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# Boon and Bane of Agricultural Drone

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**Abstract**
With the growing population the need for food security is an urging matter. Thus, the developmental revolution in agriculture is inevitable. This article speaks about one such technology, the Unmanned Aerial Vehicle (UAV) commonly called drones. The drones are used for various purposes such as planting seeds, analyzing soil, land mapping, monitoring of crops and livestock, chemical spraying and also help with geo fencing. There are also several benefits of increasing efficiency and the proper utilization of resources while increasing productivity. The government has lent their ardent support for this emerging technology by providing various subsidies and policies.

**Keywords:** Agricultural Drones, Application, Benefits, Government Subsidies, CHC, FPO.

## Introduction

India is an agricultural country where 47 per cent of the total population depends on agriculture as a primary source of livelihood as per economic survey 2022-2023. It is considered as a global agricultural powerhouse. World Bank states “India as the largest in producing pulses and spices, and the second largest in producing rice, wheat, cotton, sugarcane, fruit, vegetables, and tea”. The total land area of 1.95 lakh sq km is used for agriculture in which 63 per cent is rain-fed and 37 per cent is irrigated. Total food grain production 329.68 million metric tonnes during 2022-2023. These achievements of growth are due to the support of the government in providing subsidies for fertilizers, irrigation, seeds, electricity, export, credit, agricultural equipment’s and infrastructure in order to boost the agricultural economy.

Government of India plays an active role in upgrading technology used in agriculture. It has also updated regulations on drone usage in agriculture. Indian government has put out a certification scheme in order to promote agriculture drone spraying. A subsidy of 100 per cent is provided only to the farm machinery training institutes, Krishi Vigyan Kendra, Central Island Agricultural Research Institute and agricultural universities. In the latest report of World Economic Forum (WEF) asserted that drones have the potential to be the indicator of technology-led transformation of Indian agriculture.

A special purpose unmanned aerial vehicle (UAV) is used for agriculture devised to monitor crop health, production by tracking the crop growth and the conditions of the soil in real-time. Drone agriculture is a division of a larger subject called as the “Precision Agriculture” where it focuses on the increment of the farm productivity, quality and yield by optimal use of water and fertilizer along with the effective pest control and disease management system. The drones use multispectral sensors in which the reflected light

energy is captured within the several bands of the electromagnetic spectrum such as visible, near infrared and short wave infrared wave lengths.

**Literature review**

**Ahriwaret.al. (2019)** explained that drones are flying crafts which are used for various purposes. They defined the UAVs and have given insights about the advantages, working principle, drone mechanism and the applications based on all sectors. Drones are applied in the areas of military, delivery services, security and enforcements, television industry, disaster management, wildlife monitoring. Apart from that they have also discussed the applications in the agricultural sector. It has also stated the general laws in India.

**Yadachiet.al. (2023)** studied drones which have complemented the development of the sustainable agriculture. This study mainly focuses on the application aspect of the drones' usage in agriculture. The drones can be used for various activities such as chemical spraying, soil analysis, locust control, livestock monitoring, geo fencing, crop damage, transportation, disaster management, irrigation management and crop health monitoring. It also portrays the prospects of the drone technology in India and the challenges in adopting the drones in India.

**Objectives of the Study**

1. To detect the application, role, benefits and the challenges posed by the utilization of drones in agriculture.
2. To know about the government subsidies given to in order to make the drones accessible to the farmers.

**Application of Drones in Agriculture sector**

The combined technologies of Global positioning system (GPS), Geographic Information System (GIS) and Artificial Intelligence (AI) software have helped in precise gathering, processing and analysis of farm data in real-time. The applications of the drone in the agricultural sector are given below:

***Land mapping / Surveying****:* The agricultural drones are used to map for its further applications. As the initial step the flight planning software is used to run an aerial survey to map the specified areas that need to be monitored. Using this software an automated flight path is created with which the camera shots are taken from different angles. Each image is tagged with specific coordinates. Comprehensive data is compiled across multiple parameters using this process which is several times faster than the regular land-based methods.

