

International Journal of Agriculture Extension and Social Development

Volume 7; Issue 1; Jan 2024; Page No. 252-257

Received: 10-11-2023
Accepted: 20-12-2023

Indexed Journal
Peer Reviewed Journal

Exploring awareness and utilization of agricultural mobile apps among smallholder farmers

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DOI: <https://doi.org/10.33545/26180723.2024.v7.i1d.217>

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Abstract

Low productivity is caused by a number of factors, including high labor costs, unpredictable crop production, and a lack of knowledge about new technologies usage, and methods. The agriculture industry had undergone a change because of agri apps made to help farmers by providing weather data, crop market trends, pest and disease damage identification, guidance on pesticide and fertilizer use, familiarity with the different government initiatives to make better decisions on the management of agricultural fields, ongoing scientific changes in production systems, and taking advantage of market opportunities. A study was conducted to find out the awareness and utilization of agri apps for crop production among farmers in the Hisar district of Haryana state. From the Hisar district, 4 villages, and from each village 30 farmers were selected, randomly. The study revealed that only 30.51 percent of farmers of Hisar district were found aware about the usage of mobile apps while only 16.30 percent actually utilized mobile apps for agriculture purposes, which was found quite low and among which WhatsApp and e-Mausam were used by the majority of farmers. As a result, there are agri apps that have the potential to be utilized in farming and related tasks, but their utilization is currently limited. Agri apps and refined technologies should be developed as user-friendly as feasible in order to maintain farmers' intent to utilize an app eagerly, and promotional techniques should be tailored to target certain qualities of intended users for healthy and remarkable production.

Keywords: Awareness, utilization, mobile apps, smart farming, technology

Introduction

The backbone of the Indian economy is agriculture. Most of the farmers are small-scale, low-tech, and low-productive subsistence farmers. Low productivity is caused by a number of factors, including high labor costs, unpredictable crop production, and a lack of knowledge about new technologies usage, and methods. These difficulties were made more severe because these smallholder farmers could not afford the costs associated with utilizing contemporary farming methods and technology. The potential of agricultural mobile apps as a tool for different decision-making processes is still not completely realized (Sivakumar *et al.*, 2022) ^[14]. However, using mobile applications in agriculture can assist smallholders in accessing financial services, improving their market access, and enhancing their visibility to improve supply chain efficiency (Okoroji *et al.*, 2021) ^[10]. Recently, with the provision of updated information to farmers, digital tools have demonstrated their ability to completely revolutionize the agriculture production system and commercialization in developing nations (Raman *et al.*, 2021) ^[12]. Because smartphones are so accessible, agricultural smartphone apps can be considered a subset of smart farming technologies for agricultural production and are simple to incorporate into

farmers' regular work routines. Unlike other improved technologies, smartphones and their associated apps do not call for huge investments. This makes it possible to process and use farm- and site-specific data for agricultural output. It also helps farmers use fewer inputs, which has a positive influence on the environment (Michels *et al.*, 2020) ^[9]. Regionally appropriate digital tools including information on soil, climate, nutrient management, and input price could be quite useful in a country like India where there is linguistic diversity in the farming community and because young farmers are extremely reliant on their smartphones, agri-information can be rapidly accessed through digital applications (Raman *et al.*, 2021) ^[12]. Because of mobile apps' easy accessibility, widespread ownership, voice communication, and quick and convenient service delivery, the number of mobile apps is increasing around the world. Planning, input planning, management, access and adoption, and marketing are the five main ways that digital solutions can increase farm profitability. In this manner, the use of digital tools can lower crop loss, lower various hazards, raise yields, improve the cost-effectiveness of production, establish safety nets, expand storage, prevent rotting, and increase income. Farmers must, however, be able to participate in the technology development approach because

then Smart Farming tools, like mobile apps, can be developed and modified to fit the demands of the end-user (Kenny and Regan, 2021) [4]. The Indian government has released a number of free smartphone applications to convey agricultural information to farmers and other stakeholders. Thus, the agriculture industry had undergone a change because of agri apps made to help farmers by providing weather data, crop market trends, pest and disease damage identification, guidance on pesticide and fertilizer use, familiarity with the different government initiatives to make better decisions on the management of agricultural fields, ongoing scientific changes in production systems, and taking advantage of market opportunities. As a decision-making tool for farm activities, smartphone applications are being used by various stakeholders in agriculture (Pongnumkul *et al.*, 2015) [11]. However, some barriers prevent mobile apps from being widely used in agricultural and related industries. As smartphone technology becomes more widespread in agriculture, it is important to analyze how farmers have responded to this type of technology. Thus, the current study was done to determine the level of farmers' awareness and utilization of Agri apps for crop production.

