Original Research Article

Constraint Analysis of adopters and non adoptersof drones in agriculture in Warangal districtof Telangana

ABSTRACT

The present study was conducted with an objective to analyzeconstraints faced by farmers who are using drones, constraints faced by various stakeholders and constraints faced by farmers who are not using drones in agriculture in Warangal district of Telangana, India. Various problems faced by farmers are choosen and Garette's ranking technique is used to know the major constraints. The major constraints faced by the farmers who are using drones in agriculture are shortage of drone suppliers with a score of 67.95, non uniform coverage with a score of 61.75. the major constraints faced by farmers who are not using drones in agriculture are high labour cost with a score of 73.12, time consuming with a score of 67.55 and the major constraints faced by the stakeholders are high initial investment with a score of 78.8, battery life with a score of 59.2.The suggestions were provided for the major constraints involved in both adopters and non adopters of drones in agriculture.

Keywords: Drones, Garette's ranking technique, farmers, stakeholders.

1. INTRODUCTION

Farming, often referred to as agriculture, is the practice of cultivating soil, growing crops, and raising animals for food, fibre, and other products essential to human life. Primitive farming refers to the early methods of agriculture practiced by ancient civilizations and human societies where asmodern farming, also known as industrial agriculture, emerged with the advent of advanced technology and scientific knowledge.

Technology use in agriculture, often referred to as agricultural technology or agri-tech, has revolutionized the way food is produced, processed, and distributed globally. Artificial Intelligence (AI) and the Internet of Things (IoT) are two rapidly advancing technologies that are revolutionizing agriculture, enhancing productivity, sustainability, and efficiency across the industry. Drones are also a part of it. They can help farmers optimize their farming practices and increase crop yields. Drones have revolutionized agriculture by improving precision, efficiency, and promoting farming practices(Kamble*et al.*). They provide farmers with real-time data, enabling them to optimize operations, reduce costs, and improve crop yields.

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These tools help meet global food demand while minimizing environmental impact, making drones an invaluable tool in modern agriculture(Raahalya*et al.*).

In agriculture, drones will contribute around 7 billion USD economy globally every year. About 84 percent of the US farmers use drones daily or weekly approximately 73 percent uses for crop monitoring and 43 percent are using drones for soil and field analysis. Deforestation and land degradation are significant issues, causing significant loss of 129 million hectares of forest and 12 million hectares of land annually. The adoption rate of drones is actually very less in developing countries like India. Information provided by Stockholm International Peace Research Institute (SIPRI) clearly shows that India leads the pack in drone importing nations with 22.5 percent of the worlds drone imports. CAGR is expecting Indian drone market to grow by 18 percent during the years 2017-2023(Saidhar*et al.*).The Telangana government collaborates with private companies and research institutions to develop drone applications in various sectors like agriculture, healthcare, and urban planning. Telangana is working on creating a conducive regulatory environment for drone operations, balancing innovation with safety and privacy concerns. The Government will establish a Telangana Drone City (TDC) that would become India's leading Unmanned Aerial Vehicles (UAVs) test and business center for agriculture(Nirmala *et al.*). Various problems are discussed in this paper regarding drone use and how farmers can overcome the problems so as to increase their yield and eventually increase the income.

2. MATERIAL AND METHODS

~~In the~~ Warangal district of Telangana, two mandals, Hasanparthy and Elkaturthy, were intentionally chosen. ~~From~~ Hasanparthy, the villages of Ganturpalli and Sitampet were selected, while from Elkaturthy, the villages of Thimmapur and Suraram were chosen. In Ganturpalli and Thimmapur, 20 adopters and 20 non-adopters cultivating paddy were selected. ~~In~~ Sitampet and Suraram, ~~20 adopters and 20 non-adopterscultivating cotton~~ were selected. Therefore, the study comprised a total sample population of 80 individuals: 40 adopters and 40 non-adopters growing paddy and cotton and hence, an objective to analyseconstraints faced by farmers who are using drones, constraints faced by various stakeholders and constraints faced by farmers who are not using drones in agriculture in Warangal district of Telangana, India were selected for the study.

Garrett's ranking technique is employed for ranking the problems of stakeholders on different variables. This method helps to identify the most significant variable influencing the respondent (Devi *et al.*).By this method the respondents are asked to rank their preference for all factors. The resultant outcomes of such rankings are converted to per cent position using the formula:

$$Percent\ position = \frac{100(R_{ij} - 0.5)}{N_j}$$

Where,

R_{ij}= Rank given for the i^{th}variable by j^{th} respondents

N_j= Number of variables ranked by j^{th} respondents

From the Garrett's Table, the percent position calculated is converted into scores. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor.