***Soil Analysis:*** A critical part of any farming operation is to track the diverse soil quality indicators throughout the year. Drones are apt to automate soil analysis throughout the year all year round to attain dynamic soil monitoring, preventing soil erosion, timely nutrient replacement and preparing soil for seasonal rotation. To assist AI- driven software unique light wavelengths of different soil conditions are captured by the multispectral imaging sensors to accurately assess soil elements.

***Planting and Seeding****:* Large scale seed planting is also done by the agricultural drones which provide comprehensive data on different parameters related to climate, soil and terrain. This provides a big opportunity as reforestation can be quickly done using automated drone seeders in rapidly dealing with climate change. This is helpful in seeding the difficult terrains where the manual plantation is unsafe for workers. A tree plantation in Telangana achieved 10- fold reduction in the cost of reforestation using agricultural drones with an added benefit of covering a large area in a lesser time which was completely

safe to the workers. A domestic company of Telangana is engaged in planting 50 lakh seeds on 12000 hectares across the districts of Telangana.

***Irrigation, Monitoring and Planning****:* Accurate assessing the moisture level in the soil utilizes the microwave sensing and related technologies. This helps to efficiently distribute the water across the crops. Additionally, drones help in conservation of precious water by monitoring drainage patterns and identify irrigation leakages.

***Crop Health Monitoring****:* Drones capture images which provide valuable data on crop growth, density and other parameters such as colouration and signs of disease. Researchers at International Institute of Information Technology (IIIT) Naya Raipur developed an AI using drone- based crop health forecasting solution to proactively detect diseases and pests and suggest quick and accurate remedies.

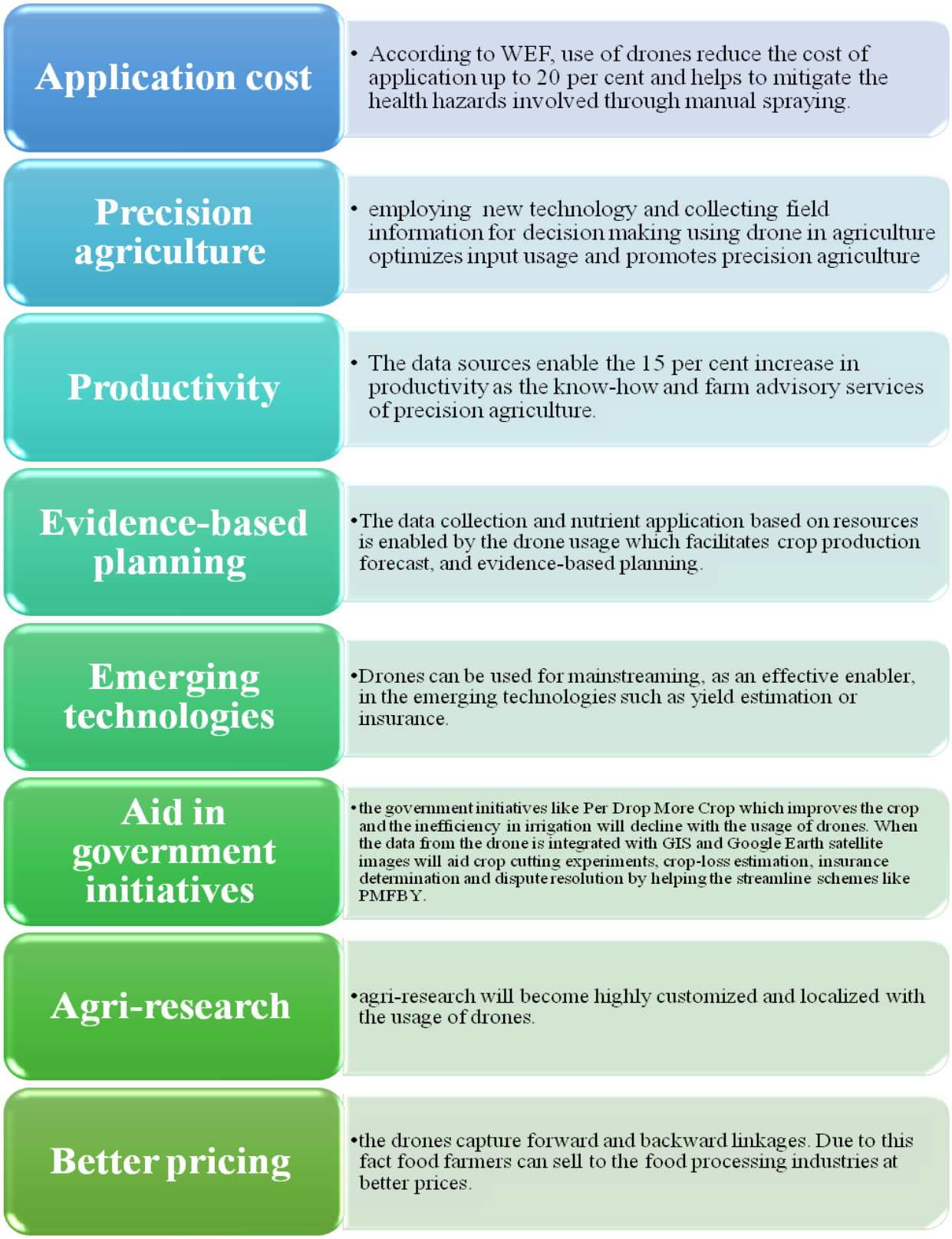
***Livestock management****:* High resolution infrared cameras in the drones are used to monitor and manage large cattle. Since the sick animals can be identified and appropriate action can be taken. Consequently, the effect of drones on precise dairy production will soon become the new norm.

