Factors Influencing the Use of Uzhavan App by the Farmers

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Keywords: Agricultural Advisory Service, Digital Agricultural Innovation, Mobile App

Abstract: The Government of Tamil Nadu, with an equivalent objective of engagement in agriculture 5.0, has devised the "Uzhavan" mobile app as an additional digital advisory service in farming. The factors influencing the use of the Uzhavan app were analyzed in this study employing the Unified Theory of Acceptance and Use of Technology (UTAUT). Data were obtained from 263 farmers in Tamil Nadu. A mixed research method was used. Quantitative data on factors influencing the use of the app was analyzed using ADANCO software and thematic analysis was used to study the reasons for non-usage of the app using Nvivo 13. The result shows that, in direct effect, the effort expectancy and performance expectancy influence the farmer's behavioral intention significantly; moreover, the behavioral intention has a positive and significant influence on the use of the Uzhavan app by farmers. The facilitating condition has a positive and significant influence on the Uzhavan app use behavior. For the indirect effect, effort expectancy and performance expectancy positively influence use behavior through behavioral intention but are not significant. The thematic analysis revealed that non-user farmers were unaware of the Uzhavan app. and lack of knowledge about it.

1 INTRODUCTION

The advents of technology and advancements in communication have led to the digitalization of various sectors, including agriculture. This digital transformation has empowered farmers with easy access to information through advanced technologies. However, amid abundant information sources, farmers face difficulty in gathering accurate and reliable information (Kumar et al., 2023). With the widespread availability of smartphones and internet connectivity, mobile agricultural applications have emerged as a powerful tool for the advancement and transformation of the farming sector in both developed and developing nations (FAO, 2019). Mobile agricultural applications, as stated by Costopoulou et al., (2016), have the potential to boost the income levels of small-scale farmers by reducing the expenses related to supply and distribution, and enhancing traceability. Among the plethora of digital tools aiming to help farmers, the Uzhavan app, developed by the Tamil Nadu government provides a ground-breaking initiative of information to farmers with easily accessible information. The app provides a diverse range of features, including weather updates, seed and fertilizer inventory, the market price of commodities, valuable crop advisory, government schemes, subsidies, etc. Utilization of these features empowers farmers to make decisions that positively impact their agricultural practices. The installation process of these applications on smartphones must be made effortless. Comprehending the determinants that impact farmers' decisions to adopt, can enhance their ability to forecast and elucidate their utilization, thus providing valuable insights for future development endeavors (Michels & Mußhoff, 2020). Furthermore, their lack of familiarity with the technology and absence of reliable information contribute to their reluctance to embrace digital tools (FAO, 2019). Thus, this paper investigates the effective utilization of the Uzhavan app among farmers, employing the UTAUT theory as a guiding framework. Through the examination of factors influencing farmers' acceptance and use behavior towards the Uzhavan app, this study aims to provide valuable insights to enhance the functionality

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Ihou, A. F. Y., M, M., J, P. M. and A, G.
Factors Influencing the Use of Uzhavan App by the Farmers.
DOI: 10.5220/0012889000004519

In *Proceedings of the 1st International Conference on Emerging Innovations for Sustainable Agriculture (ICEISA 2024)*, pages 189-195
ISBN: 978-989-758-714-6

and outreach of digital tools in agriculture, ultimately contributing to the sustainable growth and prosperity of the agricultural sector in India.

2 LITERATURE REVIEW

UTATUT Theory

Model adoption, also known as the Unified Theory of Acceptance and Use of Technology (UTAUT), pertains to the process of embracing a particular model or framework. The research conducted on model development aims to pinpoint the key factors that influence the adoption of technology. The primary goal of this development is to expedite the acceptance and integration of innovative technological advancements (Arifin et al., 2022). The UTAUT model has four main variables: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy is about how much individuals believe that using technology will help them in their work. Effort expectancy is about how much effort and difficulty individuals think they will face when adopting technology. Social influence is about how much individuals are influenced by others when adopting new technology, especially by close groups, familiar people, and industry experts. Currently, the UTAUT theoretical framework is extensively employed by scholars as the foundation for developing research models in various related studies. For instance, it has been utilized to examine the willingness and acceptance behavior of farmers towards digital information technology systems, as well as the acceptance behavior of new agricultural technologies. (Lin et al., 2023).

