Crop stress levels are tracked and identified, which helps Agro tech create healthy crops and boosts output. Utilizing techniques and technologies, smart agriculture identifies in-field soil and crop variability in order to enhance farming methods and maximize agronomic inputs. The author soft conduct a thorough assessment of the literature on institutional aspects of climate-smart agriculture by looking at 137 research publications that were publishedbetween2001and2017in total, along with a few from1996 to 1998. A capable analytical technique is required to examine, process, and analyze this enormous volume of data in order to obtain trustworthy information for accurate predictions and to create intelligent agricultural environments that can boost production.

An emerging idea is smart farming (SF), sometimes known as smart agriculture .This refers to how farmers use IoT (Internet of Things), sensors, robotics, drones (Unmanned Aerial Vehicles, machine learning or UAVs),AI(Artificial Intelligence),and Apps (Applications) to manage their farms and increase the quantity and quality of their products while reducing the need for human labor. The benefits of SF are:

Every farm is examined to determine the best crops and water needs for optimization.
Farms' various zones can be identified using satellite images.
Early detection and cost-effective application to the afflicted area only.
Prediction and analysis of the weather.
The availability of field and financial data in one location, displaying profits, yields, and patterns straight forward reports.
Providing security and reliability for suppliers and consumers.

By making agricultural goods beneficial to people, modern technology, information, and communication are applied to increase the number and quality of products. As depicted in Figure 5, various technologies are used in smart farming. Sensors (for controlling water, soil, light, humidity, and temperature), software (for specialized farm software solutions), connectivity (for cellular), location (for GPS and satellite), robotics (for contemporary tractors), and data analytics (data channels for downstream solution).

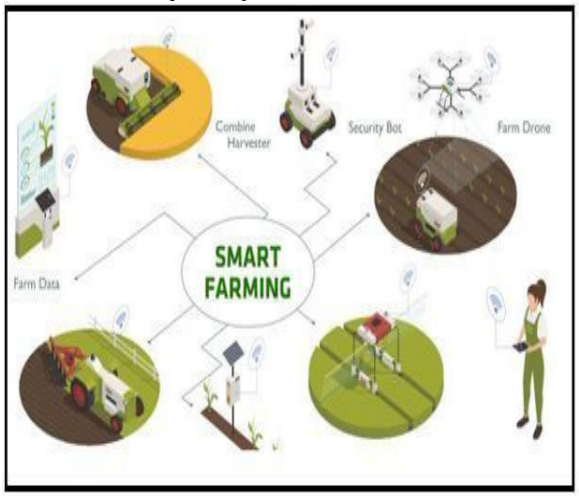

Figure 5: Smart Farming Various Technologies around Smart Farming

Smart Farming (SF) is the application of ICT (Information and Communication Technologies) in agriculture. The development and marketing of cutting- edge technologies to help farmers on the ground is being driven by data obtained and analyzed using ICT methods to support efficient production processes. This work is being done by researchers, practitioners, commercial, and public businesses.

The potential of unmanned aerial vehicles (UAVs) for aerial image sand actuation, the employment of agricultural robots, a significant amount of sensor node data collection, and satellite imagery are the most pertinent technologies and approaches, according to the European Union (EU).The statement of collaboration on a smart and sustainable digital future for Europe an agricultural and rural areas, which was signed in April 2019 by 24 EU countries, contains those indications.

IoT (Interne to Things) and Sensors in Smart Farming: a) IoT (Internet of Things)

Internet of Things (IoT) is beginning to have an impact on a range of sectors and businesses, including manufacturing, health, communications, and agriculture, in order to reduce inefficiencies and improve performance across all markets. Sensors or other devices that communicate with the cloud via network protocols make up an IoT system (Wi-Fi, Cellular LoRa WAN ,Zigbee, Z-wave etc.,). Open-source software tools are used for developing IoT applications i.e., Device Hive, Kaa, Arduino, Rasberry Pi, Home Assistant, Device Hub etc.

A radio navigation system that depends on satellites is the Global Positioning System (GPS). The Global Positioning System does not require data transmission from the user and is not dependent on cellular or internet reception to function. Globally, the GPS offers vital positioning capabilities to users in the military, civic, and commercial sectors. Databases and software that run on servers that can be accessed via the Internet are referred to as being in the "cloud." Cloud servers are housed in data centers all around the world.

The Internet of Things (IoT) technologies are essential to many agricultural applications. This is due to the capabilities of the Internet of Things (IoT), which include the basic communication infrastructure (used to connect smart objects, such as sensors, vehicles, and user mobile devices using the Internet), as well as a number of services, like local or remote data acquisition, cloud-based intelligence, and agriculture operation automation. Such capabilities have the potential to change the agriculture sector, which is now one of the least efficient in our economic value chain.

