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ADVANCEMENT IN THE AGRICULTURE SECTOR USING IOT

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Abstract

The agriculture sector plays an important part in overcoming the food shortage situations for food security worldwide in the growing population scenario. In the agricultural sector, mechanization has increased different crop yield, opening a new age for achieving agricultural accuracy. Common use of farm machinery has recently been changed by modernizing agricultural machines. This breakthrough has been revolutionized by the field of precision farming. In the field of active irrigation, fungicides, fertilizers, and disease prevention in different plants, various types of high quality efficient sensors have been used. This strategy has raised agricultural production thus lowering production costs. In agriculture, the use of Internet of Things (IoT) technologies has helped farmers to relieve themselves by using smartphone apps and high-speed internet. These programmes provide information necessary for a farmer to manage a crop precisely by matching the data collected from a field with standard charts already contained in the database. In order to ensure accuracy in agriculture, this breakthrough in the automation of agricultural equipment also helps farmers to improve productivity, overcoming the world's food shortage. This paper reviews the advancement in the agricultural field by introducing IoT technology for the precision farming.

Key words: Agriculture, Equipment, Farming, Irrigation, Machinery.

Introduction

Agricultural machines have been created for almost any level of the farming process. Both organic and non-organic farming use the same equipment. Agricultural engineers are people who have been qualified to design agricultural machines, structures, and provide better facilities for improving agriculture production. Tilling the soil, planting seeds, growing crops, irrigating the ground, protecting it from pests and weeds, harvesting, livestock feeding, threshing grains, and processing and packaging the goods require a wide range of machinery. India has focused mostly on the organized arrangement of field pathologies, trials, demonstrations, pilot projects and other applied research over the last two to three decades. Increasing agricultural strategies consisting of high yielding plant varieties, intensively cultivated crops and increased use of fertilizers, increased irrigation, and best techniques of planting, harvest, and plant defense have been the major elements of crop development strategy in the post-green revolution period. A variety of crops have produced high yield varieties, but their effect on development, efficiency and costs vary across cultures and regions. In India, farming technologies of the most basic type are used and other advanced agricultural equipment's are used, such as tractors and harvest combinations. Many farmers use bullock carts and buckets. The states of UP, Punjab and Haryana have irrigation and infrastructure, and the Green Movement has helped them[1].

A major effort for farmer training is expected in India to promote the second Green Revolution. It is insufficient to simply provide information to farmers. Farmers must be able to make the right decisions about themselves and have a clear understanding of how and what to do in order to maximize agriculture production and boost their economic situation.Indian farmers must have access to the best agricultural knowledge in the world, and they must be encouraged to use agricultural implements in their best interests. The advancement of agricultural implements is critical to agricultural growth and farmer economic growth. Farmers should put in more effort to learn new technology and become more information literate in order to survive and thrive in the knowledge-intensive farming age. In order to have permanent access to the new knowledge about agriculture, anyone from the farming families must have access to the Internet, knowledge of electronic information resources and competence to make successful use of Information Technology (IT) in agriculture[2].

Recently, the census hit 7 billion people globally and by the end of 2050 the world's population is estimated to reach up to 9.3 billion. In order to satisfy demands, this rising population requires more food. In 2050 the market for food will rise to 60 percent, as estimated by researchers. Agricultural processing is the direct food supply for most living creatures, including humans and livestock. Increased food demand also leads to a rise in agricultural production. The value of agriculture in the world rises with food shortages. Agriculture productivity determines the economy of a nation that is dependent on agriculture. Farmers must transition from traditional farming practices to new farming systems in order to maintain the agriculture sector's reputation and meet the need for additional food production. A farmer in today's agriculture system uses advanced technologies to control all forces, including biotic and abiotic stresses, to increase production and thus the financial advantages of farms. The farmer adapts regularly to new technology and continues to reduce gains in returns. The aim of the new manufacturing process is to reduce production costs while raising the return on a small parcel of land. It focuses primarily on the quality and volume of the commodity by means of efficient delivery control [3].

In the agriculture sector, precise knowledge is critical in relation to changing environmental factors, plant requirements, and irrigation demand, among other things. This expertise enables the farmer to make prompt crop management decisions. The farmers have used the information management method to solve cropping issues. In the developing world, information and communication technology is used to promote agriculture. Investors desire to extend this technology and help countries address a shortage of manpower and other resources. In the agricultural sector, considerable technological improvements are required in order to track the everyday output of agriculture at reduced costs. However, mechanization automation in farming is the latest invention which has enabled farmers to utilize the knowledge and timely assistance to increase farming efficiency. Precision agriculture requires knowledge of sustainable agricultural production. The use of web framework is crucial for identifying the necessary information to solve the problems associated with precision farming[4].