Uzhavan application

As agriculture moves to the digital era, it is crucial to study mobile applications in agricultural extension services. According to (Aker, 2011; Labarta et al., 2011) The inclusion of digital advances in the agricultural sector, such as the utilization of mobile applications, has attracted considerable interest as a catalyst for enhancing agricultural extension services. Mobile applications provide information, that promotes effective communication, and decision-making processes for farmers. The Uzhavan app is a significant application in the utilization of technology for agricultural extension. it provides a range of services to Tamil Nadu farmers that aim to help them with relevant information (*Uzhavan Mobile Application*, n.d.). Initial research conducted on the Uzhavan app indicates favorable results regarding its influence on farmers. The app plays a significant role in strengthening crop management techniques, and production, and adds to profitability for farmers in Tamil Nadu. The app has a user-friendly interface and localized content helps farmers in bridging the digital gap. The acceptance and adoption of any technological intervention in agriculture play a crucial role in determining its success. Extensive research conducted in the domain of agricultural extension services emphasizes the significance of comprehending the factors that impact farmers' acceptance of technology (Davis et al., n.d.; Labarta et al., 2011). The Uzhavan app exhibits potential, however, it is crucial to delve into the challenges and opportunities linked to its implementation. Previous research on similar apps has highlighted obstacles like connectivity problems, differing levels of digital literacy among farmers, and the necessity for continuous technical assistance (Labarta et al., 2011; Qiang et al., 2011). Overcoming these challenges is vital to optimize the Uzhavan app's impact and guarantee its long-term effectiveness in the realm of agricultural extension services.

3 MATERIALS AND METHODS

To examine the factors that impact the utilization of the Uzhavan app among farmers, an interview schedule was developed utilizing established scales derived from the Unified Theory of Acceptance and Use of Technology. The respondents' perceptions regarding the credibility of services, performance expectancy, effort expectancy, social influence, facilitating condition, behavioral intention, and use behavior were assessed using a 5-point scale developed by Liñán and Chen (2009). This scale ranges from 1 (strongly disagree) to 5 (strongly agree). The data were collected through personal interviews conducted with farmers residing in the Vellore and Ranipet districts in Tamil Nadu State from November 2023 to January 2024.

For data collection, the research employed a sample of 263 farmers residing in two districts of Tamil Nadu. The data was gathered from farmers residing in 4 blocks from Ranipet (121 Responses) and 4 blocks from the Vellore (142 Responses) districts. The interview method was opted for to ascertain the farmers' perspectives while maintaining their anonymity.

Concerning analysis, first, a confirmatory factor analysis (CFA) model was employed to analyze the relationship between the indicators and constructs. Secondly, a structural path model (SM) was utilized

to comprehend the relationship among all the constructs used in the model using ADANCO 2.3.2 Software. A qualitative approach was done through thematic analysis in Nvivo 13.

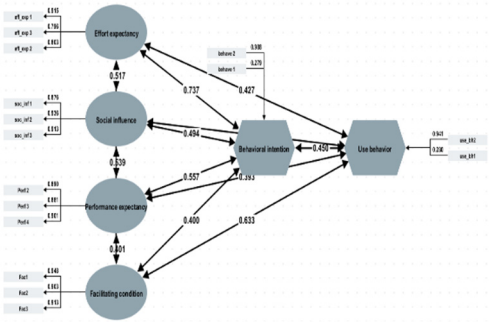
4 RESULTS

The data obtained from the original investigation were examined by the ADANCO 2.3.2 software tool conceived to execute analyses involving structural equation modeling (SEM). The research framework was established and the hypothesis was evaluated using the ADANCO methodology (Ringle, C. M., Wende, S., & Will, 2005).