Figure 6 demonstrates the need for IoT system optimization for green houses, which is well acknowledged by academics. Sensors with care, data collection, optimization, setting the appropriate parameters, and rule-based control. It can be challenging to regulate every parameter in a smart greenhouse, including pressure, humidity, CO2, rain, pH, moisture, insecticides, and temperature, especially when there is a dearth of historical data.

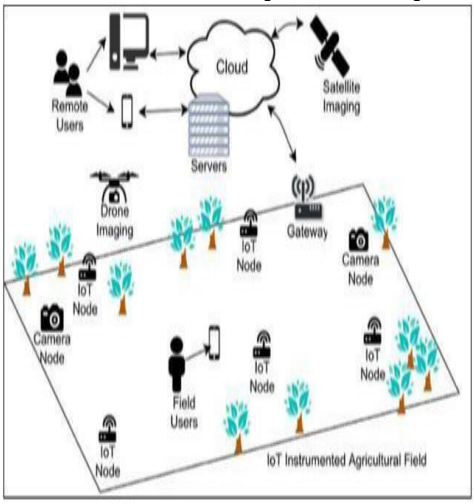

Figure 6: Core aspect sofIoT-based systems for smart greenhouses (Reproduced with permission from (Elsevier) from Popovic et al. (2017))

Smart farming developments are showing Figure 7, where cloud service providers have an advantageous way to obtain computer services and provide their own infrastructure. Cloud services that have been certified are available from companies like Amazon Web Services (AWS), Alibaba Cloud, Google Cloud Platform (GCP), IBM Cloud, Microsoft Azure, Oracle Cloud, and others. When data reaches the cloud, software processing it and decides whether to take a certain action, such alerting a user or automatically altering a sensor or equipment.

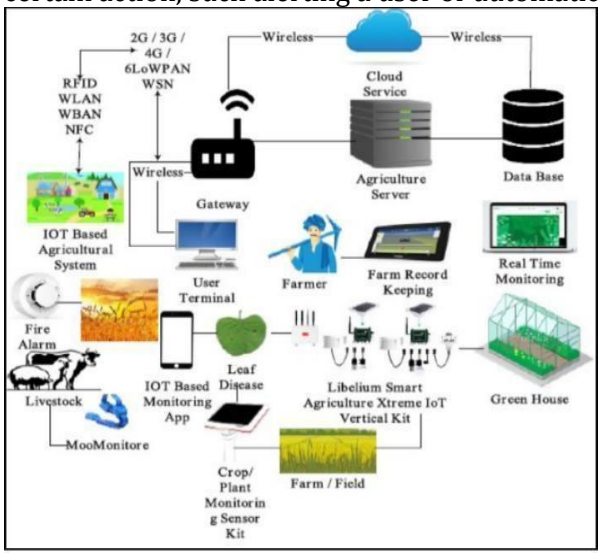

Figure 7: Smart Farming Trends

Precision farming (PF) and automation in smart greenhouses are the two main aspects of agriculture that IoT can transform.

Precision farming also known as precision agriculture enables decisions to be made per square meter, or even per plant or animal, rather than for an entire field. Farmers can make insecticides and fertilizers more effective or use them sparingly.

Automation in smart greenhouses: Greenhouse gases are gases that trap heat in the atmosphere. Production loss, energy loss, and increased labor costs are the effects of traditional greenhouse management. The best results for controlling water vapor, carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, etc. are achieved by IoT-driven smart greenhouses.

Sensors

Sensor is device that detects the change in the environment (soil, water, light, temperature etc.,) and responds to some output on the other system. Agriculture sensors are those that are utilized in smart farming. In order to monitor and improve crops in response to shifting environmental conditions, farmers might use the information provided by sensors. They are precisely controllable by mobile apps created for agricultural purposes. Drones, robots, and sensors installed and fixed in weather stations are all employed in agriculture .sensors for agriculture with wireless connectivity. With the use of mobile phone applications, they can be managed directly through wi-fi or via cellular towers.

There are numerous sensors that are used in the agricultural sector. Some of these are depicted in Figure 8: Optical sensors (can identify clay, organic matter, and soil moisture content); (ii) Electrochemical sensors (for identifying soil nutrients); (iii) Dielectric soil moisture sensors (which measures soil moisture levels); Mechanical soil sensors (when a sensor slices through soil, it measures the holding forces brought on by the soil's cutting, breaking, and displacement); and Location Sensors (can identify range and distance a sensor is from.

Figure 8: Sensors in Smart Farming

Robotic In the Smart Farming

Smart farming is the practice of integrating technological advancements like big data, machine learning, AI (Artificial Intelligence), robotics, drones, cloud computing, and the Internet of Things (IoT) into various stages of manually operated, mechanically operated, and mechanized operations throughout the entire crop production cycle. The advent of drones, self-driving tractors, robotic seeding and harvesting, and drip/sprinkler irrigation is increasing the automation of simpler and more routine operations, claims in-depth research.

