Perception, Attitude and Knowledge of Farmers towards Agri-drones: Case Study on Influence of *Mann Ki Baat* Program

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ABSTRACT

In the recent years, ICTs has proved to be highly beneficial for the farmers in getting easy access to the customized agricultural information and therefore, have a potential to influence smart agriculture. The Honourable Prime Minister through his *Mann Ki Baat* program has given a vision of quantum jumps in the economy, which will be driven by 'new-age technologies'. Out of 99 episodes on *Mann Ki Baat* broadcasted so far, 7 had major emphasis on the farming sector and farmers welfare. In the 95th episode (aired on November 27, 2022), he highlighted the roles of drones in agriculture. The present study was designed to know the overall perception, attitude, and knowledge level of farmers with respect to different aspects of Agri-drones, who have actively participated in *Mann Ki Baat* program. Primary data was collected and analysed from 1398 farmers, who participated in *Mann Ki Baat* program under the aegis of 77 Krishi Vigyan Kendras (KVKs), chosen randomly across the country. We learned that a majority of the farmers have participated in the program and perceived that drones were useful for agricultural operations and such farmers had favourable attitude towards Agri-drones. However, a significant number of farmers expressed difficulty in understanding the drones' technology. Most farmers exhibited knowledge about Agri-drones to a moderate scale and have medium to high level of knowledge, which clearly indicates that *Mann Ki Baat* program has influenced and enriched farmers with respect to the knowledge related to Agri- Drones. The socio-economic characteristics of farmers were found to have significant and positive relationship with the knowledge level. The insights gained from this present study may help policy makers and researchers in effective planning and execution of programmes on adaptive capacity development of farmers, making them more aware and knowledgeable to strengthen the adoption of drone technology in agriculture.

Keywords: Agri-drones, Mann ki Baat, Perception, Knowledge level

INTRODUCTION

In the recent years, Information and Communication Technology (ICT) has proved to be highly beneficial for the farmers and helped them in getting easy access to customized information regarding improved varieties, cropping pattern, use of high-yielding seeds, fertilizer application, pest management, marketing, entrepreneurship, etc. ICT can have a leading role in the dissemination of right information to needful farmers at right time. ICT services provide critical access to the knowledge, information, and technology that farmers require to improve their productivity and thus, enhance their livelihood and quality of lives

(Nandeesha, 2016). Advancement in ICTs has given boost to smart farming, which harness modern technologies in precision agriculture like big data, cloud and Internet of Things (IoT) for effective and efficient tracking, monitoring, automation and analysis of agricultural operations.

Hon'ble Prime Minister, with his *Mann Ki Baat*, motivated the farming community and other stakeholders to drive innovations in the sector. In the *Mann Ki Baat* 95th episode aired on November 27, 2022, Prime Minister of India highlighted the roles of drones in agriculture and informed that India is moving fast in the field of drones. He elucidated, how with the

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help of Drone Technology, delicious Kinnauri apples of Himachal are reaching people more quickly, timely with reduced wastage and expenditure of our farming communities. Driven by the Prime Minister's vision of making India a global drone hub by 2030, the Government has taken major initiatives over the last year to encourage the adoption of drones in the country. The Drone Rules 2021, built on a premise of trust, has brought ease-of-doing business for drone manufacturers, service providers, and pilots. Production Linked Incentive (PLI) scheme for drone and component manufacturing, coupled with the Government's push for *Atmanirbhar Bharat*, has encouraged an indigenous manufacturing base to come up in this strategic sector. These measures have led to a 35 per cent increase in the number of drone startups in the country in the last year itself (Mehta, 2022).

Agriculture has undergone a fourth transformation (Farming 4.0) in recent years as ICT has been integrated into conventional farming practices (Sundmaeker *et al.*, 2016). Unmanned Aerial Vehicles (UAVs) popularly known as Drones, Remote Sensing, Internet of Things (IoT), Machine Learning (ML), Artificial Intelligence (AI), Big Data Analytics (BDA) etc. have the potential to usher a new era in agricultural practices (Walter *et al.*, 2017; Wolfert *et al.*, 2017). Drones are being used in precision agriculture, photogrammetry and remote sensing in developed countries (Everaerts, 2008; Zhang *et al.*, 2012; Colomina and Molina, 2014; Natu and Kulkarni, 2016). India has an opportunity to realize approximately INR 1.8 lakh crore worth of domestic manufacturing potential by 2030 through focused implementation of drone indigenization projects across defence, commercial and homeland security sectors (EY and FICCI, 2022). One of the largest deployments of drones in the country has been initiated as a part of the SVAMITVA scheme in which drones are being used for mapping the land parcels of 6.6 lakh villages across India to create accurate digitized property records. Today, more than 2 lakh villages have already been surveyed using drones, making this a globally unprecedented use of drone technology for rural development. The use of drones in agriculture is also picking up pace. Kisan drones are being used for the effective spraying of pesticides and nutrients over farms, thereby reducing time, improving efficiency, and enhancing safety. Drones with advanced sensors are also being used to digitize farms for crop health analysis, land usage planning, transparent & quick settlement of insurance claims, and many more. It is very fast and it could reduce the work load of a farmer *Mann ki Baat* episodes have brought much needed traction in driving innovations and sustainable practices at KVK as well as farmers' level. Therefore, it has been attempted to explore, how *Mann ki Baat* programme has influenced farmers with respect to their perception, level of motivation, awareness generated, interest created and knowledge gain regarding Agri-drones.