Measurement model

To obtain accurate inferences, it is essential to evaluate the reliability and validity of the data. In the domain of indicator reliability, there is a widely acknowledged consensus that observed variables exhibiting an outer loading of 0.7 or higher are considered acceptable (Hair et al., 2011). Additionally, the assessment of the internal consistency and reliability of the scale is carried out by utilizing statistical measures such as Cronbach's alpha and composite reliability. Composite reliability is widely recognized as a more reliable indicator of internal consistency due to its capacity to uphold the standardized loadings of the observed variables (Fornell & Larcker F., 1981). Data validity evaluation entailed analyzing the average variance extracted (AVE) to determine convergent validity. According to Fornell & Larcker F (1981), Items within a measuring model are deemed to possess satisfactory unidimensional value when their Average Variance Extracted (AVE) exceeds the threshold of 0.5.

Table 1 presents the values for the outer loadings, which range from 0.7402 to 0.8819. These values indicate a robust association between the indicator and the construct.



Source: Authors compilations (2024)

Figure 1. The measurement model

Furthermore, it is noteworthy that the Cronbach's alpha value exceeds 0.7 (Ponterotto, 2007). The composite reliability values should exhibit a consistent pattern of being above the threshold of 0.70 (Hair et al., 2011). Hence, the observed factor loadings, Cronbach's alpha coefficient, and composite reliability analysis collectively indicate that the scales employed in the study possess satisfactory reliability. In the interim, it is observed that all dimensions exhibit a satisfactory level of average variance extracted (AVE) > 0.5 (BI= 0.5435, EE = 0.7057, PE= 0.7926, FC = 0.8489 and SI=0.8257). This finding suggests that the variability in the observed variables can be attributed to the latent constructs.

Table 2. Discriminant validity

Construct	BI	EE	PE	SI	FC
BI	0.90				
EE	0.47	0.82			
PE	0.22	0.04	0.79		
SI	0.16	0.12	0.28	0.82	
FC	0.20	0.20	0.16	0.03	0.84

Source: Authors compilations (2024)

In addition, the (Fornell & Larcker F., 1981), criterion was utilized to assess the existence of discriminant validity among the latent variables in the model. To ascertain discriminant validity according to the Fornell-Larcker criterion, it is necessary for the square root of the average variance extracted (AVE) for each construct to exceed the correlation with any other construct within the framework (Fornell & Larcker F., 1981). The results presented in Table 2 demonstrate that the assessment of discriminant validity yielded favorable outcomes, indicating strong construct validity and reliability. In this study, multicollinearity was assessed using the indicator, variance inflation factor (VIF). Table 1 reveals that the indicators in our regression model exhibit Variance Inflation Factor (VIF) values below the threshold of 5 (Kock, 2015), demonstrating the lack of substantial multicollinearity. This enables us to assertively interpret the distinct impacts of the predictors on the dependent variable and substantiates the dependability of our regression analysis.

Table 1. Measurement model: loadings, composite reliability, and convergent validity

Construct	Indicator	Cron. α	AVE	Loadings	VIF
Use behavior				0.96	1.00
Behavioral intention	BI1		0.54	0.91	2.92
	BI2			0.89	2.92
Effort expectancy	EE1	0.78	0.70	0.69	1.94
	EE2			0.92	
	EE3			0.85	
Performance expectancy	PE2	0.86	0.79	0.79	2.12
	PE3			0.77	2.27
	PE4			0.80	2.67
Facilitating condition	FC1	0.91	0.84	0.90	4.25
	FC2			0.81	2.77
	FC3			0.83	3.11
Social influence	SI1	0.89	0.82	0.76	2.4
	SI2			0.87	3.64
	SI3			0.84	2.70
Standardized root mean squared residual (SRMR)					0.11
Unweighted least squares discrepancy (d_{ULS})					1.72
Geodesic discrepancy (d_G)					0.91

Source: Authors compilations (2024)