Agricultural Robots (AgBots), as depicted in Figure 9, are utilized in a variety of applications, including planning, watering, harvesting, and sorting crops. The successful integration of all these AgBots through a robust network of intelligent sensors created by IoT will ultimately be the key to farm automation. The ability of all the systems, tools, and devices to communicate with one another in real-time and dynamically is essential to a genuinely "smart" farm. Maintaining an appropriate interface with human orders while allowing autonomous operation to continue. From a bullock- driven to a self-driving tractor, from manual sowing to automated aerial seed distribution, from flood irrigation to drip feeding, from manual weeding to self-applied pesticides, and from manual picking to auto-applied pesticides.

Figure 9: Precision Agricultural Robotics

Unmanned Arial Vehicles (UAV)–Drones

Agriculture is one of India's key industries. A farmer cannot control these natural elements, which include temperature, humidity, rain, and other conditions that affect crop output. Agriculture also depends on a number of other elements, such as pests, diseases, fertilizers, etc., which can be managed by treating crops properly.

Unmanned aerial vehicles, or drones, have been in the news for more than a decade. Growing drone use in the agricultural sector has significantly improved operational efficiency for farmers all over the world. Currently, tracking and distribution are two common agricultural

applications where drones are used. Both plant and livestock farmers employ tracking (and subsequent analysis) to better understand the condition, resources, and output of their farms. 2) Physical resource movement around a farm is involved in distribution using drones, including the application of agricultural agents like pesticides, fungicides, and fertilizers.

Drone Technology quickly reestablishes traditional agrarian practices and is subsequently accomplishing them as best drone practices as shown in figure 10 as follows;

Irrigation Monitoring
Crop health monitoring and surveillance
Crop damage assessment
Field soil Analysis
Planting
Agricultural Spraying
Livestock tracking

There are numerous benefits of using Agriculture Robots (AgBots). (i) Protection of human workers, (ii) study work flow, (iii) reduced wastage of farm inputs, (iv) boost efficiency in the agriculture process, (v) reduced cost farming.

Contrarily, AI can be used in agriculture to reduce environmental concerns brought on by unfavorable agricultural operations, such as the a) high use of pesticides, b) uncontrolled irrigation leading to water loss, and c) water pollution with fertilizers.

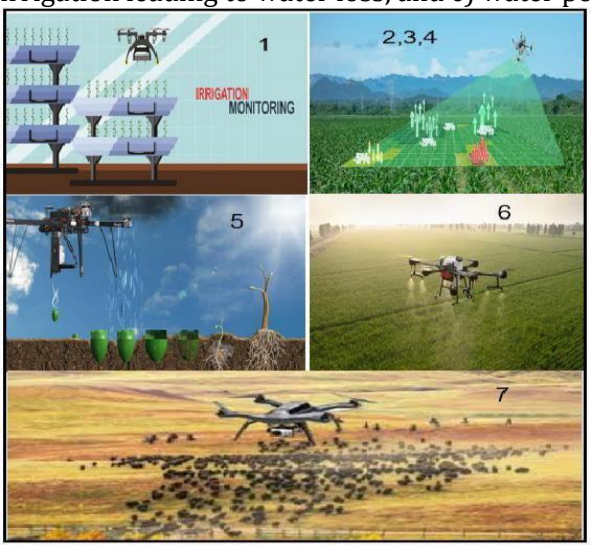

Figure 10: Best Drone practices

In agriculture, drones have a plethora of advantages. (a) Enhance protection, (b) greater safety of farmers, (c) less wastage of resources,(d)efficient and accuracy rate results,(e)useful for insurance claims, (f) evidence for insurance companies.

AI (Artificial Intelligence) In Smart Farming

Artificial intelligence-based technologies]enhance agriculture by enhancing conventional farming's productivity and removing the obstacles and disadvantages that traditional farmers must contend with. Artificial intelligence (AI) is the process through which people create synthetic devices that resemble human brains but are able to process larger amounts of data than the brain. Although AI and computer science are strongly associated, its use in agriculture should go beyond this field.

A wide range of technological gadgets and instruments have been developed using AI and have been tested and improved on agricultural fields. Figure 11 depicts some of the field-steps of

agriculture that they have developed successfully. These include 1) soil testing, weeding, 2) pesticide control, 3) treating diseased crops, 4) in sufficient irrigation to meet crop needs, 5) post-harvest activities like storage management, 6) optimizing storage parameters, etc. Farmers have boosted both the quantity and quality of their output.