Materials and Methods

The present study was conducted in the Hisar district of Haryana state. A total of 4 villages were chosen using a random sampling technique *viz.*, Mangali, Harita, Dhiranwas, and Balsamand of Hisar district. To collect the data 30 farmers from each selected village were also selected randomly. As a result, 120 farmers were chosen as responders in the current study. The farmers' socio-personal (age, education, caste, land holding), socio-economic (method of irrigation, irrigation sources, farming system, crop rotation followed, farm machinery), and communicational characteristics (extension contact, mass media exposure), Kisan Credit Card (KCC), Soil Health Card (SHC), agri mobile apps being used by the farmers as well as their overall awareness and utilization pattern of mobile apps for crop production, were considered. The awareness level of farmers about Agri mobile apps for crop production was measured on a 2-point continuum *viz.*, 'Aware'- '1' and 'Not aware'- '0'. Similarly, their level of utilization ('Used'- '1' and 'Not used'- '0') was also measured. A purposefully created interview schedule that had been pretested before being given to the sampled respondents was used to gather data from the respondents who had been selected for the sample. Appropriate statistical measures were used, *i.e.*, mean, frequency, percentage, and rank order, to draw meaningful inferences.

Results and Discussion

Profile of selected respondents

A descriptive analysis of the sampled respondents' socio-personal, socio-economic, and communicational characteristics was conducted. The majority of respondents (43.33%) belong to the young age group (upto 37 years) and had educational qualifications up to matriculation (35.00%).

According to the present study, the majority (63.33%) of respondents belong to the general caste, and a large number (45.17%) of respondents belong to the small farmer category (> 2.5 to 5 acres) on the basis of land holdings. The majority (70.83%) of respondents had a canal as a source of irrigation, applies surface irrigation (87.50%), were doing livestock practices in their farming system (79.17%), has adopted cotton-wheat crop rotation (70.83%), and 43.33 percent of respondents possessed tractor at their farm. In the case of communicational characteristics, the most popular were the progressive farmers with a weighted mean score of 2.78 among the extension contact of the farmers, social media ranked first with a mean score of 2.42 among the mass media exposure. The data regarding Kisan Credit Card (KCC) revealed that cent percent of respondents were aware of KCC and that the majority (79.17%) had availed of the KCC facility and only 39.17 percent had knowledge regarding the credit limit of KCC. The data regarding Soil Health Card (SHC) revealed that 68.33 percent of respondents possessed Soil Health Card (SHC) and were aware that SHC helps to indicate soil health (61.67%) and only 43.33 percent of respondents were aware of SHC tenure. The data pertaining to agricultural mobile applications used by the farmers revealed that the majority (72.50%) of respondents used WhatsApp for crop production followed by the e-Mausam app (40.00%). Among other existing agri mobile applications, IFFCO Kisan app (23.33%), RML-farmer Mittr (13.33%), agri app (10.00%), Kisan suvidha (05.00%) and crop insurance (04.17%) and only 03.33 percent respondents had used the Pusa Krishi and Kheta Badi apps for the agricultural purpose.

Farmers' awareness about agri mobile apps for crop production

Awareness is a crucial decision-making tool for making farming more profitable and sustainable. Table 1 shows the extent of awareness about agri mobile apps for crop production.

The majority 72.50 percent of sampled respondents were aware about mobile apps and more than half *i.e.*, 51.67 percent of the respondents had an awareness that Mobile apps improve the social relationship among farmers. It is evident that farmers were aware of the fact that doing so enables them to receive feedback from other farmers and agricultural stakeholders in various fields and engages them in positive relationships with all stakeholders. Among the sampled respondents, 46.67 percent of them were aware that mobile apps affect the social behaviour of farmers, and 45.00 percent were aware that Agril. information can be assessed quickly and accurately through mobile apps. As a result, they are aware of how to acquire information like current weather conditions, temperature, precipitation, sunlight duration, and other factors that directly influence agricultural decision-making, also huge amounts of information can be quickly and easily retrieved by category without wasting time.