Path Analysis

The analysis reveals the direct impact of the latent variable on the emerging variable. Initially, the positive and substantial influence of effort expectancy (β=0.573; p=0.008) in utilizing the Uzhavan application is observed in the behavioral intention of farmers. Furthermore, the performance expectancy (β=0.309; p=0.049) of the Uzhavan app, significantly affects the behavioral intention. Additionally, the behavioral intention (β=0.2477; p=0.087) influences the use behavior of farmers. Subsequently, the facilitation condition (β=0.539; p=0.045) significantly impacts the use behavior of the Uzhavan app by the farmers. As for the indirect effects, effort expectancy, performance expectancy, and social influence do not significantly affect the farmers' use behavior of the Uzhavan app. This demonstrates that the farmers' behavioral intention fully mediates between the three variables and the use behavior.

Table 3. The structural equation model

Direct Effect	Coef.	St. Err.	t-value	p-value	Status
BI ->UB	0.2477	0.1446	1.7125	0.0871	Accepted
EE-> BI	0.5738	0.2172	2.6417	0.0084	Accepted
PE->BI	0.3093	0.1571	1.9681	0.0493	Accepted
FC-> UB	0.5393	0.2694	2.0021	0.0455	Accepted
SI->BI	0.0465	0.1391	0.3343	0.7382	Rejected

Source: Authors compilations (2024)

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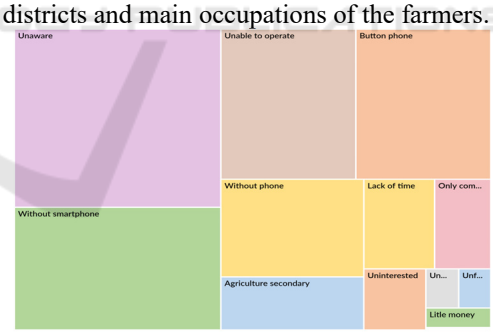
Figure 2. The path model estimation

Thematic analysis

The qualitative data were analyzed using Nvivo software. The first step was to classify the data, code each response, and then process of visualization of themes.

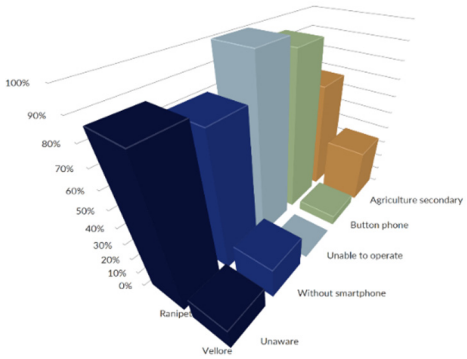
This study presented a word map, coding distribution by districts and main occupations of the farmers.



Source: Authors compilations (2024)

Figure 3: The reasons for non-use of the Uzhavan app

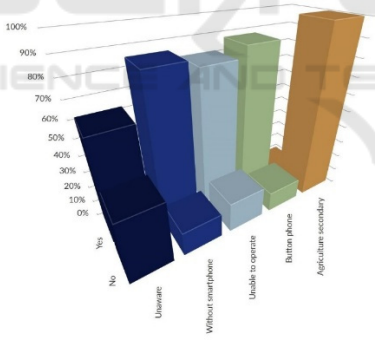
The map in Figure 3 presents a color-coded matrix of reasons why farmers may not use the Uzhavan app. Major factors include a lack of awareness about the app, an inability to operate smartphones, and the use of basic mobile phones. Other notable reasons were the absence of a phone, engaging in agriculture as a secondary occupation, time constraints, and financial limitations. The matrix also suggests that a lack of interest and other unspecified barriers contribute to the underutilization of the app among farmers.



Source: Authors compilations (2024)

Figure 4: The district-wise distribution of reasons for not using the app

Figure 4 displays the district-wise distribution of reasons for not using the Uzhavan app among farmers. The graph indicates that in the Ranipet district, the predominant reason is a lack of awareness, while in Vellore, the main issue is the absence of smartphones. Other reasons such as the use of basic mobile phones and the inability to operate smartphones are also represented, with varying degrees of prevalence across the districts. The category "Agriculture secondary" suggests that in the Ranipet district, farming is not the primary occupation, which may influence app usage.



