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Exploring the Farmers Adoption of Agri Input Mobile Applications using Tam Model

Shilpa S. K.*[1] and Royal K. L.[2]

Indian Institute of Plantation Management Bengaluru
Jnana Bharathi, Mallathahalli, Bengaluru, Karnataka 560056
*Email: kshilpa@iipmb.edu.in

ABSTRACT

Mobile applications for agriculture has great potential to facilitate farmers in timely decisions. The mobile apps provide information to the stakeholders across the agri value chain. Adoption of mobile applications for purchasing agri inputs are influenced by factors. This study provides an overview of the key features of agri-input mobile applications and examine the adoption of mobile applications for purchasing agricultural inputs by farmers from Kerala and Andhra Pradesh. The study found 29 percent of the sample responds used agri mobile apps. However only 24 farmers used the apps for purchase of agri inputs. The common features of these mobile apps were observed to be multilanguage support, providing package of practices selling the agri-inputs, and agro advisory service. The farmers perceived the apps to be easy to use and usefulness in agri input purchase.

Key words: Mobile apps, Agri inputs, Farmers, TAM model

INTRODUCTION

A macro level examination of farm sector indicates that India accounts for majority of small and marginal farmers below 2 hectares land per household. These farmers account for 86 % of all farmers contributing 47 % of the crop area. Most of these farmers still work for subsistence farming. Indian agriculture sector's contribution to the Indian economy and its existing vulnerabilities has reemphasised the need for structural reforms, adoption of technology and investments in infrastructure. Agri input industry has always strived to ensure availability of good quality seeds and agro-chemicals to the farmers. However, considering the constraints of limited availability of transport and workforce, production and movement of agriculture inputs is not an easy task. Agricultural inputs are a great determinant of yields in any type of agricultural production. In the modern world today, agriculture has become extremely dynamic therefore, making the kind of inputs that are being used in the sector today upgraded.

In this background there are various, Information and Communication technology tools including mobile applications (apps), SMS and voice-based information system (Jain *et al.*, 2015), adeptly support farmers in decision making by providing information related to weather (Mittal, 2016), agricultural input use (Ogutu et al., 2014), cost reduction (Sopegno *et al.*, 2016), pest management (Karar *et al*., 2021), climate adaptation strategies (Baumüller, 2018), market price, extension services (Namyenya, *et al.*, 2021) and

access to credit (Fu and Akter, 2016). Mobile apps also enable efficiency in the agricultural value chain (Halewood and Surya, 2012), monitoring financial transactions (Qureshi *et al.*, 2009) and schemes offered by government (Das et al., 2012; Shannon, 2013). Despite the benefits, smartphone apps usage in agriculture is very limited as compared to apps usage in other sectors (Xin, 2015). In India, technology-enabled agri-service delivery has been evolving considerably (Brugger, 2011; Krishnaswamy, 2020).

The mobile app is one of the platforms, where a farmer can get all solution and information in just one touch (Barh& Balakrishnan 2018). Agriculture mobile applications helps the farmer's with various benefits such as advisory services, weather data and information, input applications (dosages, irrigation inputs, *etc.*), market linkages and connectivity, new varieties information and all the changes related to the Indian agriculture can be found out while using these applications. About 73 different agricultural apps are present for farmers who can utilize them to increase farm yield and get an increased revenue realization (Balkrishna *et al.*, 2020).These apps are provided both by the private companies such as IFFCO Kisan Agriculture App, AgroStar, CropIn, Bharat Agri, etc likewise government organisations such as Krishi Jagran, Kisan Suvidha, Krishi Network, *etc* helps the farmers to increase their disposable income. The huge potential of mobile apps proliferation across the agri value chain needs to be properly utilized by farmers in adopting effective approach in sourcing, procurement, production, distribution and marketing of agri produce. The current study aims at filling the existing research gap by exploring the adoption of mobile apps by farmers.

