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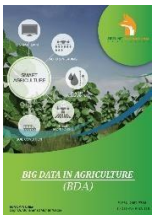

RESEARCH ARTICLE

ARE FARMERS USING MOBILE APPLICATION FOR AGRO-ADVISORY SERVICES: EVIDENCE FROM DEVCHULI MUNICIPALITY, NAWALPARASI EAST

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ABSTRACT

Mobile-based application, an important tool of Information Communication Technology (ICT) has become one of the integral parts of agro-advisory services in Nepal. This paper aims to explore the factors affecting the adoption of mobile-based applications for agro-advisory services in Devchuli Municipality Nawalpur. 96 farmers from 8 wards of the municipality were selected randomly and interviewed by using a semi structured close-ended questionnaire. Descriptive statistics, index score ranking method, and binary logistic regression model were used for data analysis. It was found that respondents use mobile applications to receive information on cultivation practice, plant protection, post-harvest, modern agriculture technology, market, weather forecast, and information regarding insurance, subsidy, and training. Age and year of schooling significantly affect the adoption of mobile-based applications. Mobile applications seem as one of the potent tools to strengthen the agro-advisory services in the municipality.

KEYWORDS

Adoption, Agriculture, Agro-Advisory, ICT, Mobile application.

1. INTRODUCTION

Agriculture is the mainstay of Nepalese economy. Agricultural development relies heavily on an effective agriculture extension system (Tamang et al., 2020). Due to insufficient extension personnel's and less extension coverage (MoAD, 2016), extension services provided by government and private sectors are not able to benefit the farmers as expected and with time, there emerged the concept of ICT based advisory services for delivery of extension service in Nepal (Paudel et al., 2018). Mobile based application has become one of the important ICT based tools employed on dissemination of information on agriculture technology and services. Scaling-up of modern ICT tools produces an avenue to use ICT in the dissemination of agriculture information (Singh and Aryal, 2023).

Most farmers lack access to a communications network that offers real-time updates on market trends and other issues (Patra, 2023). Development of mobile communication technology is bringing about a variety of chances for grassroots innovation and social empowerment in developing nations (Patra, 2023). A mobile based application is one platform where a farmer can get all the information and answers they require with just one swipe. Farmers' connectivity has shifted as a result of receiving agri-information via smartphone applications. Mobile applications make it possible to learn new approaches quickly and directly for boosting crop yields and increasing productivity in agriculture. The mobile platform is regarded as a novel and effective tool to reduce the digital divide as these platforms can empower villagers in structural, psychological, and resource dimensions, achieving political inclusion, social participation inclusion, and economic inclusion (Ye and Yang, 2020).

Nepal has 120.6% cellular mobile connection, 49.6% internet penetration and 43.5% social media users (NTA, 2023). Wide mobile coverage and radical change in information ecosystem ensure the equal access to knowledge and information and the confusion in farmers are being sorted out through adaptation of modern ICT tools (Regmi, 2016). In this vein, mobile applications also have enormous potential to reach the poorest of the poor and also address gender issues by equalizing access to information and services by women and men (FAO, 2019). Mobile based applications promote learning, which in turn can facilitate technology adoption among farmers and also revolutionize early warning systems through better quality data and analysis. On the other hand, policymakers can also benefit from increased information sharing, which allows them to gather a more complete overview of the situation on the ground in the country. With the rise of high-speed internet connections and web-enabled smartphones, mobile apps, social media, VoIP3 and digital engagement platforms have significant potential to improve access to information and services for those in rural areas. However, many small-scale farmers in developing countries remain isolated from digital technologies and lack the skills to use them (FAO, 2019).

Social networks can be strengthened and individuals are empowered through use of mobile. It provides a direct global communication channel to rural communities. It also helps in making local content, rural services more efficient, cost effective, reliable and timely communication channel in the context of markets, extension advice, monitoring, finances, health, etc. It provides multiple formats for information in one device and accessibility for illiterate users (i.e., voice and images). Several efforts are being made by government and private sector to leverage the potential of mobile based applications for sharing information related to farming technologies, livestock, pest, weather, market price and even interaction with prospective buyers. With the radical change in the information ecosystem through wide mobile coverage across the country, it has created space for more information and ICTs have been proved to be a significant indicator for development of different sectors including agriculture; where these technologies are acting to enhance agricultural production through the introduction of farm technologies (Das, 2016).