The purpose of this paper is to analyze recent improvements in the field of mechanical automation in agriculture. The report also includes improvements in IoT technology and its usage in handling agriculture, having aim of improving productivity and overcoming production losses, by providing valuable knowledge in precision agriculture.

1.1 Information Technology and Agriculture Services:

In India, various attempts are being made to absorb and introduce information technology for the agriculture sector. The use of information technology is emphasized in the National Agriculture Policy. The Department of Agriculture and Cooperation is planning an e-government strategy to concentrate on e-governance operations in the agriculture field. Plan has established a prioritized list of services offered to growers, as well as a list of processes that need to be re-engineered for this purpose. In agriculture, Phase 1 of the National e-Governance Plan is approaching completion. The position of civil society and private sector will be described inPhase 2. The department has already put in place a Central Sectors Scheme to encourage and enhance agricultural information systems with a budget of €100.00 crores to promote e-governance in agriculture at the center and to provide assistance in the centers for states and UT's[5].

At different stages efforts have been made to develop the system for knowledge sharing in India. Mobile telephony in India continues to expand by introducing modern technologies in the market. With price rivalry mobile telephony is becoming one of the cheapest telephony in the world, allowing the countryside in India to get linked to rural areas and promoting people residing in rural areas. Mobile telephony has a profound effect on rural India and enhances communications between small and marginal farmers. The National Farmers Committee of the Government has proposed that rural knowledge centers be developed across the country using modern information and communication technologies (ICT). Mission 2007 was a global effort initiated by a coalition of almost 80 civil society groups.

National Informatics Centre Network(NICNET), a government-owned network for exchanging government knowledge, is managed by the National Informatics Centre (NIC). It houses the majority of the official data

from different agencies. It also manages the websites of the District Rural Development Agency (DRDA). In the tenth five-year plan, it launched the smart village project. One of the project's goals is to implement and encourage cost-effective and relevant information and communication technologies (ICTs) for use in rural areas.Agricultural Marketing Information Network(AGMARKNET) is a platform that uses NICNET to record regular agricultural commodity prices and arrivals details for over 300 crops and 2000 varieties. A total of 1347 Agriculture Produce Wholesale Markets (APWMs) have been linked. This project has the capacity to expand to approximately 7000 wholesale markets throughout the world, as well as 35,000 rural markets in India. The AGRISNET software is being used by the Punjab government to improve and promote agricultural informatics and communications[6].

1.2 Computerization of Agriculture Sector:

Agriculture productivity has improved in recent years as a result of changes in mechanical equipment used in farm practices. The latest automation of agricultural mechanical equipment is discussed in this section:

1.2.1 Assessment of soil parameters:

Standard soil testing is very significant, as soil fertility is responsible for 60% of crop production. The testing of soil is very important. Soil productivity in precise agriculture is also considered a major element. The application of fertilizer and fertilization patterns of crops depends on soil fertility. Farmers in practically soil research labs have to take the time intensive and tough approach to busy farmers. Both pH and biochemical, physical and chemical characteristics are used for soil fertility research laboratories. The sensor-based system that achieves all parameters using ESP 8266 to address the challenge of soil testing for farmers has been created. There is a website method that compares the parameter collected by sensors to current database parameters. This website platform helps farmers to gain insight into soil fertility and offers various crops depending on the condition of soil fertility for different soils. Better soil irrigation enables farmers in accurate agriculture to produce optimal yields [7].

1.2.2 Monitoring of Moisture in Precision Agriculture:

Agriculture is a critical technology to increase farm production and alleviate food shortages in a developed world. This approach uses a combination of coordinating and knowledge tools to maximise the quantity and quality of agricultural products. This system uses automated machines and sensors to track different agricultural machinery to increase productivity (Figure 1). Kamelia used a YL69 sensor for automating a sprinkle irrigation system. As the soil humidity level falls below 15%, this sensor can detect and activate the pump of the sprinkling device automatically. The sprinkle pump is switched off until the soil moisture level exceeds 45 percent. This machine increases energy efficiency, saves time, and reduces water consumption. For the farmer, all of the device's readings are viewed on an liquid crystal display (LCD) screen and linked to values on a website system[8].