CONCEPTUAL FRAMEWORK

The process of the farmers learning and its sharing with respect to different aspects of Agri drones among the peers can be attributed to various communication theories, which in turn contribute to perception, attitude, and knowledge level of farmers, The combination of the theories is used to demonstrate effect of *Mann ki Baat* program on perception, attitude, and knowledge level of farmers (Figure 1). The diffusion of innovation theory (Rogers, 2010) explains how new ideas, products, or services spread through a social system. Theory of change shows farmers readiness to change in their status in the adoption behaviour. According to the Unified Theory of Acceptance and Use of Technology (UTAUT, 2003), the actual use of technology is determined by behavioural intention. The perceived likelihood of adopting the technology information is dependent on the direct effect of four key constructs, namely performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy refers to the degree to which farmers believe that using Agri drones will help them improve their agricultural practices and increase their productivity. Effort expectancy refers to the ease of using technology and the perceived ease in learning to use it. Social influence refers to the impact of external factors, such as the opinions of family, friends, or other farmers, on a farmer's intention to use the technology. Facilitating conditions refer to the availability of necessary resources, such as access to Agri-drones and data interpretation support system, to use the technology effectively (Venkatesh *et al.*, 2003).

In the context of Agri-drones that was emphasized in *Mann Ki Baat*, social learning can occur through interactions with peers, extension workers, or through
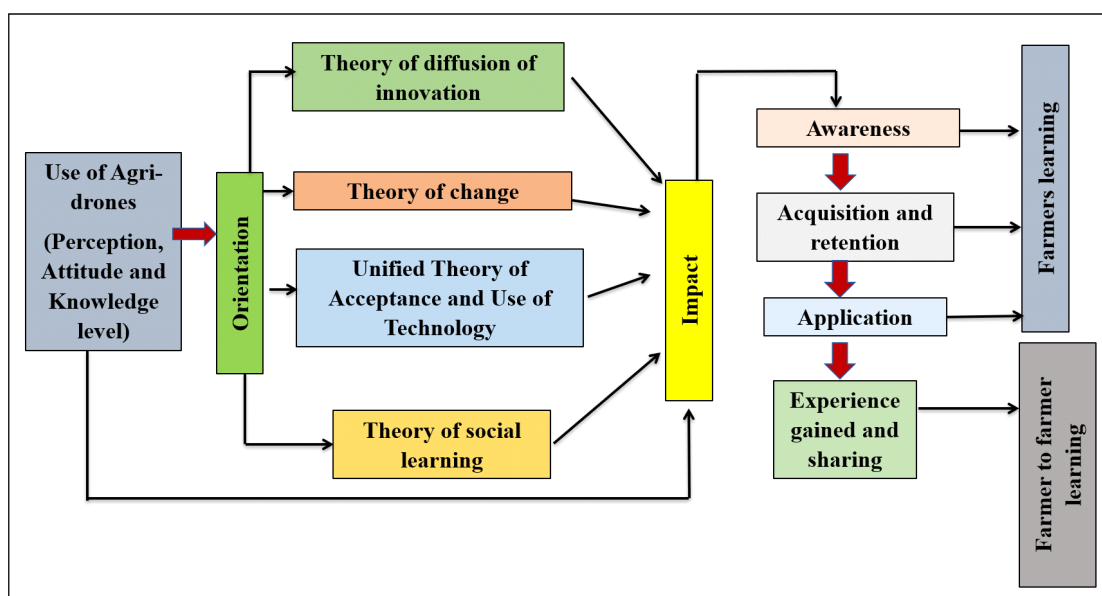
Figure 1: Conceptual framework developed for the study

online platforms (Bandura 1977). By creating opportunities for social learning, service providers can help farmers to develop the skills and knowledge needed to adopt and use these services effectively.

MATERIALS AND METHODS

Data: Primary data were collected by administering a well-structured and pre-tested interview schedule to the key informants (farmers), who listened *Mann Ki Baat* messages. Information were collected on demographic characteristics of the respondent farmers, farm specific characteristics, including ancillary activities; farmers' source of obtaining information on *Mann Ki Baat* initiatives; perception, attitude, and knowledge level of farmers, with respect to different aspects of Agri-drones.

