



Perceived Effectiveness of the Mobile Applications in Agriculture in Terms of Availability, Acceptance, Usage and Satisfaction

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The rapid advancement of mobile technology has revolutionized various sectors, including agriculture. Mobile applications have emerged as promising tools to enhance agricultural practices by providing farmers with convenient access to vital information and services. This study aims to investigate the perceived effectiveness of mobile applications in agriculture, focusing on their availability, acceptance, usage, and satisfaction. An Ex-post facto research design was used for the present study. The study was conducted in two districts namely Chikkaballapur and Shivamogga districts of Karnataka state which were purposively selected. Chintamani taluq of Chikkaballapur district and Bhadravathi taluq of Shivamogga district are selected randomly. Two villages (Kaivara

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and Kurutahalli) from chintamani taluq, Hiriyyurua and Nanjapura villages from Bhadravathi taluq were selected based on the simple random sampling method. From each village 30 farmers were selected randomly thus making it a total of 120 farmers from two districts. The four apps Farmrise, AgriApp, Krishi Mithra and Krishi Samyojaka were purposively selected based on its extensive use in the study area. The study showed that 67.50 per cent of the respondents had medium perceived effectiveness about the services of the mobile applications followed by low (19.16%) and high (13.34%) perceived effectiveness. The outcomes of this research contribute to a better understanding of the perceived effectiveness of mobile applications in agriculture and provides valuable insights into the availability, acceptance, usage, and satisfaction levels of these apps among farmers. Farmers are more likely to perceive mobile applications as effective when they are readily available and easily accessible in their daily farming activities. Alignment with specific needs and preferences is crucial for adoption. Promoting usage through training and support improves perceived app effectiveness. Farmer satisfaction, user feedback, and issue resolution enhance this perception. Emphasizing these aspects enables mobile applications to be more finely tuned to meet farmers' specific needs, leading to increased adoption, higher utilization, and ultimately, improved support for agricultural practices.

Keywords: Perceived effectiveness; mobile applications; acceptance; usage; availability; satisfaction.

1. INTRODUCTION

Information has become a valuable commodity for agricultural growers in the modern world. [1]. Access to timely, relevant and reliable agricultural information is necessary for agricultural development [2]. Highly developed and organized flow of agricultural information is capable of enhancing productivity and better market price for farmers, increase farmers knowledge and facilitate agricultural activities in rural areas [3]. Reachability has grown to be a huge task for the extensional personnel in order to offer them with information [4]. Agricultural extension which depends to a large extent on information exchange between and among farmers on the one hand and a broad range of other actors on the other, has been identified as one area in which ICTs can play a significant role [5]. ICT has many potential applications in agricultural extension [6]. ICTs do play an important role in disseminating a wide range of information and advice leading to knowledge and attitude change among rural communities [7].

Mobile applications are becoming increasingly popular among farmers among the different ICT tools, and their use in the agricultural industry is expanding quickly. Mobile-based information delivery holds great promise and it is in use as a major channel for agricultural advisory services [8]. The introduction of mobile applications has led to the development of new services in agriculture for the benefit of farmers and other stakeholders. Services that started with occasional messages have evolved to multimodal and multimedia delivery of advisory

and to m-agriculture applications for smartphones. These services are addressing the information and communication Extension gap between farmers and extension personnel and giving a bargaining position to farmers [9].

In order to meet their specific needs, farmers require timely information. There are mobile applications that offer the most recent agricultural information on methods, equipment, technologies, and trends being used, assist in identifying pests and diseases and help in its management, provide real-time weather information, early warnings on storms, local markets with the best pricing, and more [4]. Additionally, farmers may communicate with and get advice from agricultural experts around the nation via the mobile apps. These apps aid in the provision of market data, the facilitation of market links, the provision of access to extension services, the provision of farm-related information, etc. [10].

Poong et al. [11] revealed that perceived usefulness, ease of use, and perceived impact directly influenced their behavioral intention to use mobile learning. Social influence and self-efficacy indirectly affected mobile learning acceptance through perceived usefulness and perceived ease of use. Ganeshan and Vethirajan [12] reported that the mobile apps had positive impact on farming community in various ways. These apps help in reducing the transportation and input costs. It helped in managing the corruption waste and government policies. The growth of agricultural mobile apps and their impacts on Indian agriculture helped in

increasing the profit. It provided the opportunities for social empowerment of farmers and adoption of modern technologies in India. For this the perceived effectiveness of the mobile applications in agriculture has to be understood. The present study provides valuable insights into the availability, acceptance, usage, and satisfaction levels of these apps among farmers [13].