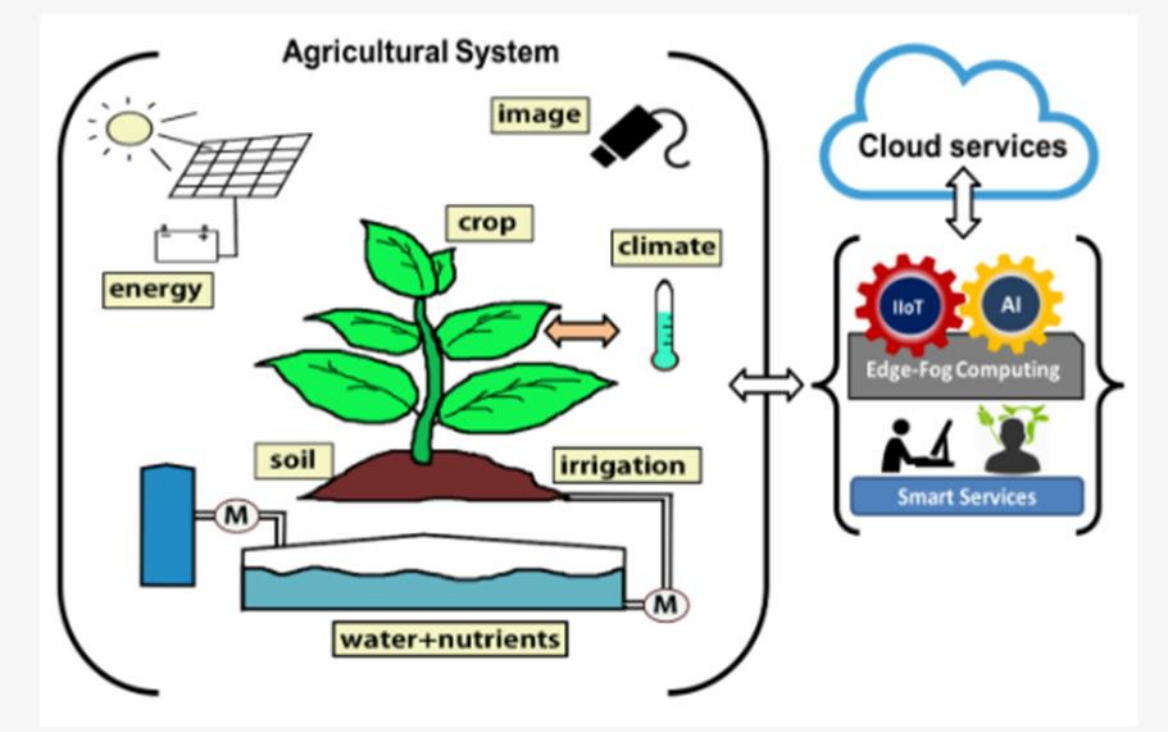

Figure 1: The Layout of Agriculture System. This method employs a variety of coordination and information resources[9].

1.2.3 Implementing Physical Monitoring System inside Precision Agriculture:

In order to increase the efficiency and quantity of agricultural crops, cyber-physical system is a recent invention used in the real world. The mechatronic method has been modified over the last 20 years with the Current Population Survey (CPS) methodology. CPS plays an important part in the advancement of knowledge and communication systems for farmers in advancing crop management within precise farming. CPS uses the procedures, tools, sensors and applications that depend on trans-disciplinary processes, as well as on suitable prototype concepts and test beds. It helps farmers, through the use of an improved information and communication mechanism in the application of good agricultural practices, to improve crop quantities and quality (Figure 2).