Sampling frame: The study was carried out in 77 districts in India, spanning across selected 29 states/union territories of the country. The study area thus covered all the agro-climatic zones of India, as by specified Planning Commission (1982) and all the geographical regions. The districts for the study were selected based on number of '*Mann Ki Baat*' events organized by respective KVKs of these districts both 'on-campus' and 'off-campus'. A list of the farmers who had participated in the '*Mann Ki Baat*' programmes were prepared. Table 1 shows the detail sampling plan covering 77 KVKs, selected randomly, representing all

ATARIs; a minimum of 30 farmers were selected randomly from each of the district to make the final sampling size of 2310 farmers. As the sample included farmers from KVKs from all ATARI zones, all states were represented in the sample. Given the above sampling plan and availability of farmers during the survey period and after data cleaning and smoothing, the final data set comprised information for 1398 farmers.

Analytical framework: Data were gathered in person using pre-tested questionnaire and voice/video recording of the *Mann Ki Baat* program (in case the sampled respondents has not participated in *Mann Ki Baat* program earlier). Out of total data of 2310 farmers, data pertinent to 1398 farmers was found fit for statistical analysis. Descriptive statistics, in the form of means and proportions, were used to analyze farmers demographic features, their perceptions regarding Agri-drones. The perceptions of farmers with respect to usefulness of drones, opinion on Agri-drones, conviction, trickledown effect on Agri-drones and response of family members/fellow farmers along with the extent of shift of farmers for adopting Agri-drones were captured through series of closed ended questions with three choices (*Yes, No* and *Do not know*). The attitude of farmers towards Agri-drones was measured with five-point rating of narrative statements based on Agri-drone usage, application,

Table 1: Distribution of respondents from selected KVKs of ATARIs

Krishi Vigyan Kendras	No. of KVKs	No. of KVKs selected for data collection	No. of farmers selected
ATARI, Zone I, Ludhiana–72 KVKs			
Himachal Pradesh	13	2	300
Jammu and Kashmir	20	2	
Ladakh (UT)	04	1	
Punjab	22	3	
Uttarakhand	13	2	
ATARI, Zone II, Jodhpur–66 KVKs			
Delhi	01	1	210
Haryana	18	2	
Rajasthan	47	4	
ATARI, Zone III, Kanpur–89 KVKs			
Uttar Pradesh	89	4	120
ATARI, Zone IV, Patna–68 KVKs			
Bihar	44	4	210
Jharkhand	24	3	
ATARI, Zone V, Kolkata–59 KVKs			
A & N Islands	03	1	210
Odisha	33	3	
West Bengal	23	3	
ATARI, Zone VI, Guwahati–47 KVKs			
Assam	26	3	180
Arunachal Pradesh	17	2	
Sikkim	04	1	
ATARI, Zone VII, Barapani–43 KVKs			
Manipur	09	1	180
Meghalaya	07	1	
Mizoram	08	1	
Nagaland	11	2	
Tripura	08	1	
ATARI, Zone VIII, Pune–82 KVKs			
Maharashtra	50	4	240
Gujarat	30	3	
Goa	02	1	
ATARI, Zone IX, Jabalpur–82 KVKs			
Chhattisgarh	28	3	210
Madhya Pradesh	54	4	
ATARI, Zone X, Hyderabad–75 KVKs			
Tamil Nadu	32	3	270
Puducherry	03	1	
Andhra Pradesh	24	3	
Telangana	16	2	
ATARI, Zone XI, Bengaluru–48 KVKs			
Karnataka	33	3	180
Kerala	14	2	
Lakshadweep	01	1	
Total	731	77	2310

benefits and risk involved. All statements were measured on five-point rating scale with positive statements as (strongly agree=5, agree=4, undecided=3, disagree=2 and strongly disagree=1). The weighted mean score of every statement was calculated to finally rank the statements and draw inferences. A knowledge test was also executed to check the knowledge level of respondents towards Agri-drones. The questions were based on diverse aspects of Agri-drones, viz. use of Agri-drones for pesticide/insecticide spray on farms, their usage in precision agriculture, safety measures for farmers, time involvement in drone led spraying, ability of drones to monitor crop growth, several Agri-drone startups, New Drone Policy, 2021 and Government support and schemes. The respondents, then categorised on low, medium, and high categories of knowledge based on mean and standard deviation, to draw inferences. Lastly, relationship of socio-economic characteristics of farmers with their knowledge level was revealed based on Pearson correlation and regression analysis.