Source: Authors compilations (2024)

Figure 5: The farmer category-wise distribution of reasons for not using the app

Figure 5 illustrates the percentage coverage of individuals for whom agriculture is the main occupation and their reason for not using Uzhavan. It is observed that farmers for whom the agriculture is main occupation are more unaware than the second group of farmers. This can be explained by the educational level which allows the second group to have additional activities. The next reason was the lack of access to smartphones which is largely observed in the farmers who have agriculture as primary activities. This might be due to the easy accessibility of smartphones through the additional income earned by the second group of farmers from activities other than agriculture.

5 DISCUSSION

This investigation examines the variables that impact the utilization behavior of farmers. The study reveals that the farmer's behavioral intention on the Uzhavan app is positively influenced by effort expectancy. Furthermore, the farmers' utilization of this app is characterized by low effort expended. Consequently, the utilization behavior of farmers is significantly influenced by performance expectancy. This can be attributed to the app's provision of pertinent and accurate information, daily market prices, and weather forecasts. However, the study finds that social influence does not have a significant impact on farmers' behavior. These findings are consistent with the research conducted by Sabbagh & Gutierrez (2022), which demonstrates that only effort expectancy and performance expectancy significantly influence the farmer's behavioral intention toward micro irrigation devices. Moreover, the study establishes that the farmer's behavioral intention fully mediates the relationship between effort expectancy and performance expectancy, and the utilization behavior of Uzhavan. Similar results were obtained by Omar et al. (2022), who found that the farmer's behavioral intention plays a mediating role in the utilization behavior of E-Agri finance apps by the farmers. However, the research conducted by Sun et al. (2021), suggested that effort expectancy, performance expectancy, and social influence directly impact the use behavior of the Internet of things. The social influence did not affect behavioral intention. The same result was found by Michels & Musshoff (2020) reported a non-significant relationship between social influence and farmers' behavioral intention to use the agri app in plant protection. The improvement of the use of the agri app can be done to make it easier to use, since the effort expectancy shows a positive influence, and then update regularly the app. Coming to the non-users of the Uzhavan app, the main reason is the lack of awareness of the app by farmers who have agriculture as their primary activity, and most of them don't have access to smartphones. By facilitating access to smartphones the use behavior of the Uzhavan app can be improved. The farmers can be assisted through short videos on the advantages and methods of using the Uzhavan app as suggested by Kumar et al., (2023).

6 CONCLUSIONS

This research study uncovers that farmers who utilize the Uzhavan app generally hold a positive perception of it. This positive perception stems from the farmers' belief in the app's user-friendliness and their expectations regarding its performance, which significantly influence their intention to use the app. Moreover, the availability of necessary conditions plays a crucial role in determining the actual usage of the app by farmers. However, it is worth noting from the qualitative analysis that the presence of facilitating conditions directly impacts farmers' usage behavior, and it was identified that some farmers do not possess smartphones; Consequently, access to smartphones would enable them to fully utilize the functionalities offered by the Uzhavan app. Additionally, through qualitative analysis, it was observed that certain farmers remain unaware of the Uzhavan app services, lack of access to smartphones, and lack of knowledge to operate it. To address this issue, it is recommended to develop concise videos that can be easily shared through platforms like WhatsApp and YouTube, thereby reaching a larger number of farmers to promote awareness. By understanding the importance of digital access and the functionalities of the e-Agriextension platform, all farmers can benefit from the technological advancements in agriculture.

As a recommendation, extension officials can strategize awareness initiatives supplemented with training sessions for farmers. Based on the findings, it is recommended that to enhance farmers' effort expectancy, the Uzhavan app should be rendered more comprehensible, with supplementary audio attributes for the farmers who are unable to read.

Further investigation can be conducted on the extent of influence of the digital tools in agriculture, especially the influence of the use of Uzhavan app on farmers' economic and profit efficiency.

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