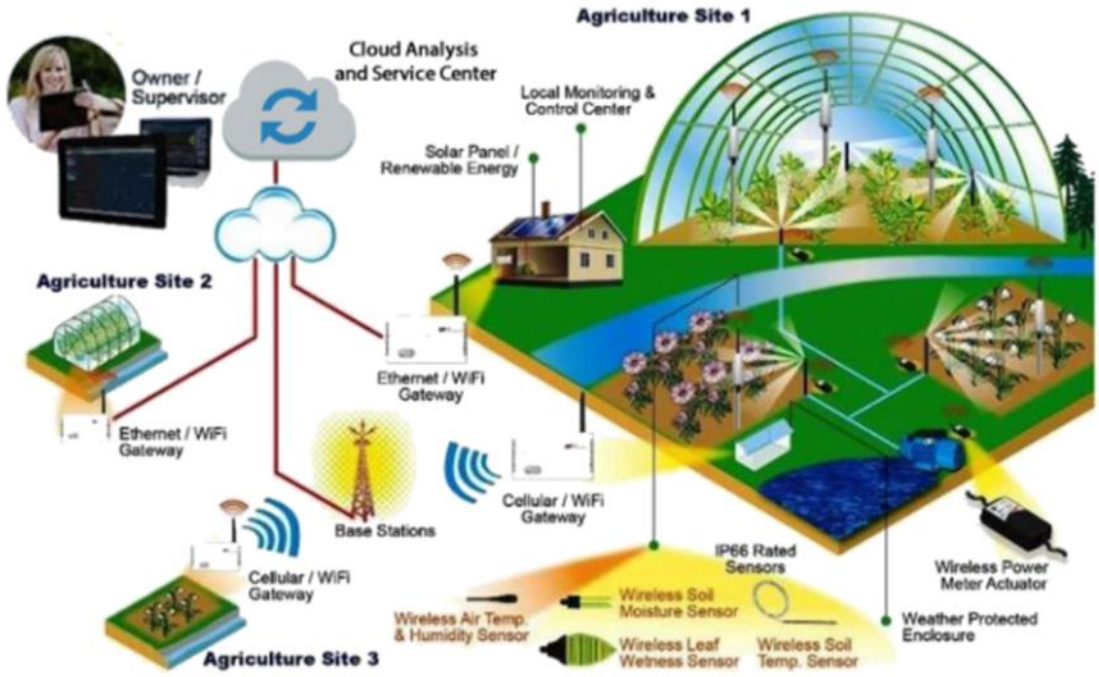

Figure 2: Smart Cyber-Physical Systems for Controlled-Environment Agriculture[9].

1.3 Modern Agricultural Development:

Agriculture, along with its associated industries, is without a doubt India's primary source of income. Sustainable agriculture is critical for holistic rural growth in terms of rural employment, food security, and environmentally sustainable technology such as sustainable natural resource management, soil conservation, and biodiversity preservation. The Ministry of Agriculture is putting a lot of focus on commercializing agriculture right now, with a goal of reaching a 4% annual growth rate. Emphasis on regionally differentiated approach, commodity diversification, future regions, and scientific resource management are only a few of them.

Adequate food production and delivery has become a high priority and global need in a rapidly developing environment with growing global competition. There is a need to maximize the use of available natural resources and use latest technologies available at a global level in order to meet domestic food demand while still targeting the export market. In terms of technological development and acceptance of new technology in agriculture, North India, especially Punjab and Haryana, is the most advanced and flourishing area of India. Punjab is the epicenter of cutting-edge agricultural machinery and equipment, which are in high demand not only in India but around the world. Haryana is not lagging behind in terms of technological innovation and acceptance.

1.4 The Improvement in IoT for Precision Agriculture:

The IoT for precision farming is a digital technology that is in use in the real world. This section discusses recent progress to improve the performance of farming and mechanical tools and systems using IoT technology.

1.4.1 Irrigation System Automation based on IoT:

The irrigation system automation model was suggested by Rajalakshmi and Mahalakshmi by IoT techniques. The IoT is essentially an Internet network that is used to assess an operation. In the agriculture industry, it is used to improve farm output in order to increase the return on food production by 9.6 billion people relying on the agriculture sector until 2050. The use of humidity sensing sensors, temperature sensors, wetness sensors and

light intensity sensors have standardized agricultural activity such as irrigation. The measurement data was sent to the web server with the standard charts already stored on the server (Figure 3). The data will be processed automatically by the programmer of the web system and the results will be sent to the farmers' Smartphone app. This allows the farmer to assess the condition of his crop easily and remotely watch the irrigation pump.