Both of these problems would be solved by the application of AI. Utilizing AI- based technology is primarily intended to decrease the amount of work necessary to provide the desired output. Additionally, AI-based gadgets can readily respond to queries that people are unable to address because of their capacity to collect and analyze vast quantities of data from official websites and real-time field data. They can then offer solutions to issues that, if produced by people, would require a lot of effort and sophisticated knowledge. As these AI technologies require training with the biological skills of the farmer and vice versa, farmers who possess the requisite capabilities will also need to acquire instruction in these AI technologies.

The first step in incorporating AI into any industry is machine learning. The necessary data must be supplied in a machine-readable manner, and the processed result must be communicated in a language that is understandable to humans. The AI-based system should be able to obtain data from the designated databases as it processes the inputted data to address the current issue. Sometimes the AI may need real-time data to reach a decision, in which case the AI should be knowledgeable enough to comprehend the real-time parameters. Making decisions concerning the farming season requires careful consideration of weather forecasts.

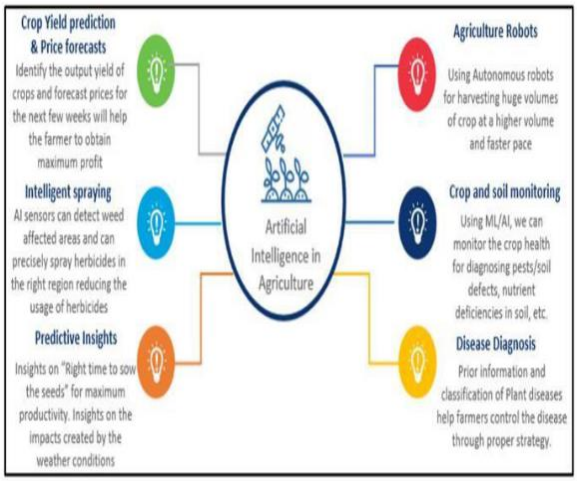

Figure 11: Artificial Intelligence (AI) in Agriculture

Four techniques are used to solve problems: (i) Neuro-fuzzy logic; ii) fuzzy logic; iii) expert systems; and iv) Artificial Neural Networks (ANNs). When developing AI-based technology, ANNs are most frequently used. A machine-based ANN mimics the functions of the human brain. Electric signals go via neurons in the brain vi a axons and synapses .AIis used in the following areas: crop or seed selection, crop management techniques, yield prediction, insect and weed control, product storage and marketing.

Farming Apps for Indian Farmers

Rural India is currently making significant technological and digital transformations. By 2020, 48% of India's population would reside in rural areas, according to the Boston Consulting Group's study, "The Rising Connected Consumer in Rural India". Additionally, 58% of Indian households still rely on agriculture as their primary means of subsistence. Additionally, the most practical and helpful tool for assisting farmers in farming is farming applications.

It provides you with instructions for conducting good scientific farming, crop cultivation, sowing, or vegetable harvesting. Farmers may simply resolve any issues that cause them difficulty in their farming operations, such as pest or insect attacks.

The Farming apps are highlighted in Table 4. In farming, apps can be a farmer's best friend because they can increase output without costing any money at all. A farmer can easily download and utilize farming software from the Google Play store without spending a single rupee, as shown in Figure 12.

AgricultureApps	Applications gives farmers a customized crop calendar in addition to practical agricultural knowledge
Krish-e	on topics like irrigation, weed control, pest and disease management, fertilizer management, seedcare, and crop diagnostic and planning.
IFFCO	Farmers have access to a variety of instructional modules throughout the profiling stage,
KisanAgriculture	including agricultural warnings,weather,marketprices,and libraries of agriculture material in the form oftext,photos, audio files,and videos in the selected language.
Pusa Krishi	Farmers can learn about novel crop varieties developed by the Indian Council of Agriculture Research(ICAR), resource-saving cultivation methods, and farm machinery and how to use them with thisapp.
Agri App	It offers thorough details on agriculturalproduction, crop protection, and otherpertinent auxiliary services. In addition,there are options for professionaldiscussion, video-based learning, themost recent news, and online markets forpesticides,fertilizers,etc.
Crop Insurance	Forfarmers,itactsasacalculatorand a reminder about their insurance. It can also be used to find out the normal sum insured, extended sum insured, premium information, and subsidy information for any crop that has been notifiedinanynotifiedregion.
Kheti-Badti	It strives to encourage and promote"Organic Farming" and offer crucialdetails about difficulties affecting Indian farmers.
Agri-Market	Using the Agri-market Mobile App,farmers can learn about crop prices atmarkets located within 50 kilometers oftheir own device location.
Shetkari	Itoffersexpertiseandinformationon government programmes, crop management, Agri-Business & regulations,marketprices,and agricultural success stories.
KisanSuvidha	It offers details on the present weatheras well as a five-day prediction, marketrates for goods and crops in the nearbytown, and knowledge of fertilizers, seeds,machines,etc.