RESULTS AND DISCUSSION

Demographic and socio-economic characteristics of farmers: It is evident from Table 2 that majority of the farmers (94.10%) were of middle age group (24 to 67 years). With respect to gender, majority of the farmers (91.50%) were males. In terms of economic status, majority of the farmers (71.80%) were above poverty line (APL). Regarding education level, majority of the farmers (41.70%) were educated up to High school; however, 28.23% of farmers had Degree/Diploma followed intermediate level of education (23.24%). It was found that majority of the farmers (72.70%) were marginal (<2.5 acres of land) followed by small farmers (2.51-5 acres of land). Most of the farmers (40.99%) have annual income of Rs.1.0 to 2.0 Lakh, followed by 39.20 per cent of farmers having annual income of more than Rs.2.0 Lakh. Overall, the data indicates that majority of the farmers were males of middle age group, who were marginal farmers.

Farmers Participation in Mann ki Baat Program: It is evident from Figure 2 that farmers got information about *Mann Ki Baat* program from multiple sources simultaneously. On analysis of data, it was revealed that KVKs were the prime source of information

Table 2: Demographic and socio-economic characteristics of farmers (n=1398)

Characteristics	Frequency	Percentage
Age		
Young (< 24 years)	35	2.5
Middle aged (24 to 67 years)	1316	94.1
Older (> 67.7 years)	47	3.4
Gender		
Male	1279	91.5
Female	119	8.5
Economic Status		
Above Poverty Line	1004	71.8
Below Poverty Line	394	28.2
Education level		
Non-formal Education	19	1.43
High school or less	658	47.1
Intermediate	324	23.24
Degree/Diploma	397	28.23
Total land (hectare)		
Land less	3	0.2
Marginal (<2.5 acres)	1016	72.7
Small (2.51-5 acres)	247	17.7
Medium (5.01-10 acres)	85	6.1
Big farmers (>10 acres)	47	3.4
Annual income (Lakhs)		
< Rs. 1.0 Lakh	277	19.81
Rs.1.0 to 2.0 Lakh	573	40.99
> Rs.2.0 Lakh	548	39.20

(87.14%) followed by peer communication of farmer to farmer (51.57%), FPOs (18.02%), State Departments (16.73%) and ATMA (10.94%). Gram panchayats, SAUs, input dealers, NGOs and SHGs also played role in creating awareness about *Mann Ki Baat* program. Analysis of extent of participation indicated that majority of the farmers (94.63%) actively participated (listened) *Mann Ki Baat* program with varied place of participation. Out of total farmers who participated in the program, 51 per cent of farmers participated from respective KVKs followed by 49 per cent of farmers, who participated from their respective homes.

Farmers perception towards agri drones after listening Mann ki Baat program: As majority of the farmers actively participated (listen) *Mann Ki Baat* program it is pertinent to know their perception regarding content of *Mann Ki Baat* program with special reference to Agri-drones. Perception of farmers was captured under three heads: usefulness of drones, opinions (price, availability, ease of understanding and usefulness), conviction level, trickle down of information, family members/fellow farmers response and extent of shift (Figure 3&4).

Attitude towards usefulness of drones: It is evident from Figure 5 that majority of farmers (97.60%) perceived the drones are overall useful for agricultural operations. Perception of farmers with respect to Agri-drones was also measured using Weighted Mean Score
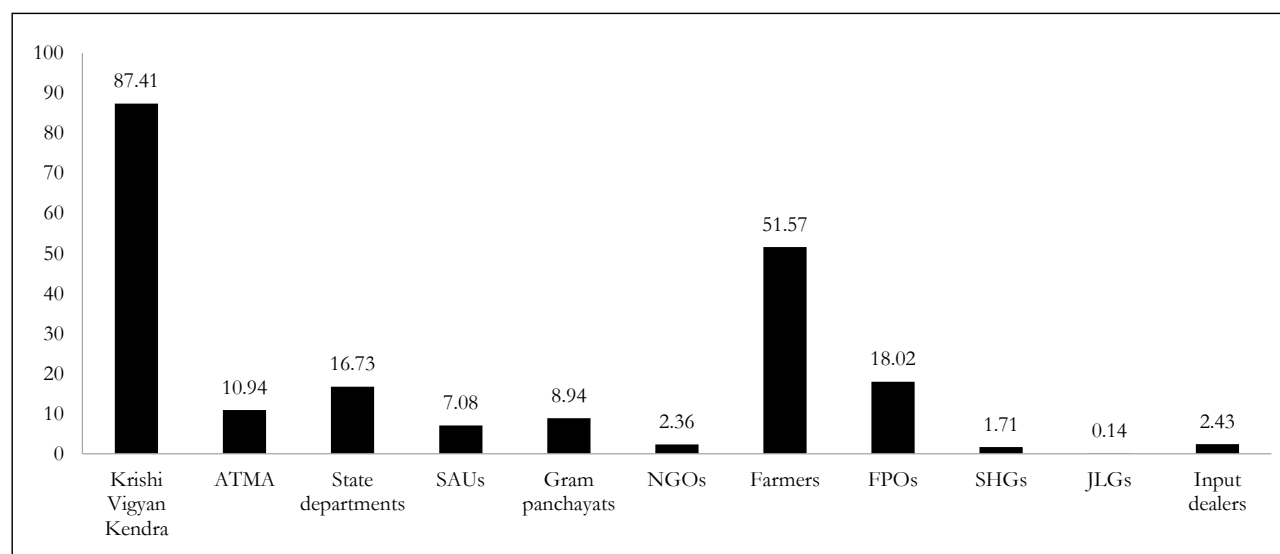