2. METHODOLOGY

2.1 Research Design

An Ex post facto research design was used for the present study.

2.2 Sampling Procedure

2.2.1 Location of the study

The study was conducted in Karnataka state which was purposively selected because it has good number of progressive farmers who adopt mobile applications in agriculture.

2.2.2 Selection of district

Chikkaballapur and Shivamogga districts of Karnataka state were purposively selected for the study because these are the most developed districts in the state. Also, the districts comprised of good number of progressive farmers who adopt mobile applications in agriculture.

2.2.3 Selection of taluqs and villages

Chintamani taluq of Chikkaballapur district and Bhadravathi taluq of Shivamogga district were selected randomly. Two villages (Kaivara and Kurutahalli) from chintaamni taluq, Hiriyurua and Nanjapura villages from Bhadravathi taluq were randomly selected for the present study.

2.2.4 Selection of respondents

From each village 30 farmers ($30 \times 4 = 120$) were selected randomly thus making it a total of 120 farmers from two districts.

2.2.5 Selection of mobile apps

The four apps namely Farmrise, AgriApp, Krishi Mithra and Krishi Samyojaka were purposively selected based on its extensive use in the study area.

2.3 Perceived effectiveness of Mobile Apps in Agriculture

The perceived effectiveness of the mobile apps in Agriculture was studied in terms of level of availability, level of acceptance, level of usage and level of satisfaction.

2.3.1 Level of availability

To study level of availability of mobile apps, a schedule was developed that consisted of three statements and the responses were recorded on a three-point continuum i.e., 'greater extent', 'moderate' and 'lesser extent' and scores of 3, 2 and 1 were given, respectively.

2.3.2 Level of acceptance

A schedule was developed to study level of acceptance of mobile apps under technology characteristics which includes compatibility, complexity, ease of use, observability, trialability, usefulness and relative advantage. The responses were measured on three-point continuum i.e., greater extent, moderate and lesser extent with scores of 3, 2 and 1 respectively.

2.3.3 Level of Usage

To study the level of usage of mobile apps a schedule was developed by discussing with scientists and review of literature which consisted of 14 items and the responses were recorded on a three-point continuum i.e., 'frequently', 'less frequently' and 'rarely and scores of 3, 2 and 1 were given respectively.

2.3.4 Level of satisfaction

A schedule was developed to study level of satisfaction of mobile apps after discussing with scientist and review of literature which consisted of 14 items and the responses were recorded on a three-point continuum i.e., 'more satisfied', 'satisfied' and 'not satisfied' and scores of 3, 2 and 1 were given respectively.

Perceived effectiveness of mobile apps in agriculture was measured by summing all the related factors like level of availability, acceptance, usage and level of satisfaction. The total score was used to categorize the respondents on a three-point continuum i.e., 'high perceived effectiveness', 'medium perceived

effectiveness' and 'low perceived effectiveness' based on mean and standard deviation.

3. RESULTS AND DISCUSSION

From the Table 1 it is evident that majority of the respondents (45.00%) were using Farmrise app followed by Agri app (27.50%), Krishi Mithra app (24.50%) and Krishi Samyojaka app (15.83%).

Table 1. Different mobile apps used by the respondents

S.No	Name of the apps	Frequency*	Percentage
1	Farmrise	54	45.00
2	Agri App	33	27.50
3	Krishi Mithra	29	24.17
4	Krishi Samyojaka	19	15.83

*data includes multiple responses

3.1 Perceived Effectiveness of Mobile Apps in Agriculture

The perceived effectiveness of the mobile apps in agriculture was studied in terms of level of

availability, acceptance, usage and level of satisfaction.

3.1.1 Level of availability of mobile apps

From the Table 2, it is inferred that majority of the respondents (23.00 %) opined that information available from the Farmrise app was highly relevant followed by Agri app (15.00%), Krishi mithra app (14.00%) and Krishi Samyojaka app (7.00%). In order to increase agricultural output, farmers must have access to mobile applications. These apps give farmers useful knowledge, resources, and tools to help them make wise decisions, increase crop yields, and effectively reach markets.

From the Table 3 it can be inferred that majority (88.00 %) of the respondents had agreed that there are relevant of mobile apps available for accessing agriculture information (73.33%), there are mobile apps available for providing relevant information (93.00%) and there are paid apps available for providing better services i.e., regular and latest information about agriculture (51.66%).