Therefore, this study will investigate how mobile based applications are used in agriculture extension and the major determinates of its adaption in Devchuli Municipality of Nawalpur.

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2. Materials and Method

2.1 Study area

The study was conducted on Devchuli Municipality of Nawalpur east of Nepal which is fostering on adoption of ICT in agriculture. The municipality covers the area of 112.72 square kilometers having 17 wards.

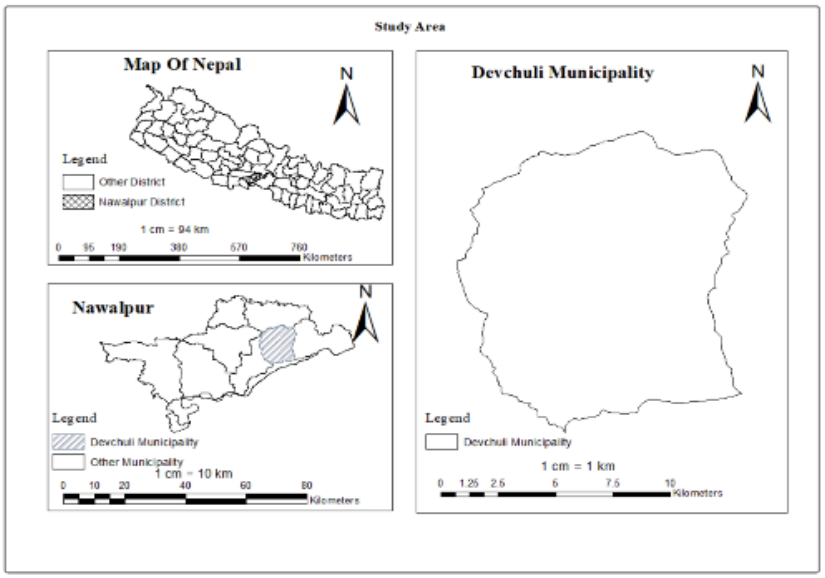

Figure 1: Map of the study area

2.2 Sampling technique

Sampling procedure helps to minimize the cost and provides acceptable results (Casley and Kumar, 1988). The quantity and quality of information obtained from the survey depends on the size of the sample and amount of variation (Scheaffer et al., 2012). Purposive sampling technique was employed to select the Devchuli Municipality as this local body was one of progressive municipality on agriculture in the district. Simple random sampling was followed to sample the farming household. The farmers registered in the agriculture section of the municipality was considered for sampling frame. The sample size was estimated using Taro Yamane formula (Yamen, 1968) shown in Equation (1) below.

$$n = \frac{N}{(1+Ne^2)} \quad (1)$$

Where, N is the population size, n is the sample size to be estimated, and e is the margin of error (Kept 10% in our study). Thus, the sample size was calculated to be: $n = \frac{1941}{1+1941*0.1^2} = 96$

This study was conducted in Aug-Dec 2022 covering 8 wards. The wards were purposively selected for this study. Farmers were randomly selected for interview from 8 wards and thus the total sample size consisting 96 farming households was used for the collection of data. Farmers from each sampled household were interviewed by administrating a pre-structured questionnaire.

2.3 Analysis tools

The socio-demographic information representing variables like the size of family, economically active population, education level, caste and size of holdings were analyzed by using descriptive tools such as frequencies, percentage and mean.

2.4 Logit model

The logistic model analyzes the binary or dichotomous response and allows examining how a change in any independent variable changes all the outcome probabilities (Gujarati, 2004). Logistic regression analysis was used to determine the important factors that affect the adoption of ICT tools. The dependent variables, adoption of ICT tools was binary (1 for the adoption of variables and 0 for otherwise) and were attributed to socio-economic independent variables i.e., sex, age, ethnicity, family size, education status, major occupation, annual income, training and farmer group. In this process marginal fixed effects were also calculated to determine the probability of different factors under study to determine the adoption of ICT tools.

If $Y_i=1$; P ($Y_i=1$) =P_i

Y_i =0; P (Y_i =0) =1-P_i

Where, P_i =E(Y=1/X) represents the conditional mean of Y given certain values of X.