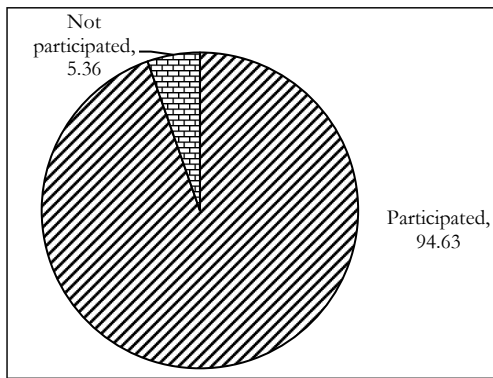**Figure 2: Farmers categorization based on Sources of information about *Mann Ki Baat***

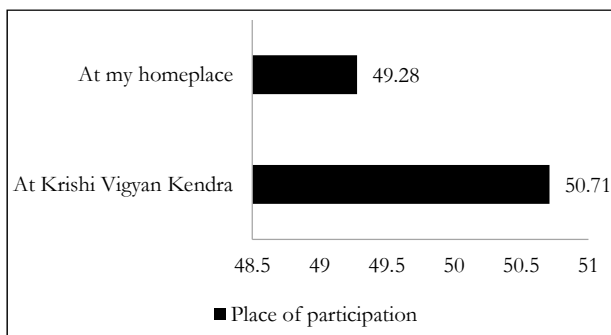**Figure 3: Farmers categorization-based participated and not participated**

Figure 4: Farmers categorization based on place of on participation
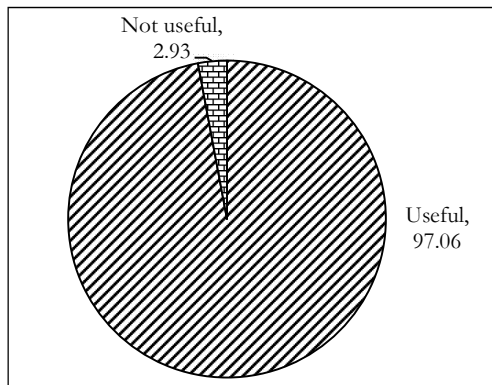

Figure 5: Farmers categorization based on Attitude towards usefulness of drones

(WMS) and it was revealed (Table 3) that farmers gave first rank to the fact that drones are highly beneficial technology for increasing input efficiency, followed by its immense use in monitoring of crop and cattle, highly effective in assessment of crop losses, ability to reduce the cost of pesticides use and promotion of drone creating the jobs for youth in villages. The negative statements with respect to Agri-drones were ranked lower by the farmers viz., the fact that drones will be difficult for farmers to handle was ranked sixth followed by the statement drones are not affordable for small farmer and use of drone is risky, with rank seventh and eighth, respectively. Overall farmers perceived that drones are highly beneficial technology in agriculture.

Opinion on Agri-drones: It is evident from Figure 6(a-d) that majority of farmers (71.31%) believes that the price of drone is very high, which are generally not affordable by farmers.

Conviction and trickle down on agri drones: It is evident from Figure 7 that majority of the farmers (92.56%) are convinced about the overall usefulness of Agri-Drones in precision farming after listening to *Mann Ki Baat*. In addition to this majority of farmers (74.35%) share information learnt from the episodes with others farmers also (Figure 8).

Response of family members/fellow farmers and extent of shift: It is evident from Figure 9 that majority of farmers (70.95%) got positive response from family members/ fellow farmers towards Agri-Drone Technology. However, a significant proportion of farmers (23.60%) got positive response from family members/fellow farmers towards Agri-Drone Technology. Figure 10 reveals that 28.68 per cent of