Table 2. Distribution of the respondents according to their level of availability of information from the mobile apps

Name of the app	% of respondents using mobile apps	Level of availability of information from mobile apps (%)		
		Highly relevant	Relevant	Not relevant
Farmrise	45.00	23.00	14.00	8.00
Agri app	27.50	15.00	7.00	5.50
Krishi mithra	24.17	14.00	2.17	8.00
Krishi Samyojaka	15.83	7.00	5.00	3.83

* Data includes multiple responses

Table 3. Distribution of the respondents according to their level of availability of mobile apps

Level of availability		Greater extent		Moderate		Lesser extent	
S.No	Statements	F	%	F	%	F	%
1	There are relevant apps available for accessing agriculture information	88	73.33	27	22.50	5	4.17
2	There are apps available for providing relevant information.	93	77.50	19	15.83	8	6.67
3	There are paid apps available for providing better services i.e., regular and latest information about agriculture	62	51.66	36	30.00	22	18.34

3.1.2 Level of acceptance of mobile apps

The perceived effectiveness of the mobile apps in agriculture in terms of level of acceptance was studied based on the technological characteristics. The technological characteristics were measured technology characteristics were measured in terms of compatibility, complexity, ease of use, observability, trialability, usefulness and relative advantage.

3.1.2.1 Compatibility

From the Table 4, it can be inferred that majority of the respondents those who are using Farmrise app (30.00%), Agri app (17.00%), Krishi Mithra (14.00%) and Krishi Samyojaka (7.00%) had perceived that the mobile apps should be compatible to greater extent with existing situations and needs of the farmers. It can be concluded that mobile apps should be compatible with the socio-cultural aspects of the farmers community.

3.1.2.2 Complexity

The data in the Table 4 indicates that mobile apps are perceived to be difficult to understand and use to a moderate extent by 21 per cent of the farm rise apps respondents and 10.17 per cent of the Krishi Mithra app respondents. While 15.00 per cent and 7.00 per cent of Agri app and Krishi samyojaka app respondents perceived that mobile app is be less complex to understand and use. It can be concluded that it is important to design a mobile app as simple as possible and increasing the experience of farmers in using the mobile apps by blending those in extension service delivery would decrease the complexity and the acceptance of the mobile apps among the farmers would be more.

3.1.2.3 Ease of use

From the Table 4, it can be inferred that majority (30%) of the respondents those who are using Farmrise app (23.00%), Agri app (18.00%), Krishi Mithra (16.00%) and Krishi Samyojaka (9.00%) had perceived that it is important that mobile app is easy to use. This might be due to the fact that the mobile app developed was

farmer-centric, so care was taken during the development and designing of the mobile apps that it would be helps very easy to use and access information. So, the respondents had found the mobile app flexible and had ease in using them for accessing the agriculture information.

3.1.2.4 Observability

It is clear from the Table 4, majority of the respondents who are using the Farmrise app (20.00%), Agri app (14.00%), Krishi Mithra (18.00%) and Krishi Samyojaka (8.00%) had perceived to a greater extent of observability about the use of mobile apps is easily appreciable by others in the community. Observability of the mobile apps in the farming community would stimulate the very deep discussion among the friends and neighbors of the respondents and would motivate the other farmers to use the mobile for accessing various information related to agriculture.

Trialability: From the Table 4, it can be inferred that majority of the respondents those who are using Farmrise app (21.00%), Agri app (19.00%), Krishi Mithra (15.00%) and Krishi Samyojaka (8.00%) felt to a greater extent that mobile apps should be experimented on a limited basis. It can be concluded that personal experience of the respondents with mobile apps would be the most effective learning and increases the acceptance of technology by reducing the uncertainty related to its usage. Thus, trialability would help in improve the attitude of the farmers and motivate them towards accepting the mobile apps for accessing Agriculture related information.

Usefulness: Majority of the respondents who are using Farmrise app (21.00%), Agri app (17.00%), Krishi Mithra (14.00%) and Krishi Samyojaka (7.00%) had found that greater level of usefulness as mobile apps provides latest and complete information. This might be due to the reality that the mobile apps provide latest and complete information on the new scientific methods of agriculture farming which increases the level of acceptance of mobile apps by farmers.