Table 4: Best Agriculture Mobile Apps for Farmers in 2022

Figure 12: Farming Apps used by Indian Farmer

Advantages and Disadvantages of Smart Farming

Interestingly, farming has evolved into a far more intriguing art form than it once was in the modern agricultural world due to the steady expansion in the invention and development of extremely complex equipment and tools to make the growing process much easier. Today, technology and agriculture are integrated very easily. High-end technology makes it simple and enjoyable for farmers to grow their plants, care for them properly, and eventually harvest them in great amounts without suffering any loss. Smart farming does, however, have advantages and disadvantages, just like anything else.

Advantages and Disadvantages of Smart Farming

Advantages	Disadvantages
Data collection with smart agriculture sensors ,better Control over the internal processes.	Internet access must be available constantly for smart agriculture.
1. Waster deduction and saves time.	The majority of rural communities in developing nations
2. Precision farming and remote monitoring.	do not meet this requirement. The speed of the internet is also slower.
Effective cost management ,increased business efficiency.	Farmers' lack of education. This is a significance to bstaclet other widespread adoption of smart farming across all nations.
Increase high quality crop production, makes transportation easy.	High maintenance cost.
Waters supply easy, which reduces the efforts of the farmers.	Better sensors only would help.
1. Increase the soil's fertility.	
2. Determine the crop's level of maturity.	Robots could change the culture / emotional appeal of agriculture
3. Determine the growth stage and higher	

	accuracy rate.	
	Electricity costs are reduced via mobile andsolar-powered pumps.	Sensors require solar energy power.

Table 5: Advantages and Disadvantages of Smart Farming

Ref. No	OutcomeofthePaper	FutureScope
[1]	1. Trends in agriculture and forestry's supply and consumption. 2. How climate change will affect peat lands, grasslands, and croplands. 3. Tradeoffs and connections between biodiversity ,water ,and the land.	Implement several potential landscape change ideas in the future across all regions.
[3]	1. Created a system that uses RGB-D cameras or laser scanners to quickly analyze the state of the soil. 2. Described a method for analyzing soil properties based on eyesight.	1. Focus on putting the sensing component on an unmanned aerial vehicle (UAV) and switching the action Pro sensor for the newest K inject v2.0, which has a higher resolution and won't obstruct typical light emissions. 2. The UAV's inertial unit and sensor fusion can be used to integrate the reorientation.
[4]	1. WSNs with solar energy harvester nodes were equipped with anew Distributed CDS (Connected Dominated Sets)algorithm to increase their lifespan when utilized in precision agriculture applications. 2. The algorithm simulation findings also suggest that variances in the outcomes of	1. In order to increase the network life time, The cut vertices in the topology of the Network should be kept active for as long as is practical. 2.Asaresult,infuturedevelopment,variableslikecutvertexidentificati

	different simulations are caused by the placements of harvester and ordinary nodes, the neighbors ,and there sidewall energy levels.	onand Choosing them as harvester nodes will be taken into account.
[10]	1. Several advantages, uses, and difficulties of IoT in agriculture have been noted in this research.	1. One significant topic that is anticipated to draw a lot of research attention is the application of LPWA (Low Power Wide- Field)
	2. Additional considerations include the IoT(Internet of Things) Ecosystem and the role established by various	communication technology for agricultural uses.
	communication technologies in the deployment of IoT system. IoT and DA (Data Analytics) together enable smart agriculture.	2. Among the LPWA technologies, the NB-IoT (Narrow Band-IoT)is anticipated to stand out. This is due to the 3GPP open Standard and telcofirms'adoptionofit.
[11]	1. As callable network architecture for managing and monitoring agriculture and farming in remote areas has been found.	In the future, it will be crucial to identify threats, protect user privacy, and secure individual devices so they can interact on their own through networks like the Internet ,fog ,and clouds.
	2. Examined the network topology based on performance, latency, and coverage area.	
[12]	1. This article describes the architecture of agricultural sensor systems and shows how, depending on the application	The deployment of several WSN system son every farm in the future will provide an

	domain, intelligence levels change.							integrated environment that will cover a variety
	2. Wireless Network intelligent system.	Sensor for	agriculture					of farm management functions. Future farming will be improved with the use of clever
	3. Data Analytics into Farm-based WSN System ,its benefits and challenges.							understanding gathered from the settings.
[13]	1. This article discusses leading research initiatives, standards and technologies, platforms, and recent advancements in wireless sensor network technology.			mo re	security-related issues,		su ch as	It will be important in the future to look into the security-related issues such as the
	2. In addition ,are mention WSN research that looks at the interplay between sensor networks and other technologies demonstrates how this can help sensor networks realize their full potential.			assessment consumption,	of data	security-related assurance,		energy authentication level and kind of security required, and QoS-security evaluation.
[14]	1. It goes over how the Extended Kalman filter(EKF) issued to separate the system state from the associated noisy measurements, such as the temperature and moisture levels of the soil that have been identified.							
	2. In addition, each crop's suboptimal irrigation water use is calculated based on the crop's anticipated system status, and the soil conditions.	proactively needs, the		A	random	bit	climbing	optimizationtechniquewillbeappliedinthefuture