Table 1: Awareness of farmers about agri mobile apps for crop production (n=120)

S. No	Statements on awareness about the use of mobile apps	Awareness Level			
		Aware		Not aware	
		F	%	F	%
1.	Awareness of any mobile app	87	72.50	33	27.50
2.	Mobile apps help in increasing the knowledge of farmers regarding crop production	52	43.33	68	56.67
3.	Awareness regarding Govt. recognized mobile apps	44	36.67	76	63.33
4.	Agril. Information can be assessed at any time free of cost	40	33.33	80	66.67
5.	Agril. information can be assessed quickly and accurately	54	45.00	66	55.00
6.	Provides agricultural information even in remote areas	43	35.83	77	64.17
7.	Mobile apps help in adopting appropriate cropping patterns/crop rotation	26	21.67	94	78.33
8.	Mobile apps help in crop selection	24	20.00	96	80.00
9.	Provides information about weather forecasting	52	43.33	68	56.67
10.	Provides information about seed treatment	41	34.17	79	65.83
11.	Helps in better seasonal crop management	32	26.67	88	73.33
12.	Provides information about the optimum seed rate of different varieties/crops	26	21.67	94	78.33
13.	Provides information regarding weed infestation and management	24	20.00	96	80.00
14.	Helps in the scheduling of irrigation for different crops	49	40.83	71	59.17
15.	Helps in effective planning of plant protection measures	35	29.17	85	70.83
16.	Helps in different intercultural operations	29	24.17	91	75.83
17.	Provides information about soil health	46	38.33	74	61.67
18.	Provides information about nursery establishment	22	18.33	98	81.67
19.	Provides information about the suitable method of crop harvesting	18	15.00	102	85.00
20.	Provides information about best crop produce storage practices	24	20.00	96	80.00
21.	Provides information about the current market price of crop produce	36	30.00	84	70.00
22.	Provides facility for online buying of inputs	15	12.50	105	87.50
23.	Mobile apps affect the social behavior of farmers	56	46.67	64	53.33
24.	Mobile apps improve the social relationship among farmers	62	51.67	58	48.33
25.	Provides information about the packaging of crop produce	16	13.33	104	86.67
26.	Provides information about protected cultivation	23	19.17	97	80.83
27.	Provides information about PMFBY	26	21.67	94	78.33
28.	Provides information about Soil Health Card	16	13.33	104	86.67
29.	Provides information about Kisan credit card	44	36.67	76	63.33
Mean Awareness Score = 8.85					
Overall Awareness = 30.51%					

Similarly, 43.33 percent were also aware that Mobile apps help in increasing the knowledge of farmers regarding crop production and provides information about weather forecasting and 40.83 percent of them were aware that it helps in scheduling irrigation for different crops, 38.33 percent were aware that it provides information about soil health and 36.67 percent were aware that it helps regarding Kisan credit card, 35.83 percent were aware that it provides agricultural information even in remote areas, 34.17 percent were aware about it provides information about seed treatment, and 33.33 percent of them aware about Agril. Information can be assessed at any time free of cost through mobile apps. It is obvious that they were aware of its potential applications, including sensor-based farming, managing irrigation systems in expansive fields, and identifying various soil types by collecting data, analyzing it, and making appropriate recommendations for various farm practices, which helps efficient farm management and is used for distributing inputs and other services the government provides to farmers, such as subsidies. However, 87.50, 86.67, 85.00, 81.67, 80.83, 80.00, 78.33, 75.83, 73.33, 70.83, 70.00 percent of the respondents were not aware that the mobile app’s facility for online buying of inputs, providing information about Soil Health Cards, packaging of crop production, a suitable method of crop harvesting, nursery establishment, protected cultivation, weed infestation and management, crop selection, and crop