Table 4. Distribution of the respondents according to their level of acceptance of mobile apps

Characteristics	Statements	Level of acceptance (%)											
		Farmrise			Agri app			Krishi mithra			Krishi Samyojaka		
		GE	M	LE	GE	M	LE	GE	M	LE	GE	M	LE
Compatibility	Mobile apps are compatible with existing situations and needs of the farmers	30.00	9.00	6.00	17.00	6.50	4.00	14.00	8.00	2.17	7.00	5.00	3.83
Complexity	Mobile app is perceived to be difficult to understand and use.	13.00	21.00	11.00	5.50	7.00	15.00	9.00	10.17	5.00	5.00	3.83	7.00
Easy to use	Mobile app is easy to use.	23.00	14.00	8.00	18.00	5.00	4.50	16.00	5.00	3.17	9.00	4.83	2.00
Observability	The use of mobile apps is easily appreciable by other in the community.	20.00	14.00	11.00	14.00	6.00	7.50	18.00	3.17	3.00	8.00	2.83	5.00
Trialability	Mobile app to access the agriculture based information may be experimented on a limited basis	21.00	14.00	10.00	19.00	5.00	3.50	15.00	4.00	5.17	8.00	4.00	3.83
Usefulness	To what extent mobile apps provide latest and complete information.	21.00	13.00	11.00	17.00	6.50	4.00	14.00	8.00	2.17	7.00	5.00	3.83

**Data includes multiple responses*

GE= Greater extent; LE=lesser extent; M= Moderate

Table 5. Distribution of the respondents according to their level of usage of mobile apps

Name of the app	% of respondents using mobile apps	Level of usage (%)		
		Frequently	Less frequently	Rarely
Farmrise	45	26.00	11.00	8.00
Agri app	27.50	17.00	8.00	2.50
Krishi mithra	24.17	13.00	8.00	3.17
Krishi Samyojaka	15.83	8.00	4.83	3.00

* Data includes multiple responses

Table 6. Distribution of the respondents according to their level of usage of information provided by the mobile apps

S.No	Information parameters	Level of usage					
		Frequently		Less frequently		Rarely	
		F	%	F	%	F	%
1	New varietal technologies	31	25.83	67	55.83	22	18.34
2	Seed availability	58	48.34	33	27.50	29	24.16
3	Latest management practices	63	52.50	38	31.66	19	15.84
4	Land Management	33	27.50	31	25.84	59	49.16
5	Pest & disease diagnosis	73	60.83	31	25.84	16	13.33
6	Nutrient management	55	45.84	30	25.00	35	29.16
7	Irrigation management	34	28.34	59	49.16	27	22.50
8	Weather information	63	52.50	37	30.84	20	16.66
9	New equipment in market	28	23.34	21	17.50	71	59.16
10	Equipment on rent	31	25.84	56	46.66	33	27.50
11	Government schemes	33	27.50	31	25.84	59	49.16
12	Information about buyers	23	19.17	41	34.17	56	46.66
13	Price in different markets	73	60.84	30	25.00	17	14.16
14	Chat on agriculture	31	25.83	33	27.50	56	46.67

3.1.3 Level of usage of mobile apps

From the Table 5 it is evident that majority of the respondents frequently used farmrise (26.00%) followed by Agri app (17.00%), Krishi mithra app (13.00%) and Krishi Samyojaka app (8.00%).

It is clear from the Table 6 that majority of the farmers have frequently used mobile apps to access information to check price in different markets (60.84%), pest and disease diagnosis (60.83%), weather information (52.50%), latest management practices (52.50%), seed availability (48.34%) and nutrient management (45.84%). While farmers have less frequently used mobile apps to access information about new varietal technologies (55.83%), irrigation management (49.16%) and equipment on rent (46.66%). Whereas farmers have rarely used mobile apps to access information about new equipment in market (59.16%), Government schemes (49.16%), land Management (49.16%), Chat on agriculture (46.67%) and Information about buyers (46.66%). Mobile apps play a

critical role in agriculture, providing farmers with real-time data, weather predictions, crop management tools, and market insights. Their widespread implementation improves productivity, livelihoods, and efficiency.

3.1.4 Level of satisfaction about mobile apps

It is evident from the Table 7 that majority of the respondents were fully satisfied by mobile apps providing information about price in different markets (60.00%), new varietal technologies (53.34%), pest & disease diagnosis (53.34%), weather information (50.84%) and nutrient management (50.83%). While majority of the respondents were satisfied by mobile apps providing information about buyers (55.00%), Seed availability (53.34%), Chat on agriculture (52.50%), Latest management practices (49.16%), water/irrigation management (48.34%), land management (40.83%), equipment on rent (39.16%) and Government schemes (39.16%).