***Crop spraying***: Drone mounted sprayers can spray chemicals on the crops quickly when compared to the conventional spraying methods because they have reservoirs recharged with fertilizers, pesticides, herbicides, fungicides and plant growth regulators. Thus, a new era of precision farming can be brought out by the drone technology. Sometimes it becomes detrimental to overuse chemicals like herbicides or pesticides. Surplus spraying can alter the soil's fertility and the quality of the crop. These problems can be rectified by using agricultural drones which can identify pest attacks and calculate the optimal quantity of pesticides appropriately.

***Helps with Geo-fencing****:* There is a chance of animals entering the farming lands and destroying crops, especially at night. Thermal cameras in the drones help to detect any animal activity in the fields. The external factors that damage or interfere with crop production can be greatly visualized by the farmers. Drones act as a guard to the fields from external damage caused by animals, especially at night.

**Advantage over Manual Spraying**

- Since the manual spraying of pesticides is getting increasingly costlier, drone spraying is seen as an essential alternative.
- The cost of spraying for an acre is ₹700. It also takes four hours to spray for an acre the increase in the costs is due to the increasing labour wages, labour shortage, rising petrol prices etc.
- The cost of manually spraying insecticides using drones' costs relatively less and the spraying of pesticides using drones can be potentially done in 4 minutes per acre.




**Role of Drones in Agriculture Sector**

**Benefits of Using Drones in Agriculture**

The Government is easing up the restrictions to allow the flying and management of drones on realizing the level of the potential an agricultural drone contains. Thus, it has encouraged many startups and

small-scale industries to fly drones for the purpose of agriculture as a service. The purpose of the drones in agriculture is as follows:

1. **Increase in Farm Production & Yield:** To help farmers improve their production and productivity drones serves as an ultimate tool with which the farmers can put planning in the matters of improved irrigation methods, accurate monitoring of crop's health, more knowledge and improved actions to increase soil's health and identification of new and improved methods to adapt to environmental changes.
2. **Timely Allocation of the Right Resources :** The drones help farmers to employ right resources on time with the ability to provide accurate and real-time data about their crops and fields. Drones serve as a tool to monitor crops and providing measures with the correct data from the drones. The farmers can monitor their fields and crops in real-time without even having to be physically present there.
3. **Quick Decision-Making for Farmer :** The drones provide accurate, real-time data at quick intervals with which the farmers can take quick and timely decisions. Thus, the farmers can plan the practices to cultivate a better yield or to eliminate the practices which are unnecessary.
4. **Utmost Accuracy up to 99 per cent in Crop & Field Data:** The farmers can precisely perform correct soil mapping by calculating the land size and crops with the advanced technology of the drones. Thus, the gaps in the growth patterns of the crops can be analyzed by sitting remotely with the use of the data collected by the drones.
5. **Great Evidence for Insurance Claims:** The drones serve as evidence to claim insurance at times of crop damage or failure by collecting data. Hence, an unmanned aerial vehicle can help to calculate risks/losses associated with land.
6. **Helps save Water:** In addition to the traditional spraying methods the farmers can use drones for spraying as the drones use ultra–low volume (ULV) spraying methods and thus water bills are saved.
7. **Security:** Drones are handled by trained drone pilots hence the misuse of drones in negligible which increases the security.
8. **High Efficiency:** Drones helps to increase cost efficiency and also helps to increase the efficiency in the matters of spraying, resource allocation and monitoring etc by operate instantly and doing tasks twice as quickly as humans.
9. **sLow-Cost frame and Easy to Maintain:** Agricultural drones are reliable, economical and require a little to maintain. A detachable container, an affordable frame, and precision pesticide spraying are a few important qualities of the drones. The imaging operations are most likely to be carried out by the drones that weigh less than 5 kg. In the next three to five years, subsidies and incentives will drive heavier drones weighing 5-25 kg (with 10L payload) for spraying operations with BVLOS (Beyond Visual Line of Sight) permission. By utilizing ultra-low volume spraying technology, drones contribute to a remarkable 80-90 per cent is achieved of tiny droplet sizes of approximately 50 microns as against manual spray droplet size of approximately 500 microns. The cost of drone spraying is significantly lower, with a reduction of 30 per cent when compared to conventional spraying methods. There is a reduction in input costs of spray items which is estimated to be around 25-30 per cent.

**Limitations of Agricultural Drones**

1. **Connectivity issue:** Rural areas often face significant challenges when it comes to online availability. Unfortunately, internet connectivity issues can be a reality for farmers in these regions. To overcome this limitation, farmers are required to invest in internet connectivity, resulting in an ongoing expense. This can pose a financial burden for farmers who rely on digital resources for their operations.
2. **Dependency on the weather:** Drone operations are highly dependent on favorable weather conditions. It is crucial to ensure that drones are not operated during periods of rain or strong winds. The weather plays a pivotal role in determining the feasibility and safety of drone flights. Therefore, farmers must closely monitor weather conditions before utilizing this technology on their farms.
3. **Knowledge and skill:** While embracing new technologies like drones can bring about significant benefits, it also demands a certain level of knowledge and skill. For the average farmer, comprehending how a drone functions may pose a challenge. In order to make the most of this technology, farmers must either acquire the necessary knowledge or continue relying on experts who can assist them in utilizing drones effectively. This presents an additional hurdle for farmers who may already have a busy schedule managing their farms.

**Common Challenges Associated with the Use of Drones**

Drones are a blessing to Indian farming, but they also have certain setbacks which cannot be ignored. Few challenges in the usage of drones in agriculture are mentioned below.

- The approval of the government is required by the farmers or smallholders require government approval to use drones.
- High-tech drones are not always at affordable prices for everyone.
- The technical knowledge and skill associated with flying drones is necessary.
- The drones which are affordable only cover short distances of the land. In order to cover long distances and crop fields more technically advanced drones are needed which are expensive.
- Farmers would have to invest in advanced network or connectivity resource, which adds to the recurring expenses to farmers.
- There is a lack of technological awareness among the farmers with regards to the drone utilization in agriculture.
- There is an increase in the cost of operation as most farmers in India are small and marginal farmers.