Prior studies have focused on awareness level of farmers and benefits of the mobile apps, however there lies a gap in understanding the usage of mobile apps for purchasing of agri-inputs. Hence the current study intends to explore the farmers adoption of mobile applications for purchase of agri inputs. More specifically this study aims (1) to examine the usage of mobile applications (2) to identify and compare agri-input mobile applications (3) to explore the farmers adoption of agri-input mobile applications using TAM model. This study provides on overview of the agri-input mobile applications and examine the adoption of mobile applications for purchasing agricultural inputs by farmers. TAM model is used as tool which gives idea on the farmers' adoption level to the technology with perceived ease of use and perceived usefulness of the new technology adopted by farmers.

REVIEW OF LITERATURE

The emergence of mobile apps is creating number of opportunities in developing countries. One of the areas with wide potential impact is mobile applications for agricultural and rural development (mARD apps).The mARD apps provide information to the stakeholders across the agri value chain. The advantages of using mobile apps are wide ownership, affordability, voice communication, speed and convenience (World Bank, 2012). Mobile phones are effective in providing information access among the farmers even in isolated conditions and remote places. They help farmers is sharing knowledge about the

world class agronomic practices and consult agricultural experts (Banerjee, 2010). In most of the countires across the globe, agriculture is the major occupation in rural areas (Salemink *et al.*, 2017) and innovation adoption is the important factor to support agriculture development (McFadden and Gorman 2016). To increase agricultural production farmers need to have good information (Ali-Olubandwa et al., 2011). Use of information and communication technology (ICT) particularly mobile applications helps farmers in availing market information, weather & transportation facilities (Aker 2010). Mobile applications provide market information and information on package of practices for crops (Costopoulou *et al.*, 2016) as well as get information about the changing seasons and climate (Barh and Balakrishnan 2018). Farmers using these applications shown with improved access of quality inputs and reduction in transportation costs (Kumar *et al.*, 2020). Majority of farmers raised savings and decrease rate in taking loans due to M-services (Haider Rizvi 2011).

In Kenya mobile phones are mostly used for diagnosing livestock diseases (Martin & Abbott 2011). Small holder farmers using mobile phones contribute to a more effective value chain in maximising time utilization and lowering transportation costs (Halewood and Surya 2012., Qiang *et al.*, 2012). Individual's perception is important determinant to adopt technology (Cheney 2018 and Crandall 2012) and lack of awareness is the primary reason for non-adoption of mobile applications in Kenya (Thiga and Ndungu 2015). Adoption of mobile applications for purchasing agri inputs was influenced by factors such as perceived usefulness, ease of use, social influence, and trust (Rehman et al., 2020).The price values derived from any particular technology and also the farmers adoption decisions will play an important role in TAM (Qianchan Dai and Kequn Cheng 2022). The major factors influencing TAM are individual innovativeness, perceived enjoyment, social norm, content and technology quality, experience with regards to the technology (Castiblanco *et al.*, 2020). For the farmers the main important factors to be considered while utilizing technology are the usefulness of the technology and the ease of use for that technology (Pierpaoli *et al.*, 2013.)

Kabbiri *et al.* (2018) extended the TAM model with two more constructs, perceived advantage and socio-economic characteristics and stated that perceived ease of use had positive effect on both perceived usefulness and adoption of mobile phones by Ugandan farmers. Pick et al. (2014) identify the factors that increase the use of telecenters by farmers as - relative advantage, compatibility, low complexity and observability, pointing to the TAM factors of perceived usefulness and perceived ease of use. Shah *et al.* (2014) state a slew of disadvantages of mobile apps which hinder adoption by farmers-viz., apps not supporting regional languages, which in turn demands for translation and hence, lesser acceptability; lack of affordability of farmers in the developing nations; applications requiring huge data usage, high network charges, thereby, making it expensive for the farmer to adopt.