produce storage practices, helps in adopting appropriate cropping pattern/crop rotation, provides information about optimum seed rate of different varieties/crops, Provides information about PMFBY, helps in different intercultural operations, helps in better seasonal crop management, helps in effective planning of plant protection measures, provides information about the current market price of crop produce respectively. Respondents’ overall awareness regarding mobile apps was found 30.51 percent. As depicted in Table 1, the awareness level is found to be better in the case of agri mobile apps for crop production at various levels, viz., awareness about mobile apps (72.50%), improves the social relationship among farmers (51.67%), affects the social behaviour of farmers (46.67%) and Agril. information can be assessed quickly and accurately (45.00%), increase the knowledge of farmers regarding crop production (43.33%) and provide information about weather forecasting (43.33%), and helps in scheduling irrigation for different crops (40.83%). The overall awareness level is found to be relatively lower in the case of agri mobile apps facility for online buying of inputs (12.50%), providing information about Soil Health Cards (13.33%), packaging of crop production (13.33%), a suitable method of crop harvesting (15.00%), nursery establishment (18.33%), protected cultivation (19.17%), weed infestation and management (20.00%).

Farmers’ utilization pattern of mobile apps for crop production

The pattern of utilization of the sampled farmers was measured with the help of an interview schedule. The extent of the utilization of agri-mobile apps for crop production is presented in Table 2.

The data regarding the utilization pattern of mobile apps for gaining information about crop production revealed that only 35.00 percent of respondents were found to utilize the mobile app for gaining information about irrigation management and the rest of the respondents not utilized it, only 30.00 percent utilized it by getting information about pest and disease management, and 26.67 percent of the sampled respondents utilized for gaining information about seed treatment and new technologies in agriculture. The

explanation could be that farmers were most eager to learn about crop protection strategies, high-quality inputs, and growing techniques. Whereas only 25.00 percent was utilized for weed management, 20.00 percent was utilized for the selection of variety and for accessing the package of practices. On the other hand, only less than 20 percent of the sampled respondents utilized the agri mobile apps for gaining information about nutrient management, soil and water testing, claiming insurance under PMFBY, field preparation, cropping pattern, sowing or transplanting, harvesting and storage as 19.17, 17.50, 15.83, 10.83, 10.00, and 06.67 percent respectively. The most likely explanation is that most farmers have a great deal of farming experience, so they are familiar with crop rotation from their forefathers as well as from personal observation.

Table 2: Utilization pattern of mobile apps by the farmers (n=120)

S. No	Statements on utilization pattern mobile apps	Utilization level			
		Used		Not Used	
		F	%	F	%
A. Utilization pattern of mobile apps for gaining information about crop production					
1.	Information about the suitable cropping pattern	12	10.00	108	90.00
2.	Information about field preparation	13	10.83	107	89.17
3.	Information about the selection of a variety	24	20.00	96	80.00
4.	Information about seed treatment	32	26.67	88	73.33
5.	Information about Sowing/transplanting	12	10.00	108	90.00
6.	Information about weed management	30	25.00	90	75.00
7.	Information about nutrient management	23	19.17	97	80.83
8.	Information about irrigation management	42	35.00	78	65.00
9.	Information about Pest and disease management	36	30.00	84	70.00
10.	Information about Soil & water testing	21	17.50	99	82.50
11.	Information about harvesting & storage	08	06.67	112	93.33
12.	Accessing package of practices	24	20.00	96	80.00
13.	Information about new technologies in agriculture	32	26.67	88	73.33
14.	Information about claiming insurance under PMFBY	19	15.83	101	84.17
B. Utilization pattern of mobile apps for getting information about marketing					
15.	Information about sources of inputs	18	15.00	102	85.00
16.	Calculating the insurance premium for the notified crop	00	0.00	120	100.00
17.	Getting information about Bhavanter Bharpai Yojna (BBY)	21	17.50	99	82.50
18.	Govt. subsidies related information	32	26.67	88	73.33
19.	Information about market location for selling crop produce	00	0.00	120	100.00
20.	Information about current price and Minimum Support Price	43	35.83	77	64.17
C. Utilization pattern of mobile apps to contact					
21.	Scientists of university/research institutions/ICAR	35	29.17	85	70.83
22.	SMS of KVKs for gaining information	00	0.00	120	100.00
23.	Officers under ATMA for gaining information	00	0.00	120	100.00
24.	Progressive farmers	12	10.00	108	90.00
25.	Contacts with farmer portal	00	0.00	120	100.00
Mean Utilization Score = 04.08					
Overall Utilization = 16.30%					

