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Artificial Intelligence (AI) and Agricultural Biotechnology

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Abstract:

Indian agriculture not only provides food-grains to more than 142 crore peoples but also generates huge employment, earning rare forex currency, increasing country's national income, and so on. The share of the Indian agricultural sector in national income is 18 percent but more than 45 percent of the labour force are depending on the agricultural and allied sectors. In contrast in developed countries, only 5 % of the labor force is dependent on the agriculture sector. India's agricultural productivity and competitiveness are also low compared to those of developed countries. Lack of capital, backward technology, in sufficient irrigation facilities, highly dependence on monsoons, and high cost with low returns are obstacles to Indian agricultural development. However, owing to the increasing population and demand for food grains, it is very important to use artificial intelligence in agricultural biotechnology. Artificial intelligence in agriculture biotechnology is very useful because it helps weather forecasting, monitoring of soil, crops and livestock health etc. Artificial Intelligence (AI) has enormous potential to help increase the productivity and efficiency of Indian farmers and agro-industries. Agricultural problems will be minimize through the use of drones, robotics, sensors, satellite etc. and highly profitable farming will become possible. The researcher has used secondary data to analyze the of research paper. The present study focuses on how AI is important for sustainable agricultural development in India.

Key Words: *Artificial Intelligence, Indian Agriculture, Biotechnology, Development*

Introduction:

India is a developing country and agriculture is not only the main occupation but also the backbone of the Indian economy. After independence India faced a shortage of food grains but today India is self-reliant. A high population, low per capita income, poverty, and high dependence on the agricultural sector are features of the Indian economy. As per a UN report, India is the world's largest country in the population. The working age population (15 to 60 years) is higher in India than other countries. Hower, owing to high unskilled labour, resources are not used at the optimum level. During 1967-68 green revaluation took place in the Indian agricultural sector. Following this green revaluation India became self-reliant on food production. In 2023-24 food grain production was 332.22 million metric tons. However, 55 % of the peoples depend on the agricultural sector. Indian farmers face several problems and challenges. Lack of capital, backward technology, insufficient irrigation facilities, highly dependence on monsoons and high cost with low returns are obstacles to Indian agricultural development. In view of these problems, the key issue is how to double farmers income. Indian farmers are not getting faire prices for their goods because of the lower storage capacity of agricultural commodities. At the international level, Indian farmers export capacity and competitiveness are low. Therefore, the role of Artificial Intelligence (AI) in increasing the productivity and capacity of farmers is important in the current situation of Indian agricultural sector.AI, which is bringing about a revolutionary change in agriculture and allied sectors. AI farmers can more effectively manage resources, such as water, fertilizers and pesticides reduce waste and reduce their adverse impacts on humans and the environment. According to the definition of NITI Aayog, AI is a constellation of technologies that enable machines or robots to act with higher levels of intelligence and emulate the human capabilities of sense, comprehend and act .

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The role of AI is very important in weather forecasting, soil and crop and livestock health monitoring, crop management, pest detection, automated weed control systems and automated irrigation. Recently, the Ministry of Agriculture developed the kisan e-Mitra and National Pest Surveillance system and. the ICAR introduced an IoT- based irrigation system.Agricultural biotechnology is a scientific technique for developing a new variety of plants, animals, and microorganism for agricultural development. Therefore, to avoid these adverse effects, a second green revaluation is require. However, in this second green revaluation, it is necessary to place more emphasis on organic farming than only chemical based farming and this revaluation of the use of AI is very important.

Statement Of the problem:

Even so, there are 12 five-year plans to address problems in the agricultural sectors such as disguised unemployment, low productivity, lack of irrigation facilities, backward technology and raising prices of agricultural inputs. However, the use of AI in agricultural biotechnology can reduce agricultural problems.

Objectives of the Study:

The main objectives are as follows:

1. To study recent trends of Indian agricultural sector
2. To study the role of AI in agricultural biotechnology
3. To study challenges of using AI in agricultural Sector.

Research Methodology:

This study mainly relied on secondary data. The data are collected from various economic surveys of India, the NITI Aayog report, the Ministry of Agriculture and Farmers' welfare, etc., as well as journals and books for data collection.

Current status of Indian agricultural sectors:

Indian agricultural is the largest occupation but has a declining share in GVA, Stagnant share in exports, and a high fluctuation in growth. Datils regarding Indian agriculture are as follows.

Table No.1
Key indicators of Indian Agricultural sector

Year	Growth rate (in %)	Share in GVA (in %)	Food grains production (in million tonnes)	Share in export (%)
2015	1.1	**17.7**	**251.6**	**12.6**
2018	2.6	**17.6**	**285.2**	**11.8**
2019	4.3	**18.1**	**297.5**	**10.6**
2020	3.6	**20.3**	**310.7**	**14.3**
2021	3.9	**19.0**	**315.6**	**11.9**
2022	4.7	**18.3**	**329.7**	**11.9**
2023	1.4	**15**	**332.3**	**11.3**