Table 3: Perception of students based on Weighted Mean Score (WMS) with respect to Agri drones (n=1398)

| S.No.	Attributes	WMS	Rank
1.	It is highly beneficial technology for increasing input efficiency	4.37	I
2.	It is of immense use in monitoring of crop and cattle	3.99	II
3.	It is highly effective in assessment of crop losses	3.31	III
4.	It will reduce the cost on pesticides	3.27	IV
5.	Promotion of drone will lead to creation of jobs for youth in villages	3.24	V
6.	It will be difficult for farmers to handle drone	2.19	VI
7.	It is not affordable for small farmers	1.73	VII
8.	Use of drone is risky	1.20	VIII
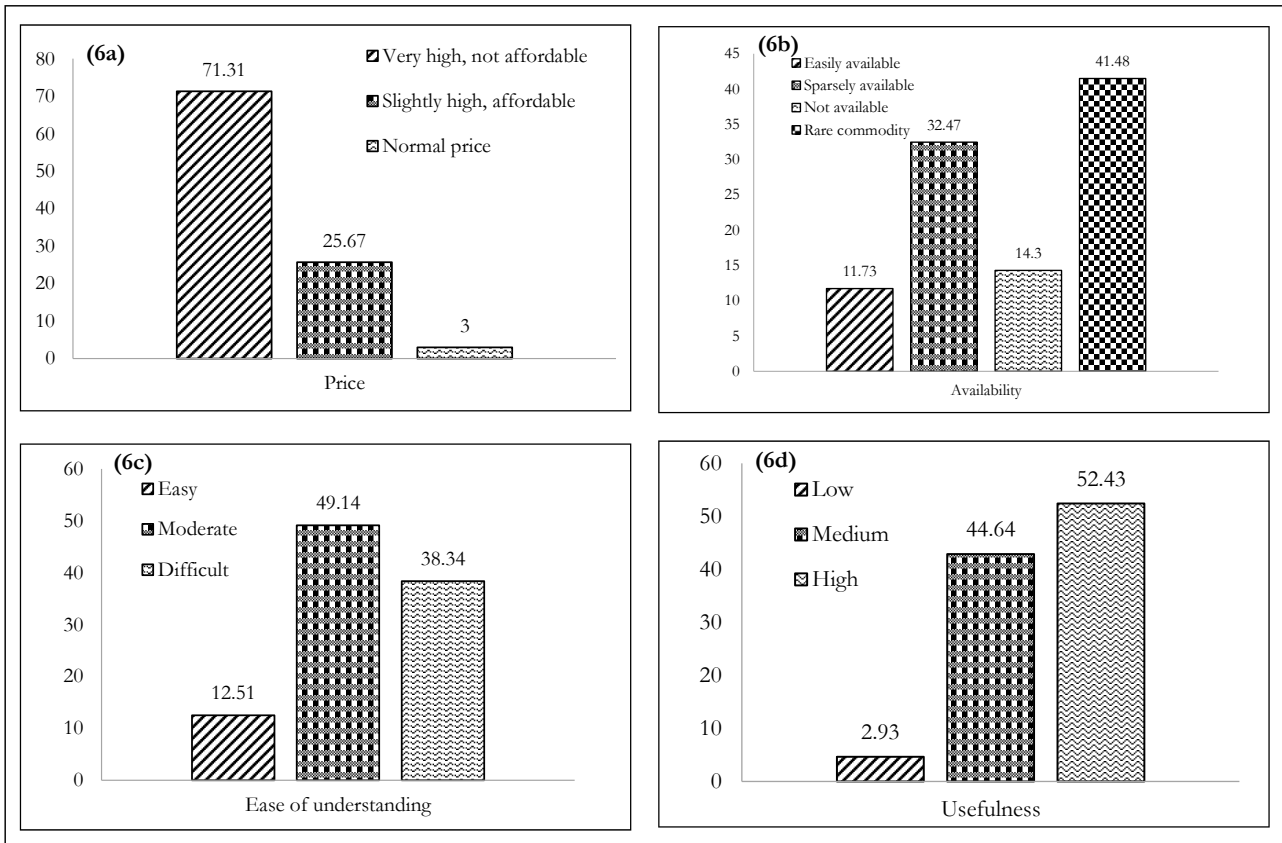
Figure 6a: Farmers categorization-based on Opinions with respect to Agri-Drones; Figure 6 (b) indicates that most of the farmers (41.48%) believes that drones are rare commodity followed by 32.47% of farmers who believes that drones are sparsely available; Figure 6 (c) indicates that most of the farmers (49.14%) believes that ease of understanding the drone's technology is moderate followed by 38.34% of farmers, who believe that drones technology is difficult to understand. It is pertinent to note from Figure 6 (d) which shows majority of farmers (97.60%) perceived that drones are overall useful for agricultural operations.
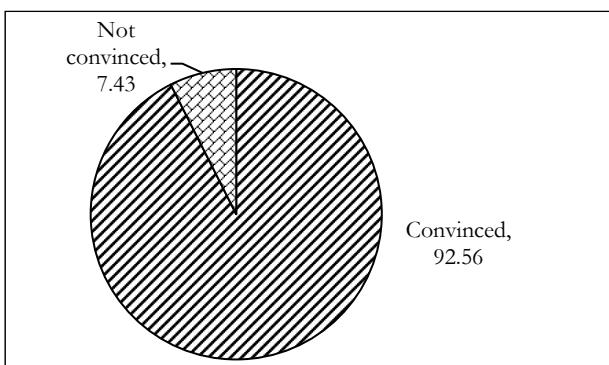
Figure 7: Farmers categorization-based on Conviction on Trickle down
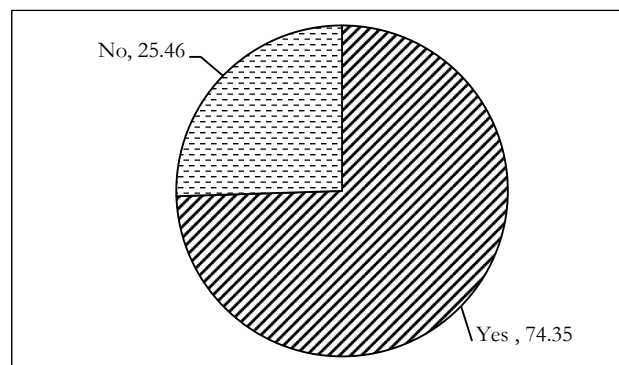