The logistic transformation of the probability of the practicing adoption strategies by farmers were represented as follows

$Li = \ln [P_i/ 1-P_i] = Z_i = \beta_0 + \varepsilon_i$

Where, Y_i = a binary dependent variable (1, if for adoption of ICT tools, 0 otherwise), X_i includes the vector of explanatory variables used in the model, β_i = parameters to be estimated, β_0 = a constant term, ε_i= error term of the model, exp (e) = base of the natural logarithms, L_i =Logit and [P_i/ 1-P_i] = odd ratios for i= 1, 2, 3, 4…n farm households. Thus, the binary logistic regression model used in the study was expressed as:

$Y_i = f(\beta_i X_i)$ = f (sex, age, ethnicity, family size, education status, major occupation, annual income, training, famers group).

2.5 Indexing

Index score method is a tool to rank the problems based on index score obtained by the respective problem. This tool is used to rank preference ICT tools. Index score was calculated using the following formula:

$$\text{Score} = \frac{\sum Si*Fi}{N}$$

Where,

$\sum$ = summation

Si = score obtained

fi = frequency

N = total number of observations

Value of score ranged from 0 to 1. The option with the highest score was ranked first and the lowest score with rank last.

3. Result and Discussion

3.1 Socioeconomic profile

The socio-economic characteristics of the respondents is presented in Table 1. The data analysis reveals several key insights into the demographic and economic characteristics of the respondents. The average age of the respondents was 43.27 years, at the time of the survey. Respondents had an average of 9.17 years of schooling. The average total cultivated land area was 0.51 hectares, reflecting small-scale farming practices. The mean annual income was NRs. 7,32,917, with a high standard deviation of NRs. 8,65,016, suggesting a wide range of income levels among the respondents. The average number of family members was 5.79.

Table 1: Socioeconomic characteristics of the farmers of Devchuli Municipality

Variables	Mean	Standard Deviation
Age	43.27	13.27
Year of schooling	9.17	4.67
Total cultivated land area (ha)	0.51	0.40
Annual Income (NRs.)	7,32,917	8,65,016
Family Members	5.79	2.37

The study categorized the respondents into two age groups: youth and adults. Youth were defined as individuals between the ages of 16 and 40, while adults were those above 40 years old. The data revealed that 38% of the total observations were youth, while 58% were adults. Regarding household head gender, the majority were male (76.04%), with female-headed households accounting for 23.96%. In terms of primary occupation, 79.17% of respondents were engaged in agriculture, while 20.83% were involved in non-agricultural businesses. Additionally, 25% of respondents were members of various local groups and organizations, while only 26.04% received agriculture training from public and private sectors.

Table 2: Age group of the respondents at the study area

Age Group	Frequency	Percentage
Youth	38	39.58
Adult	58	60.42
Gender		
Male	73	76.04
Female	23	23.96
Primary Occupation		
Agriculture	76	79.17
Non-Agriculture	20	20.83
Involvement in Organization		
Yes	24	25.00
No	72	75.00
Training		
Yes	25	26.04
No	71	73.96

3.2 Type of mobile applications used by respondents

It was found that most of the farmers (63%) used agriculture mobile apps from private sectors. And least farmers only 8% of respondents used mobile application from NG0s sector and 29% of farmers used mobile application from government sectors.

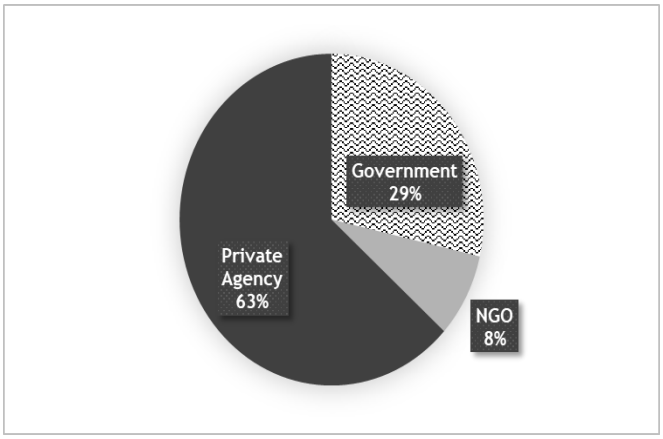

Figure 2: Type of Mobile Applications used in the study area

3.3 Frequency of mobile applications use by farmers

Among the farmers who used mobile application as a source of agriculture information, it was found that most of the farmers (56.60%) used the mobile application daily and 24.53% of farmers used the mobile applications randomly.