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3. RESULTS AND DISCUSSION

In this section, the problems faced by farmers using drones, problems faced by farmers who are not using drones and problems faced by the drone suppliers were highlighted and various suggestions given by them are also enlisted. Problems related to adopters and non adoptersand the suggestions to address these problems are presented below.

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Table 1. Garette's ranking for the various constraints faced by farmers who are using drones.

S.No.	Problem	Mean scores	Rank
1.	Shortage of drone suppliers	67.95	I
2.	Non uniform coverage	61.75	II
3.	Small size of land holding	59.65	III
4.	Noise made by the drone	53.40	IV
5.	High cost	53.30	V
6.	Degree of skill	51.47	VI
7.	Risk to human and animals on ground	48.72	VII
8.	Short flying time	48.55	VIII
9.	Crop damage due to weather	46.50	IX
10.	Small size of the tank	39.70	X
11.	Obstacles like trees, hills and birds	33.65	XI
12.	Lack of SOP's and guidelines	31.35	XII

Drones are been used for various agronomical practices like sowing, transplanting, spraying various plant protection chemicals which is helping farmers to reduce labour costs and spraying costs in the field. But various constraints faced by farmers who are using drones include shortage of drone suppliers with a mean score of 67.95,non uniform coverage with a mean score of 61.75, small size of land holdings with a mean score of 59.65, noise made by the drone with a mean score of 53.40 and high cost with a mean score of 53.30.

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Table 2. Garette's ranking for the various constraints faced by farmers who are not using drones.

S.No.	Problem	Mean scores	Rank
1.	High labour cost	73.12	I
2.	Time consuming	67.55	II
3.	Non uniform coverage	51.95	III

4.	Risk of human health	50.65	IV
5.	High usage of resources	47.60	V
6.	Lack of awareness about drones in agriculture	47.10	VI
7.	Unsupportive weather conditions	37.62	VII
8.	Noise made by the drone	37.07	VIII
9.	Degree of skill	33.32	IX

Other traditional methods are used by the farmers to undergo various agronomical practices and there is a large requirement of labour for sowing, transplanting and is a time taking process for spraying plant protection chemicals, and hence major constraints faced by the farmers who are not using drones in agriculture include high labour cost with a mean score of 73.12, time consuming with a mean score of 67.55, non uniform coverage with a mean score of 51.95, risk of human health with a mean score of 50.65 and high usage of resources with a mean score of 47.60.

Table 3. Garette's ranking for the various constraints faced by various stakeholders/ drone suppliers.

S.No.	Problem	Meanscores	Rank
1.	High initial investment	78.80	I
2.	Battery life	59.20	II
3.	Skill requirement	50.60	III
4.	Government regulations	50.20	IV
5.	Signal interference	47.80	V
6.	Data management	45.40	VI
7.	High maintainance costs	43.60	VII
8.	Weather conditions	41.20	VIII
9.	Security risks	40.20	IX
10.	Accidental crop damage	39.60	X

Drones are leased out and a professional is hired for various agronomical practices like sowing, spraying of plant protection chemicals. As drones is an emerging technology in agriculture, drone suppliers also are facing various challenges like high initial investment with a mean score of 78.80, battery life with a mean score of 59.20, skill requirement with a mean score of 50.60, government regulations with a mean score of 50.20 and signal interference with a mean score of 47.80.

In the study area, farmers who are adopting drones in agriculture are facing a major problem of shortage of drone suppliers and this could be achieved by collaborating with academic institutions and research organizations to innovate and improve drone designs and by supporting startups and new

companies entering the drone manufacturing industry through grants, loans, and incubation programs. Farmers who are not adopting drones in agriculture are facing a major problem of high labour costs which could be achieved by seeking government programs that offer financial assistance or subsidies for purchasing agricultural machinery and technology and forming agricultural cooperatives to share resources, including labor and machinery, among multiple farmers.

4. CONCLUSION

The present study provides significant insights into the farmer's and drone supplier's perspective of constraints and suggestions to overcome their constraints. The analysis is based on the primary data collected from the paddy and cotton growing farmers in the study area. The analysis identified that shortage of drone suppliers, non uniform coverage are the major constraints face by the farmers using drones in agriculture and high initial investment and battery life are the major constraints faced by the drone suppliers. The above provided suggestions could help farmer to overcome the constraints. Government and policy makers should concentrate on those areas to make the farmers well aware about the emerging technologies in agriculture.

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