	3. When the simulation results are compared to those of other conventional irrigation schemes, it shows that the proposed OHI (Optimally Heterogeneous Irrigation) approach improves water utilization, satisfies the needs ofheterogeneouscrops,manages varioussoiltypes,prioritizescropclasses,and Ultimately increases crop yields.		toenhancemoreoptimizableresultsandpredictthesuboptimalwatervolume for each place.
[15]	1. The advantages of employing thermal imaging in smart irrigation are discussed in this research. Implementing automated irrigation powered by the cloud.		It is difficult to create legislative and regulatory frameworks that are adaptable enough to keep up with the complex and continuously changing technical anddanger landscape.
	2. The Applicability of Temperature Distribution Measurement in Thermal Imaging Irrigation Security and Regulatory issues.		
[16]	1. A wide range of national approaches to agricultural development and associated pollution are found in this paper's historical analysis of agricultural nitrogen-use efficiency (NUE).	For additional developments may be necessary,	other technological benefits, including affordable slow-release fertilizers, or
	2. In addition, examples of nitrogen consumption were looked at, and goals were suggested per crop type and area in order to meet the Food and Agriculture Organization		nitrification and unease inhibitors, fustigation (the administration of irrigation fertilizer via water), and high-tech techniques for precision

	'sprojected 2050 world food demand.		agricultu re.
[17]	1. There search addressed here examines the state-of-the-art and potential uses of thermal remote sensing in PA (precision Agriculture). 2. Potential uses for thermal imaging in PA include crop maturity mapping, yield estimation, soil property mapping, residue cover and tillage mapping, plant identification ,and plant water Stress monitoring.		Its usage is complicated by a variety of practical issue includi a air attenuation and s, ng s absorption, calibration, meteorological factors, crop growth stages, and intricate soil-plant interacti ons.
[18]	1. The interest in institutional views of CSA Smart Agriculture) technologies is demonstrated researc h. 2. Although the study recognizes the significance of some institutions (such as the market) in the adoption of CS A technology, other viewpoints, such as the involvement of the private sector in agricultural development, have received less attentio n.	(Cl im at e in thi s	1. In the future ,the institutional and polit ical aspects of CSA technologies require additional focus. Rethinking this strategy for C technol promoti whi builds on S ogy on, ch A institutional a well as technology enablers s packages, may offer chances for efficient CSA option scalability. 2. Improvin the layo of C g ut S A research and supporting policy need this understan ding.
	1. A number of control strategies for automating		

	agriculture are reviewed in this study paper, including Internet of Things (IoT), aerial photography, multispectral,	
[20]	hyper spectral, NIR, RGB infrared, and cameras, as well as techniques for machine learning and artificial intelligence.	In order to goals modernize agriculture ,there are provide a potential road for further
	2. Additionally, various automated and control approaches	research into advanced control systems.
	make it simple to address issues in agriculture such plant	Systems are more effective when they use
	diseases, pesticide control, weed management, irrigation, and water management.	architectures based on artificial intelligence.
	1. According to this study ,smart farming can offer a concerted exit from locked-in technologies and practices that are characterized by high market segmentation and	
[21]	polarization.	In the future ,both proponents were work

CONCLUSION AND FUTURE SCOPE

In a nation's economy, agriculture is crucial. In this essay, we thoroughly examined the role of the farmer, various agricultural practices, different types of Indian farmers, traditional farming practices themselves, as well as the benefits and drawbacks of traditional farming in India. Traditional agriculture production lacks the knowledge and technology that have been widely used in commerce and other areas of life.

In this work, numerous smart agricultural technologies developed by diverse researchers are reviewed. Aggro tech can develop healthy crops and increase production by leveraging technology such as IoT, Sensors, Robotics, Drones, Artificial Intelligence, and farming mobile apps used by Indian farmers. The chosen papers are for monitoring and identification of the stress level crops. Numerous agricultural applications, such as yield estimation, crop sowing dates, crop land monitoring, land surface temperature, irrigation forecast using satellite images, agriculture greening, prediction of water dynamics in the soil, elimination of slavery and human trafficking from space, and disaster management support, all greatly benefit from technology. These applications have been thoroughly studied to understand their significance in achieving global sustainable goals.