Table 7. Distribution of the respondents according to their level of satisfaction from information provided by the selected mobile apps

S.No	Information parameters	Level of satisfaction					
		Fully satisfied		Satisfied		Not satisfied	
		F	%	F	%	F	%
1	New varietal technologies	64	53.34	34	28.33	22	18.33
2	Seed availability	24	20.00	64	53.34	32	26.66
3	Latest management practices	38	31.67	59	49.16	23	19.17
4	Land Management	35	29.16	49	40.83	36	30.00
5	Pest & disease diagnosis	64	53.34	34	28.33	22	18.33
6	Nutrient management	61	50.83	34	28.33	25	20.84
7	Water/irrigation management	41	34.16	58	48.34	21	17.50
8	Weather information	61	50.84	36	30.00	23	19.16
9	New equipment in market	43	35.84	21	17.50	56	46.66
10	Equipment on rent	36	30.00	47	39.16	34	28.34
11	Government schemes	42	35.00	47	39.16	31	25.84
12	Information about buyers	30	25.00	66	55.00	24	20.00
13	Price in different markets	72	60.00	31	25.84	17	14.16
14	Chat on agriculture	38	31.66	63	52.50	19	15.84

Table 8. Distribution of the respondents according to their perceived effectiveness of mobile apps

Name of the app	Percentage of Respondents (%) using mobile apps	Perceived effectiveness of mobile apps (%)		
		High	Medium	Low
Farmrise	45.00	28.00	12.00	5.00
Agri app	27.50	16.00	7.50	4.00
Krishi mithra	24.17	12.00	5.00	7.17
Krishi Samyojaka	15.83	4.83	9.00	2.00

* Data includes multiple responses

Table 9. Overall distribution of the respondents according to their perceived effectiveness of mobile apps

S.No	Category	Frequency	Percentage
1	Low (up to 87 score)	23	19.16
2	Medium (88-105 score)	81	67.50
3	High (above 106 score)	16	13.34

3.2 Perceived Effectiveness of Mobile Apps

The data in Table 8 depicts that about 28 per cent of the respondents had opined that there is a high level of perceived effectiveness of Farmrise mobile app. In case of Agri app, 16 per cent of the respondents had opined that there is a high level of perceived effectiveness. About 12 per cent of the respondents had opined that there is a high level of perceived effectiveness of Krishi mithra app. In case of Krishi Samyojaka app, 9 per cent of the respondents had opined that there is a medium level of perceived effectiveness.

It is evident from that Table 9, that 67.50 per cent of the respondents had medium perceived effectiveness about the services of the mobile applications followed by low (19.16%) and high (13.34%) perceived effectiveness. The perceived effectiveness of mobile apps by farmers is crucial to modern agriculture, as it influences productivity, decision-making, and access to essential information, ultimately transforming methods of farming and the production of sustainable food. Therefore, it's crucial to improve the perception of mobile apps' usefulness for farmers by providing them with user-friendly interfaces, real-time data access, customized content, and responsive support,

enabling them to make wise decisions and maximize their farm operations.

4. CONCLUSION

The perceived effectiveness of mobile applications among farmers, as assessed through the lenses of availability, acceptance, usage, and satisfaction, provides valuable insights into their impact on agricultural practices. Farmers are more likely to perceive mobile applications as effective when they are readily available and easily accessible in their day-to-day farming activities. Farmers are more inclined to adopt and utilize applications that align with their specific needs and preferences. Understanding and addressing the requirements and expectations of farmers in the design and development process of these applications is crucial to ensure higher acceptance and perceived effectiveness. Farmers who actively and consistently engage with these applications are more likely to perceive them as effective tools in their farming routines. Encouraging regular usage through targeted training programs, technical support, and ongoing engagement can contribute to enhancing the perceived effectiveness of these applications. Farmers satisfaction with the features, functionality, and overall performance of the applications directly influences their perception of effectiveness. Continuous feedback collection, incorporating user suggestions, and addressing any issues or concerns raised by farmers are critical in improving user satisfaction and maximizing the perceived effectiveness of these applications. By focusing on improving these factors, mobile applications can be better tailored to meet the specific needs of farmers, resulting in higher adoption rates, increased utilization, and ultimately, enhanced effectiveness in supporting agricultural practices.

Ultimately, the perceived effectiveness of mobile applications among farmers has the potential to revolutionize the way farming is conducted, improving productivity, decision-making, and overall farm management. By prioritizing availability, acceptance, usage, and satisfaction, stakeholders can contribute to the sustainable development and digital transformation of the agricultural sector, benefitting farmers and fostering agricultural growth.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

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