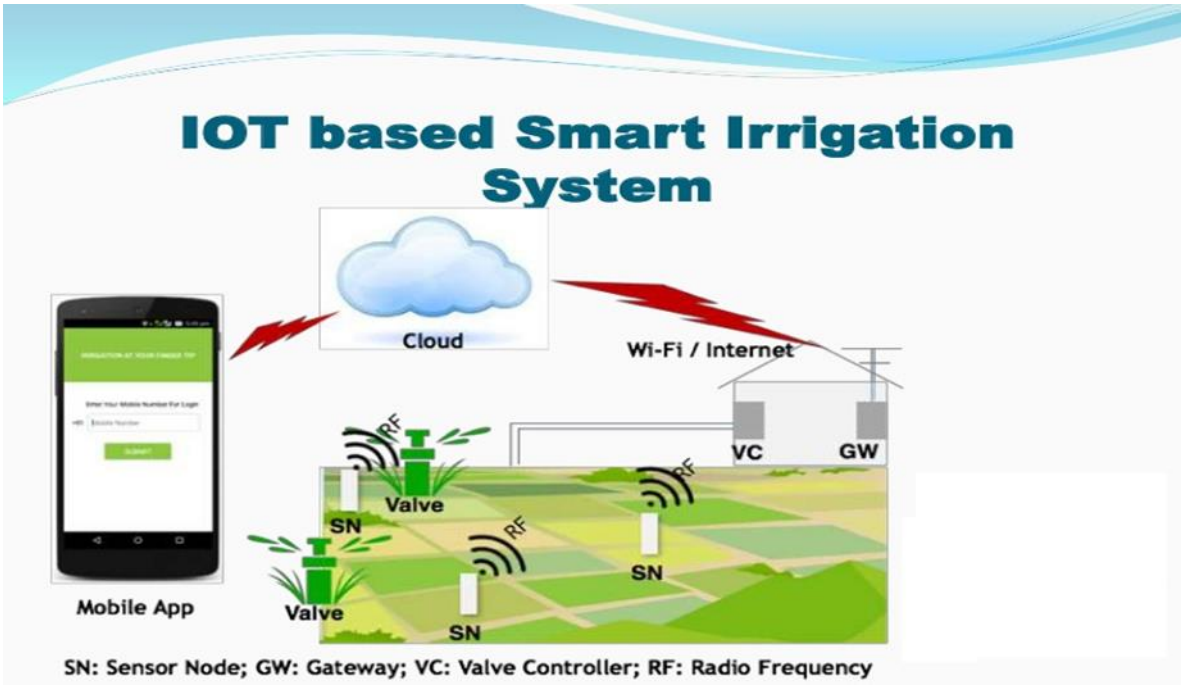

Figure 3: The layout of IoT based Smart Irrigation System. The use of humidity sensing sensors, temperature sensors, wetness sensors and light intensity sensors have standardized agricultural activity such as irrigation[9].

The IoT approach allows the development of an automatically mounted Raspberry Pi irrigation model. This system improves agricultural production by using irrigation water efficiently in areas of water shortages. The circuit model uses two kinds of sensors to measure daylight time, temperature and moisture, and send the readings to a database. The database measures the irrigation water requirements of the crops and activates the irrigation system automatically when the crop needs them. This approach avoids water scarcity and provides a sufficient water quantity for a region, making it an optimal solution for areas with insufficient water.

1.4.2 IoT System Applications in Prevention of Disease in Crops:

The major cause of agricultural losses was biotic the stresses like rodent's, mosquitoes and diseases. The prevention of disease is a critical process for a farmer. A new disease prevention programme, termed as the Decision Support System (DSS), has been adopted and has proved effective in controlling potato diseases. In addition to the detection of fungal conditions in potatoes, this system has been successfully used with sensors to deter environmental conditions High quality sensors are used to collect climate data and are transmitted through IoT technology to the database through internet connection that analyses data and evaluates performance, this collected data is submitted to the cloud IoT system. Subsequently, farmer's mobile gets all information about climate and application requirements for a specific disease prevention fungicide. The cost of fungicide applications is reduced and disease control in due time [10].

1.4.3 Use of IoT Technique to Enhance Growth and Development in Plants:

In order to improve yield and effectiveness of agricultural production, scientists and technologists concentrate mainly on the precise IoT farm by implementing real-time monitoring systems in farmland. IoT technology uses different types of high quality data collection sensors, which are then transferred over an internet connection to the servers of the Website Device. Recent research has proposed algorithms to evaluate data for tasks that

increase energy quality on cloudy or sunny days in a greenhouse cropping system. In controlling the energy system in a greenhouse this method proved to be very efficient, leading to lower energy costs and reduced production losses.

1.5 Agriculture Machinery, Tools and Implements:

The machines are being used to perform direct force action that is dependent on energy work. Among the most commonly employed agricultural machines working in the fields are motor mechanisms which are used in agriculture to lighten the work of production and develop farming techniques:

1.5.1 Walking Tractor:

Agricultural machine is one axle and is manufactured using handles with medium engine power and strength leading to ornamental and horticultural work. It is used mostly to till the earth. It can work in strong fields and it can produce weeds free field in gardens building, walking tractors are used. It causes the work to move.