Source: various economic survey of India

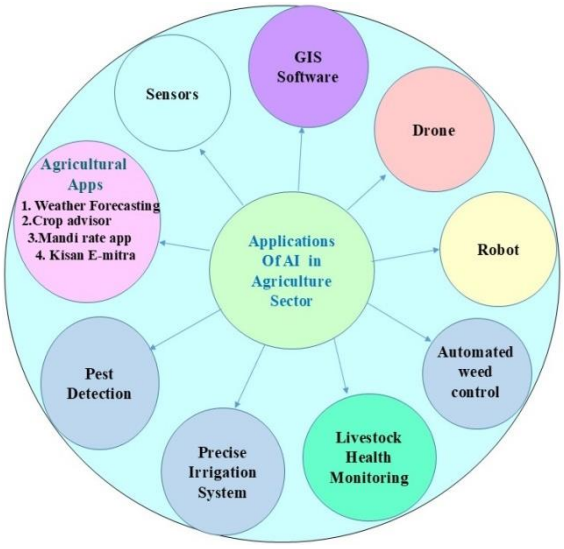
Table no.1 is indicated than an overview of Indian agricultural sector during the year of 2015 to 2023.Many times agricultural growth rate is fluctuated during this period. In the year 2015 agricultural growth was 1.1 percent and it was 4.7 percent in 2022.but in recent year 2023 it was sharply decline which was 1.4 percent. However, agricultural is only one sector which growth rate was positive in covid-19 pandemic.

The share in GVA is continuously declined in the recent. In 2015 share in GVA was 17.7 percent and it was 15 percent in 2023. The total foodgrains production was 251.6 million tonnes in 2015 and it was 332.3 percent in 2023.But share export is still stagnant 11 to 12 percent during the 2015 to 2023.After green revaluation Indias foodgrains production is growing rapidly. If Indian agriculture has been called gamble in monsoons, but after 2015 foodgrains production is continuously increasing. .

After green revaluation India has become self-reliance in foodgrains. But in this green revaluation, the soil fertility has decreased due to the large scale used chemicals, fertilizers and pesticides in the agricultural sector. This excessive use of chemicals, fertilizers and pesticides are not only affecting on agricultural sector but also adversely impact on environment and entire human species.

Applications of AI in agricultural sector:

Biotechnology is very important for sustainable agricultural development; because it enhances crop varieties by reducing costs and providing food security for huge population. Given the side effects of chemical agriculture, the uses of AI in agricultural biotechnology is very important. This also enhances organic farming for sustainable development. Several AI applications are useful in the agricultural sector



Source: Above graph is designed by researcher

1. Robotics:

Robotics is one of important AI application for various types of agricultural applications such as monitoring crops, harvesting, weeding and planting. This helps to reduce the cost of production and increase productivity in the agriculture sector.

2. Drone:

Drone are modern AI instrument. It is helpful for farmers to monitor and survey of crops, distribute fertilizer and pesticide, spray crops, soil and monitor irrigation .It also assists farmers with precision mapping, seeding and livestock management.

3. Automated weed control:

This application is assisted by armers to increase crop yield, reduce environmental impacts, reduce labor costs and increase income.

4. Livestock health monitoring:

In this AI application the role of a senser (tracker device) attached to the animals is very important. This application informs to farmers about the animals' heart rate, temperature and r behavioural patterns as well as preventing the spread of animal diseases and reducing antibiotic use.

5. Precise irrigation system:

Irrigation is essential for agriculture. However, water scarcity has become a challenge for farmers in recent year. In such cases, this system helps farmers in terms of proper and strict planning of the available water. This irrigation system delivers moisture directly to crops in micro units when required and accurately supports crop need. Drip lines, micro sprinklers, control units, weather stations and GIS mapping are components of a precise irrigation system. This system minimizes water waste and optimizes crop yield.

6. Pest detection:

AI is identified by pests and their damage from the help of cameras, sensors, radar, and video equipment which helps farmers and food processing industries take early to prevent infestations. Apart from this there are some agricultural applications that provide agricultural information to farmers such as forecasting, crop advisers, Kisan mandi and GIS software.

Major Challenges of AI in use of Agriculture in India

1. Higher cost of technology but income of Indian farmers is low
2. Many farmers are illiterate about use of AI.
3. Unemployment will be increased because AI can displace rural labour
4. One of other challenge use of AI is provide education and training among the huge farmers
5. From technical expertise.
6. Lack of basic infrastructure
7. problems of data collections and analysing, securities and privacy issues

However, it is necessary to balance the benefits and risk of using AI in the agricultural sector.

Suggestions and Conclusions:

The agricultural sector faces many challenges derive from climate changes and economic and social factors. Soil degradation, water scarcity, and labour shortages other critical issues in agriculture. One of the major challenges is growing pressure on the agricultural sector to produce foodgrain sustainably, while demands are increasing from the Indian population. Therefore, farmers and food processing industries are looking for artificial intelligence for help, because it holds transformative capacity advanced and innovative solution to the agriculture sector pressing challenges. The use of AI reduces soil degradation, greenhouse gas emissions and food waste; it also increases the holding capacity, bargaining power and income of farmers. AI encourages farmers to avoid the overuses of water, fertilizer and pesticides in agriculture. Considering the importance of AI in the development of the agriculture sector, the government has also launched some important schemes such as Kisan e-Mitra an AI chatbot, PM Kisan Samman Nidhi, and the National Pest Surveillance System.

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Conflicts of interest
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