**Various Schemes Provided by the Government to Buy Agricultural Drones**

The Ministry of Agriculture is actively supporting state governments through various schemes to promote agriculture nationwide. These initiatives aim to enhance production and productivity while reducing the reliance on human labor in agricultural activities. The government is also facilitating farmers' access to modern technology to improve the efficiency of inputs such as seeds, fertilizers, and irrigation.

**Sub-Mission on Agricultural Mechanization (SMAM) Schemes**

To encourage the utilization of drones in the agricultural sector and to make this technology more affordable for farmers and other stakeholders, former Minister of Agriculture and Farmers' Welfare Tomar emphasized that monetary support is to be provided. Under the Sub-Mission on Agricultural Mechanization (SMAM), the Farm Machinery Training & Testing Institutes, Institutions of Indian Council of Agricultural Research, Krishi Vigyan Kendra (KVK), and State Agricultural Universities (SAUs) are

eligible to receive 100 per cent funding for the cost of drones, along with the associated expenses, for conducting demonstrations on farmers' fields.

**Custom Hiring Centers (CHC)**

The main objective of the Custom Hiring Centers (CHCs) is to supply farm implements to small, marginal and poor farmers at subsidized rates on hire. The assistance given by the government to the CHCs is 40 per cent of the basic cost of the drone and its attachments, or a maximum of Rs. 4 lakhs. Additionally, agriculture graduates who establish CHCs are eligible to receive financial aid amounting to 50 per cent of the drone's cost, up to a maximum of Rs.5 lakh.

Apart from the institutions already identified for drone demonstrations, other agricultural institutions under the state and central government, as well as central public sector undertakings engaged in agricultural activities, have been included in the eligibility list for financial assistance in conducting drone demonstrations for farmers.

**Farmers Producer Organization (FPO)**

Farmer Producer Organizations are receiving substantial financial assistance, amounting to 75 per cent of the total cost. This financial support will remain in effect until March 31, 2023. Furthermore, agencies that employ drones for demonstrations will receive contingency funds of Rs 6,000, while those involved in drone procurement will be allocated Rs 3,000 per hectare as a contingency budget. Notably, the Farmers Producer Organization (FPOs) will be eligible for grants to purchase Kisan Drones and related attachments, with the government covering 75 per cent of the drone's cost, up to a maximum of Rs. 7.50 lakh. It is important to highlight that this assistance is limited to the purchase of one drone per FPO.

**Other Schemes**

The government provides up to 50 per cent assistance on the purchase of drones based on the categories of Scheduled Tribes, Women, Tribes, Small and Marginal farmers. 75 per cent of its total price will be given as subsidy, if this drone is bought by a farmer group or organization. Only 40 to 50 per cent of the amount grant will be given, if it is bought by a farmer for personal purposes. A subsidy up to Rs 5 lakh (50 per cent) will be given to small farmers, women, low- and middle-class people on drones. The government is providing 50 per cent or maximum Rs. 5 lakh subsidies to SC-ST, small and marginal, women and farmers of to buy drones, for promoting the use of Kisan Drones.

**Documents Required to Apply for Subsidy on Drones**

- Aadhar card and Aadhar linked mobile numbers of farmers.
- A Pan card of the applicant farmer.
- Farming land papers of farmers
- Bank details with a copy of the passbook.
- A passport-size photo of the farmer.

**Conclusion**

Agriculture will continue to use drone technology as the next agricultural revolution is data oriented. This new technology can help farmers to work more efficiently and in less time. The drone utilization is proved useful in leading to more efficient resource utilization and reducing the quantity of chemical pesticides

and fertilizers which tends towards better health and economic outcomes for Indian farmers. The drones enable the farmers to know more about their farming system. Hence, they can use their land efficiently with optimal resource utilization, thereby increasing productivity. Thus, the drones might become a part and parcel of agriculture with the continuous support of the government towards the goal of better utilization in a sustainable way.

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