The Internet of Things (IoT) used in precision farming, automation in smart greenhouses, and sensors give data that aids farmers in crop monitoring and environmental condition optimization. Throughout the whole crop cycle, from planning and watering through harvesting and sorting, agricultural robots (AgBots) are used. Utilizing unmanned aerial vehicles (UAVs) significantly improves farmers' operating efficiency in the agricultural sector. To reduce environmental concerns brought up by undesirable agricultural practices, artificial intelligence (AI) can be used in agriculture. Additionally, the most practical and helpful tool for assisting farmers in practicing the correct scientific method of farming is a farming app. It has been noted that the quality and quantity of technology available for smart farming is expanding quickly. The scope of thisstudy will eventually be expanded to include identifying various cyber-attacks on IoT devices, communication networks, robotics, drones, the cloud, the edge, etc.

REFERENCES

Akshay Krishnan et al., (2020). "Robotics, IoT, and AI in the Automation of Agriculture Industry: A Review", IEEE, 2020 IEEE Bangalore Humanitarian Technology Conference (B-HTC), Oct., pp. 1-6, doi: 10.1109/B-HTC50970.2020.9297856.

Ali Lakhiar, I. etal., (2018). "Monitoring and control systems in Agriculture using Intelligent Sensor Techniques: A Review of the Aeroponic System", Journal of Sensors, 1–18. https://doi.org/10.1155/2018/867276.

Chrysanthos Maraveas et al., (2022). "Application of IoT for Optimized Greenhouse Environments and resource management", ELSEVIER, Agri Engineering, vol. 198, July, pp. 120,https://doi.org/10.1016/j.compag.202 2.106993.

Dennis M. Te Kronyand Dennis B. Egli, (1991). "Relationship of seed vigour to crop yield: A review", Crop Science, May, https://doi.org/10.2135/cropsci1991.0011183X003100030054x

E. Sisinni et al., (2018). "Industrial Internet of Things: Challenges, opportunities, and directions", IEEE Trans.Ind.Informat.,vol.14,Issue (11),Nov., pp.4724-4734, doi:10.1109/TII.2018.2852491

E. Totin et al., (2018). "Institutional perspectives of climate-smart agriculture: A systematic literature review", Sustainability, vol. 10, Issue (6), June, pp. 1–20, doi: 10.3390/su10061990. https://concaveagri.com/smart-farming/.

https://www.dreamstime.com/smart-farming-robotic-working-vegetable-greenhouse-modern-organic-farmhouse-adopts-technology-industry-to-apply-image139184291.

J.Lin et al., (2017). "A survey on Internet of things: Architecture, enabling technologies, security and privacy, and applications", IEEE Internet ThingsJ., vol. 4, Issue (5), Oct., pp. 1125–1142, doi:10.11 09/JIOT.2017.2683200.

Jha, Kirtan. et al., (2019). "Acomprehensive review on automation in agriculture using artificial intelligence", Artificial Intelligence in Agriculture, vol.2, June, pp.1–12, https://doi.org/10.1016/j.aiia.2019.05.004.

Judy Mathushika et al., (2022). "Smart Farming Using Artificial Intelligence, the Internet of Things, and Robotics: A comprehensive Review", Book: Artificial Intelligence and Smart Agriculture Technology, chapter, May, pp. 1-19, doi: 10.1201/9781003299059-1.

Khudoyberdiev, A. et al., (2021). "Optimization-assisted water supplement mechanism with energy efficiency in IoT based greenhouse" ,J. Intell. Fuzzy Syst., vol.40, Issue (5), Jan., pp.10163–10182, https://doi.org/10.3233/JIFS-200618.

M. Roopaei et al., (2017). "Cloud of things in smart agriculture: Intelligent irrigation monitoring by thermal imaging", IEEE Cloud Computer., vol. 4, Issue (1), Jan., pp. 10–15, doi: 10.1109/MCC.2017.5.

M.Ayaz etal., (2018). "Wireless sensor's civil applications, prototypes, and future integration possibilities: A review" IEEE Sensors J., vol. 18, Issue (1), Jan., pp.4–30,doi:10.1109/JSEN.2017.2766364.

Mobasshir Mahbub, (2020). "A smart farming concept based on smart embedded electronics, internet of things and wireless sensor network", Elsevier, Jan, pp. 1-30, doi: 10.1016/j.iot.2020.100161. https://www.tractorjunction.com/blog/types-of-smart-sensors-in-agriculture-for-farming-in-india/.

Muhammad Ayaz et al., (2019). "Internet- of-Things (IoT)-Based Smart Agriculture: Toward Making the Fields Talk",IEEE,vol.7,Aug., pp.1- 33 doi: 10.1109/ACCESS.2019.2932609.

N. Ahmed et al., (2018). "Internet of Things (IoT) for smart precision agriculture and farming in rural areas", IEEE Internet Things J., vol. 5, Issue (6), Dec., pp. 4890–4899, doi: 10.1109/JIOT.2018.2879579.