Review of literature suggests that a number of studies have been carried out to study the adoption of mobile apps in various vertices

across the agriculture value chain. Moreover most of these studies have identified the types of mobile applications for agriculture, and benefits and mobile apps to farmers in developed countries. The Scopes of most of the existing studies are limited to either as single mobile app benefit on agriculture development or cover limited geographical regions more particularly developed countries. The huge potential of mobile apps proliferation across the agri value chain needs to be properly utilized by farmers in adopting effective approach in sourcing, procurement, production, distribution and marketing of agri produce. This study aims at filling the existing research gap in an emerging potential of mobile app adoption by farmers. Moreover there are no studies on usage of mobile apps for purchase of agri input in India. Farmers invest in agri inputs for enhancing their production and productivity. With change in attitude and perception of farmers regarding the usage and benefits of mobile services, there arise a need to understand the usage of mobile apps by farmers in purchase of agri inputs becomes important.

MATERIALS AND METHODS

The study aimed to explore the adoption of agri input mobile applications by farmers using TAM model. For the purpose of the study data was collected from secondary and primary sources. Apps were downloaded and analysed to get insights about the features of those apps used by sample respondents. Further to understand the adoption of mobile apps, farmers from the states of Andhra Pradesh and Kerala were approached. A total of 291 Farmers were selected randomly from 4 districts of AP and seven districts of Kerala (refer table 1). The information related to mobile apps used and agri inputs purchased through the apps was collected from the sample respondents using structured questionnaire. Information related to the TAM variables perceived usefulness and perceived ease of use using the likert scale was collected.

Table-1 Sample respondents

S.NO	STATE	DISTRICT	NO. OF FARMERS
1	Andhra Pradesh	Tirupati	23
		Kadapa	67
		Anantapur	5
		Guntur	9
		Sub total	104
2	Kerala	Idukki	30
		Palakkad	20
		Wayanad	20
		Kanoor	15
		Tiruvananthapuram	10
		Thrissur	10
		Kottayam	10
		Sub total	115
		Total	219

RESULTS AND DISCUSSION

3.1 Adoption of agri-input mobile applications

As stated the study focused on understanding the adoption of agri-input mobile applications by farmers for purchase of agri inputs. From the discussion with the farmer members from Andhra Pradesh (104) and Kerala (115), it was noted that 39 farmers from Andhra Pradesh and 25 farmersfrom Kerala were using mobile applications. On further discussion with the farmers, it was understood that only 14 members from Andhra Pradesh and 10 members from Kerala were using mobile apps for purchase of agri-input (refer table 2).

Table-2 Sample respondents for mobile apps usage

S. No	State	Mobile application users	Users of agri-input mobile applications
1	Andhra Pradesh	39	14
2	Kerala	25	10
	Total	64	24

Source: Author's description based on interview

4.2. Comparative Analysis

Furthermore, analysis was done to get insights about the features of agri-input apps used by farmers in Andhra Pradesh and Kerala. Common features observed in three mobile apps used by farmers are discussed. Firstly, the apps provided multi language support which is important for the farmers in a country such as India where number of languages are more and illiteracy among farmers is high. Second common feature was, providing package of practices with recommendations to farmers in giving details from production stage to harvest stage for crops. Another common feature across these apps was, selling the agri-input such as seeds, crop protection and crop nutrition products with cash on delivery option (COD) as many farmers were not aware about digital payment methods. Additionally, agro advisory feature which helps farmers in solving their queries through calls and field visits by experts to farms was offered in these apps (Refer table 3).