With respect to the utilization pattern of mobile apps for gaining information about marketing, only 35.83 percent of respondents utilize the app to some extent for getting information about current prices and Minimum Support Prices, 26.67 percent of them utilized it for Govt. subsidies-related information, only 17.50 percent of the respondents utilized it for getting information about Bhavanter Bharpai

Yojna and 15.00 percent were utilized for sources of inputs. It is to be noted that, none of the respondents used the agri mobile apps for calculating the insurance premium for notified crops and also for information about the market location for selling their crop produce. Regarding the utilization pattern of mobile apps to contact, only 29.17 percent of respondents utilize the mobile to contact

scientists of university/research institutions/ICAR. Few of the respondents (10.00%) were found to utilize mobile apps to contact progressive farmers also. None used to contact SMS of KVKs, offices under ATMA for gaining information, and with farmers portal. The overall utilization of agri mobile apps found as 16.30 percent, with a mean utilization score of 4.08.

As depicted in Table 2, the utilization pattern is found to be relatively lower in almost all cases i.e., the level of utilization of agri mobile apps was only to the extent for getting information about current prices and Minimum Support Prices (35.83%), irrigation management (35.00%), pest and disease management (30.00%), seed treatment and new technologies in agriculture (26.67%), for Govt. subsidies-related information (26.67%) for crop production. As for as, the not-used category of mobile apps among the respondents was high for calculating the insurance premium, identifying the market location for selling the produce, contacting SMS and officers at KVKs and ATMA respectively, for finding suitable cropping patterns, harvesting and storage information, sowing or transplanting related information, etc. This can be the result of farmers' antiquated mindsets, which prevent them from using new, modern methods like mobile applications.

Therefore, the present study revealed overall utilization of agri mobile apps for crop production is at a low level (16.30%). According to the study by Khan *et al.* (2019) ^[5], farmers have the least tendency to utilize mobile apps for formal agricultural practices. In addition, farmers can access the necessary information, and the sharing of farm knowledge, market information, and discussions about farm-related financial issues were most frequently accessed by all mobile phone users. In the study by Giridhar *et al.* (2019) ^[3], only 38.33% of respondents reported using mobile phones frequently. This low usage rate may be due to respondents' negative attitudes toward mobile phones, their lack of familiarity with them, and the fact that farmers lacked the technical abilities necessary to use mobile phones effectively. According to the findings of the study by Asif *et al.* (2017) ^[1], 70% of respondents fell into the low mobile phone usage category and found that farmers in the research area have not been using them effectively to gather information about vegetable farming. The study by Lahiri *et al.* (2017) ^[8] revealed that using a phone to collect agricultural information is not satisfactory, as they use their mobile phones for a variety of personal purposes, but they use them less to get information about farms, which lowers their mobile usage efficiency score for gathering farm information. In many ways, these findings are comparable to those of the current study.

Conclusion

Mobile applications can be utilized to increase farm income and productivity by giving accurate information, promoting improved input and farm management, making marketing simple, connecting with government agencies for policy support, and other purposes. The current study found an overall gap of roughly 16% between farmers' awareness and utilization of agri mobile apps for crop production that has to be addressed. The awareness of the farmers varied across agri-mobile apps for crop production. Awareness level was favourable with awareness about mobile apps, improves the

social relationship among farmers, affects the social behaviour of farmers and Agril. information can be assessed quickly and accurately, increase the knowledge of farmers regarding crop production and provide information about weather forecasting. However, more effort is needed to increase the utilization level of farmers about the agri mobile apps for crop production, which is very low. For farmers to use mobile apps, they must be sufficiently knowledgeable and skilled. The government has to improve digital literacy to address the issue of farmers' lower utilization of mobile apps. Agri apps and refined technologies should be developed as user-friendly as feasible in order to maintain farmers' intent to utilize an app eagerly, and promotional techniques should be tailored to target certain qualities of intended users for healthy and remarkable production. Thus, agricultural mobile applications help in transforming the future of farming.

Conflict of interests

The authors declare that there is no competing interest.

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