Figure 8: Farmers categorization based on Conviction on Trickle down

farmers showed more than fifty percent chance to adopt Agri-Drones for their farms if opportunity is provided, after listening to *Mann Ki Baat*, followed by 32.26 per cent of farmers who showed 26-50 per cent chance to adopt Agri-Drones for their farms if

opportunity is provided. A significant proportion of farmers (31.04%) showed less than 25 per cent chance to adopt Agri-Drones for their farms if opportunity is provided; however, only 8.01% farmers showed no interest to adopt Agri-Drones for their farms.
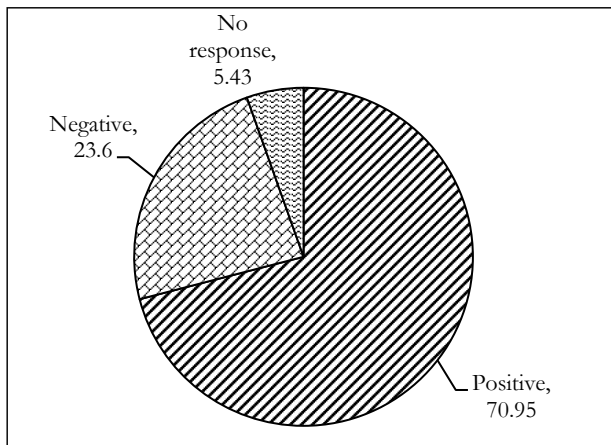
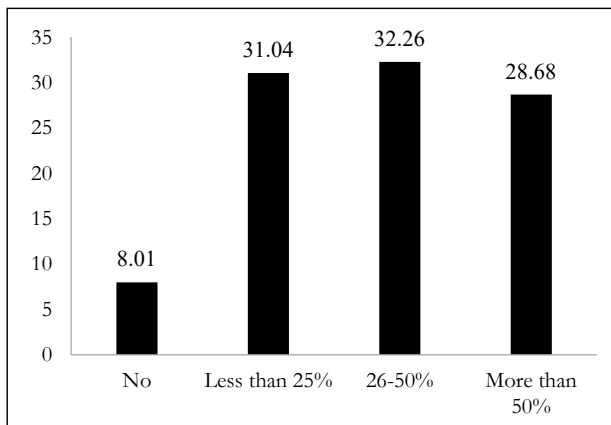**Figure 9: Farmers categorization based on Response of family members/fellow farmers**

Figure 10: Farmers categorization based on Extent of shift

Farmers' gain in knowledge level with respect to Agri-Drones after listening Mann ki Baat Program: A knowledge test was executed to check the knowledge level of respondents towards Agri-Drones. The questions were based on diverse aspects of Agri-Drones, viz. use of Agri-Drones for pesticide/insecticide spray on farms, their usage in precision

Table 4: Farmers categorization based on Knowledge level

Knowledge level	Percentage
Low	9.6
Medium	52.4
High	38.1

agriculture, safety measures for farmers, time involvement in drone led spraying, ability of drones to monitor crop growth, several Agri-Drone startups, and New Drone Policy, 2021. When we categorised the knowledge of farmers on low, medium, and high categories (Table 4) based on mean and standard deviation, we found that majority of farmers (52.40%) had medium level of knowledge, followed by high level of knowledge (38.10%). Overall, it can be concluded that 90.50% of farmers have medium to high level of knowledge, which clearly indicates that *Mann ki Baat* program has influenced and enriched farmers with respect to the knowledge related to Agri-Drones.