Table-3 Comparative analysis of mobile applications used

Company Name	Agri App	Rallis India (Krishi samadhaan)	*Napanta*
Logos			
App Notification	✓	✓	✓
Subscription based	×	×	✓
Promoting Different Branded products	✓	×	✓

Crop protection	✓	✓	✓
Seeds	✓	✓	✓
Crop Nutrition	✓	✓	✓
Farm Implements	×	×	×
Demonstration videos to use products in field	✓	×	×
Dealers Information	×	✓	✓
Crop protection kits	×	×	×
Multi-language support	✓	✓	✓
Agri advisory	✓	✓	✓
Cash on delivery Option	✓	✓	✓
Fertilizer calculator	×	✓	×
Subsidy info information	×	×	✓
Package of practices with Input recommendations	✓	✓	✓
Video call with experts in recommending inputs	×	✓	✓
Crop calendar Option	×	×	×
Farm Machinery (Buy/sell/Rent)	×	×	✓
No. of downloads	1M+	50k+	100k+
Rating	3+	3+	3+

Source: Application Analysis of mobile apps (Agri app, Napanta, Krishi samadhan, Bharat Agri)

4.3. Farmers perception of Agri input mobile apps

Adoption of agri-input mobile applications was explored using TAM model, where in the farmers perception using the TAM variables perceived ease of use and the perceived usefulness was captured. With respect to 'Perceived Ease of Use', the farmers agree that the agri input mobile apps are easy to use, with specific reference to learning to use the app, interaction and overall usage with mean ranging between 4.0 to 4.6 (refer table 4). Perceived usefulness talks about how the learning or usage helps the individual in improving their performance towards usage of technology. Perceived usefulness is influenced by perceived ease of use. The farmers agreed that the apps were useful in searching and buying agri-input products with mean 4.4, using the agri input apps enabledthem to search and buy agri-input products faster with mean 4.20 and enhanced their effectiveness in agri-input product searching and buying with mean 4 (refer table 5).

Table 4: Perceived ease of use

S.NO	Perceived ease of use	Average
1	Learning to use the app is easy to me	4.6
2	It's easy to make the app to do what I want to do?	2.0
3	My interaction with app is clear and understandable.	4.2
4	It's easy to use the application.	4.5
5	The app that I am using makes it easier to search for and purchase agri-input products.	3.8

Source: Author's description based on interview

Table : TAM model for perceived usefulness

S.NO	Perceived usefulness	Average
1	The app that I have used is useful for searching and buying agri-input products.	4.4
2	The agri input app that I have used improved my performance in product searching & buying.	3.6
3	The app that I am using enables me to search and buy agri-input products faster.	4.2
4	The app that I am using enhances my effectiveness in agri-input product searching & buying.	4
5	The app that I am using increases my productivity in searching & purchasing products.	3.8

Source: Author's description based on interview

CONCLUSION

Technology plays significant role in changing process of life wherein critical information is available at tips of fingers. As India is broadly divided into urban and rural area, the proposed research focuses to enhance the quality of life of farmers with adoption of technology. The advantages of using mobile apps such as wide ownership, affordability, voice communication, speed and convenience (World Bank, 2012) can easily be passed to the rural mass. Studies across the globe have proved the effectives of mobile apps in terms of changing productivity and incomes, linking poor farmers to urban, regional and global markets.The study demonstrates the usage of mobile apps for purchase of agri inputs by farmers from Kerala and Andhra Pradesh. It was interesting to note 29 percent (64 farmers) of the sample responds used agri mobile apps. However 24 farmers used the apps for purchase of agri inputs. The common features of these mobile apps were observed to be multilanguage support, providing package of practices selling the agri-inputs, and agro advisory service. The farmers perceived the apps to be easy to use and usefulness in agri input purchase.

There are numerous usages of mobile phones reported by rural people. There has been improved access to knowledge in agriculture, including non-grain products, such as vegetables and milk production.

Besides knowledge, information about market prices secured through mobile phones enabled farmers to choose wholesale markets in which to sell their products or even harvesting of vegetables. The farmers, who use mobile phone for seeking information has reported improved marketing because of better price information. Increasing access to price information would seem to improve the functioning of markets, reducing the spread between prices in different locations. Cost savings were realised by both farmers and petty traders. Farmers could reduce spoilage by harvesting when prices in the market were better. All these benefits will in turn lead to better income and lifestyle of the rural people especially farmers.

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