1.5.2 Tractor:

Tractor is a very useful farm machine that can drive through the field, with four wheels. It has pulling power to ensure good farming in flooded areas. The brake pedals are two and it is ready for traps. It is used to ploug, smooth the field and show the grain.

1.5.3 Combine:

A combine is a versatile farming vehicle with a powerful engine. Winnowing, reaping, and threshing are the three harvesting activities that give the combine its name. In agriculture, the combine is the most time and labor saving machine. The use of combines has a positive impact on agricultural operations while still having a negative impact on labor displacement.

1.5.4 Farm Machinery:

There is a set of instruments designed to grind, shred, spray, and fertilize the dirt.

1.5.5 Sprayer:

A sprayer is a piece of agricultural equipment that is used to spray crops. Using different forms of insecticides, fungicides, or herbicides, the spray pump is used to eliminate larvae, fungus, and weeds. It helps to keep pests away from the crops. It was attached to the sprayer's rear. When using a sprayer pump, the sprayer must wear a special mask over his or her mouth and nose. Sprayers will be harmed if anything is not done.

1.5.6 Tillage Planter:

A tillage planter is a system that prepares the ground for seeding. It softens and smoothes the soil, making it easier for plants to spread.

1.5.7 Fertilizer:

Fertilizers are used to promote rapid plant growth, protect plants from disease, and eliminate weeds. Fertilizers boost crop production, which is beneficial to economic growth. It also has an effect on national and per capita revenue.

1.5.8 Packaging:

Farm machinery such as bags, crates, and containers are constructed to package crops and other items. They are used not only in agriculture but also in agro-based industries. It protects the plants from animal harm.

1.5.9 Plough:

Before the showing, ploughing is needed. Diverse machines are used for ploughing. The soil is smooth and moist by these machines for the proper seed growth. Some ploughing machines are used as follows:

a. Disc plug:

Disc plug is used to remove the weeds before the upper soil.

b. Dragging:

Agricultural machinery is constructed to break down the bits and plots of the land that the plough removed, consisting of a wooden and metal toothed frame and a lock attached to the tractor.

Discussion

Agricultural production has been improved in terms of yield, but efficiency and diversification have been reduced which have eventually caused farmers to struggle in many parts of the state. The drivers of growth thus played an important role in the global improvement of agriculture, but they were limited mainly to a few crop that, due to agricultural progress, were not considered a positive indication of the overall development of the State. Agricultural progress leads to both productivity and unemployment growth. For big farmers it is useful, but due to high costs small farmers cannot afford such machinery. Advancing farm machinery is not conducive to balanced growth. The growing cost of agricultural inputs and the relatively low price for agro-food goods creates a crisis situation for Indian agriculture on the international market. Milk and milk goods are easier to purchase on foreign markets than from Indian markets. Small farmers and their families suffer from constantly increasing costs of agriculture input. The farmers' debt and tension are on their way. Many Indian farmers are being exposed to the latest available technology, and trained farmers are employed in international agriculture companies to aid in the diffusion of better agriculture technologies in their fields. Increased agricultural exports, increased economic productivity by ensuring the integration of potential and achieved outputs, and value added activities utilizing agricultural produce, and finally improved access to domestic and foreign markets that are either tightly controlled or secured, are the three components of agricultural globalization.

Conclusion

It has been concluded that agricultural machines and automation of machinery have increased agricultural production in comparison to the normal use in the agricultural sector of agricultural machinery. Many forms of high quality sensors, IoT technology and high-speed Internet have revolutionized the agricultural manufacturing process. This technique of automation also lowered the cost of production and improved crop return. Latest methods of robotics and high-quality sensors have opened a new door in the field of precise farming. Agriculture globalization is a part of the real science and economic flow of technological transition. Advance agricultural equipment depends on the nature of farmers because farmers welcome innovation and other farmers use old farming methods, particularly if they want to reduce physical labor. The continuous use of the new ideas and better technology in agriculture is used to increase production for the sake of farmers' economic wellbeing and the safeguarding of food safety.In India, agricultural information is primarily transmitted to farmers by extension programmes, which include magazines, radio, one-to-one communication, television discussions, and exhibits of goods, fertilizers, and seeds at farmers' fairs. Agriculture's sophisticated machinery boosts the economy while still affecting farm workers and increasing causal labor. As a result, technological advancements in agriculture benefit big farms while harming agricultural labor and small farmers. Agriculture should be developed in such a manner that it promotes a sustainable growth of the industry..

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