In addition to the knowledge level of respondents towards usage of Agri-drones, knowledge of respondents with respect to Government support and schemes was also tested. Table 5 indicates that majority of farmers (59.44%) were aware about the financial assistance (40% up to a maximum of Rs. 4.00 lakhs) being provided by government for purchase of drones by Custom Hiring Centers under Cooperative Society of Farmers, FPOs/ and Rural entrepreneurs. It is also evident from Table 5 that majority of farmers (57.08%) were aware about the fact that Agriculture graduates who are establishing Custom Hiring Centers are eligible to receive financial assistance @ 50% of the cost of drone up to a maximum of Rs.5.00 lakhs per drone.

Table 5: Farmers categorization based on Government support

Government support	Yes		No	
Statements	Freq.	%	Freq.	%
Do you know that in order to make available drone services to farmers on rental basis, financial assistance @ 40% up to a maximum of Rs. 4.00 lakhs are provided for purchase of drones by Custom Hiring Centers under Cooperative Society of Farmers, FPOs/ and Rural entrepreneurs.	831	59.44	567	40.55
Agriculture graduates establishing Custom Hiring Centers are eligible to receive financial assistance @ 50% of the cost of drone up to a maximum of Rs.5.00 lakhs per drone.	798	57.08	600	42.91
If Yes, are you willing to take benefit of this service?	955	68.31	443	31.69

Table 6: Correlation between socio-economic characteristics of farmers with Knowledge level

Independent variables	Pearson correlation	Sig. (2-tailed)
Gender	0.142**	.000
Age	0.056*	.037
Category	0.023	.387
Economic status	0.201**	.000
Education	0.162**	.000
Family size	0.054*	.045
Total land holding	0.124**	.000
Annual income	0.094**	.000
Place of contact	0.198**	.000
Source of information	0.180**	.000
Mass media	0.232**	.000
Attitude	0.234**	.000

Overall, majority of farmers (68.01%) are willing to take benefit of these supports being provided by Government.

Relationship of socio-economic characteristics of farmers with knowledge level: It is evident from Table 6 that p value for the variables gender, economic status, education, total land holding, annual income, place of contact, source of information, mass media exposure and attitude has a significant positive relationship with knowledge level at 1% level of significance (p<0.01). Table 6 also indicates that the variables like age and family size also have a significant positive relationship with knowledge level at 5% level of significance (p<0.05). Overall, all socio-economic characteristics of farmers have significant positive relationship with knowledge level except one variable that is category.

CONCLUSION

Drones have shown potential to transform Indian agriculture into smart agriculture. With the further advancement of information communication technologies (ICTs) in the future, the production and usage of drones is expected to become economical and easier, respectively. Evidences suggest that the modern Indian youth are not attracted towards agriculture due to hard work, drudgery and uncertainty involved in it. Introducing Agri-drones can encourage the youth towards agriculture since drones provide real

time and high-quality data with respect to aerial imagery of agricultural areas, localizing weeds and diseases, determining soil properties, detecting vegetation differences and the production of an accurate elevation models. This study has tried to explore the perception of farming community towards Hon'ble Prime Minister's program on *Mann Ki Baat* with special reference to Agri-drones. Farmers' perception was captured with respect to usefulness of drones, opinion on Agri-drones, conviction, trickledown effect on Agri-drones and response of family members/fellow farmers along with the extent of shift of farmers for adopting Agri-drones. In addition to this, the present study has explored the demographic and socio-economic characteristics of farmers along with the level of participation of farmers in *Mann Ki Baat* Program. Gain in knowledge of farmers on Agri-drones after listening the *Mann ki Baat* program was assessed and contextualized with their socio-economic attributes.

In conclusion, it is pertinent to note that majority of farmers have perceived that drones are overall useful for agricultural operations; however, farmers have ranked and believed that this technology is difficult in understanding (moderate scale). Also, a significant proportion of farmers has showed chance (<25%) to adopt the Agri-Drones for their farms if opportunity is provided. Policy makers and researchers may consider in organizing capacity building (awareness, training and demonstrations) programmes to enhance ease of understanding the Drone technology. In addition, policy makers and researchers may establish coherence in their planning and programmes so that, majority of farmers can move up from medium level of knowledge to high level of knowledge with respect to applying the usage of Agri drones. Additionally, concerted efforts on awareness program is need of the hour to purse and motivate the farmers for adopting Agri-drone with integral support from and access to institutional resources (policy, and finances. Such measures may considerably help in mobilizing farming community to achieve India's vision of becoming a Drone hub by 2030.

Informed consent statement: Respondents gave their informed consent for inclusion before they

participated in the study. Informed consent was obtained from respondents for information published in this article.

Data availability statement: The data that support the findings of this study are available on request from the author, upon reasonable request.

Conflicts of interest: The authors declare no conflict of interest.

Ethical statement: In this study data has been taken from the *Mann Ki Baat* participating farmers on the basis of informed consent.

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