Navarro, E. et al., (2020). "A Systematic Review of IoT Solutions for Smart Farming",Sensors,vol.20,Issue(15), July, pp. 1-29, doi:10.3390/s20154231.

O. Elijah et al., (2018). "An overview of Internet of Things (IoT) and data analytics in agriculture: Benefits and challenges", IEEE Internet Things J., vol.5, Issue(5),Oct., pp.3758–3773,doi:10.1109 /JIOT.2018.2844296.

O.Gulecetal., (2020). "Anovel distributed CDS algorithm for extending lifetime of WSNs with solar energy harvester nodes for smart agriculture applications", IEEE Access, vol. 8, March, pp.58859–58873, doi 10.1109/ ACCESS.2020.2983112. https://www.nationalgeographic.org/encyclopedia/agriculture/.

P. Smith et al., (2015). "Agriculture, forestry and other land use (AFOLU)", in Proc. Clim. Chang. Mitig. Clim. Chang., pp.811922, doi:10.1017/cbo9781107415416.017. https://kalsepadaishuru.com/types-of-agriculture-in-india/.

P. Rawat et al., (2014). "Wireless sensor networks: A survey on recent developments and potential synergies" ,J. Super computer., vol. 68, Issue(1),Apr., pp.1–48,doi: 10.1007/s11227-013-1021-9.

P. Tripicchio et al., (2015). "Towards smart farming and sustainable agriculture with drones", in Proc. Int. Conf. Intell. Environ., Jul., pp.140– 143,doi:10.1109/IE.2015.29.

Popović, T. etal., (2017). "Architecting an IoT-enabled platform for precision agriculture and ecological monitoring: A case study", Comput. Electron. Agric., vol. 140, pp.255–265, doi:10.1016/j.compag.2017.06.00

S. Ivanov, K. et al., (2015). "Precision farming: Sensor analytics ",IEEE Intell. Syst., vol. 30, Issue(4), Jul., pp. 76–80, doi: 10.1109/MIS.2015.67.

S. Khanal et al., "An overview of current and potential applications of thermal remote sensing in precision https://edurev.in/studytube/Key-Concepts-Chapter-4-Agriculture--Class-10--SST-/8671ece0-7e89-4565-94fc-298c166a24f9_t#. https://www.tractorjunction.com/blog/types-of-farming-in-india-procedure-benefits-and-role/. https://laquilaactive.com/5-traditional-farming-methods-that-are-still-popular-today/. https://stories.pinduoduo-global.com/agritech-hub/traditional-agriculture.

SyedaIqra Hassan et al., (2021). "A Systematic Review on Monitoring and Advance Control Strategies in Smart Agriculture", vol.9, pp.1-32,Feb., doi: 10.1109/ACCESS.2021.3057865.

Talaviya, T. et al., (2020). "Implementation ofartificial intelligence in agriculture for optimization of irrigation and application of pesticides and herbicides", Artificial Intelligence in Agriculture, vol.4, pp.58–73, https://doi.org/10.1016/j.aiia.2020.04.002.

https://www.wipro.com/holmes/towards-future-farming-how-artificial-intelligence-is-transforming-the-agriculture-industry/.

Ullah, I. et al., (2021). "An optimization scheme for IoT based smart greenhouse climate control with efficient energy consumption", . Computing, Springer, vol.104, June, pp. 433-457,https://doi.org/10.1007/s00607-021-00963-5.

Walter A et al., (2017). "Opinion: smart farming is key to developing sustainable agriculture", Proc NatlAcad Sci., vol. 114, Issue (24), June; pp. 6148–50, doi:10.1073/pnas.1707462114

X. Hi et al., (2019). "State-of-theart Internet of Things in protected agriculture",Sensors,vol.19,Issue(8), April,. pp. 1-24,doi:10.3390/s19081833.

X. Zhang et al., (2015). "Managing nitrogen for sustainable development", Nature,vol.528,no.7580, Dec., pp.51–59,doi:10.1038/nature15743.

Y. E. M. Hamouda & C. Phillips, (2019). "Optimally hetero generous irrigation or precision agriculture using wireless sensor networks", Arabian J.Sci.Eng., vol.44, Issue(4), Apr., pp.3183–3195,doi:10.1007/s13369-018-3449-.

Yashik Guptaetal., (2022). "DRONES: The smart Technology in Modern Agriculture", International Journal for Research in Applied Science& Engineering Technology (IJRASET), vol .6, Issue(4), Feb., pp.341-346,2018, ISSN:2321-9653. https://www.arrow.com/en/research-and-events/articles/agricultural-drones-taking-smart-agriculture-to-new-heights. https://ubidots.com/blog/iot-in-agriculture/.