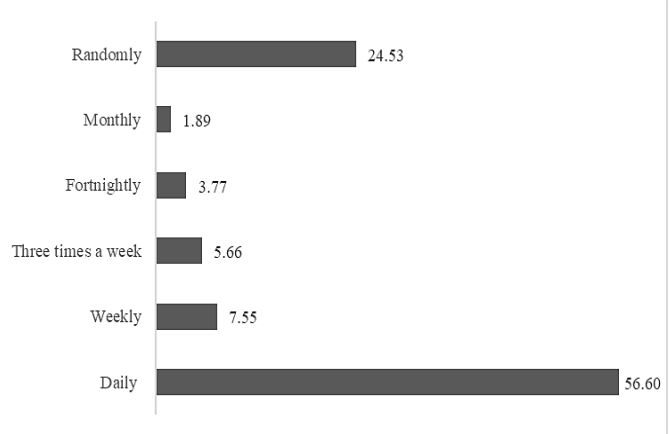

Figure 3: Frequency of Mobile Application used by farmers

3.4 Areas of application

Mobile based application was found more useful to get information about cultivation practice (48.95%) and least used for post-harvest (20.83%). Furthermore, farmers were also using mobile based application to get information on plant protection (32.29%), insurance, subsidy and training (26.04%), market (38.54%), modern agriculture technology (28.125%) and weather forecast (31.25%).

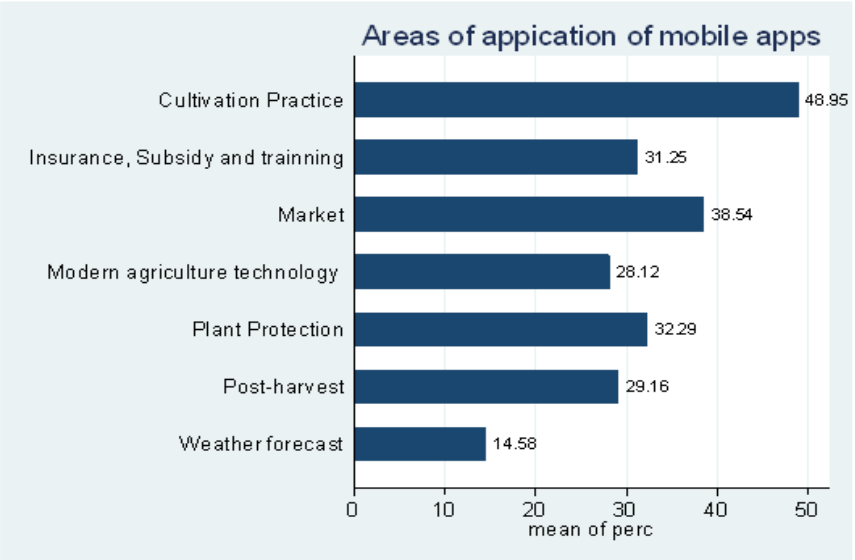

Figure 4: Application areas of Mobile based application in Devchuli Municipality

3.5 Factors affecting adoption of mobile based application for agro-advisory services

The logistic regression model was statistically significant with x^2 value 90.43 at p value <0.000. The model explained 70 % of the variance in the adoption of mobile application as per pseudo R^2. It was found that the age of the respondents significantly affects the adoption of mobile based application negatively at year of schools had positive influence on adoption. Keeping other things constant with the one-year increase in the age of the respondents, the probability of adoption of the mobile based application decreases by 4 % and was significant at 1% level of significance. Similarly, one year increase in the year of schooling increases the probability of the adoption of mobile based application by 9 % and was significant at 5% level of significance keeping other things constant.

Table 3: Factors affecting adoption of mobile based application for agro-advisory services in Devchuli Municipality

Variables	Coefficient	Standard Error	P> z	dy/dx	Standard Error
Age	-0.21***	0.08	0.009	-0.04	0.01
Gender	2.00	1.43	0.16	0.42	0.29
Ethnicity	0.28	0.95	0.76	0.05	0.19
Family Size	0.18	0.25	0.46	0.03	0.05
Primary Occupation	1.04	1.09	0.34	0.18	0.17
Year of Schooling	0.44**	0.22	0.04	0.09	0.04
Cultivated Land	-0.02	0.03	0.45	-0.005	0.007
Annual Income	-0.000000185	-0.00000088	0.22	-0.000000185	0.00
Trainning	0.94	1.17	0.42	0.21	0.27
Farmers Group	1.34	1.11	0.22	0.3	0.24
Constant	0.05	5.45	0.99		
Number of obs.	96				
LR chi^2 (9)	93.43				
Prob>chi^2	0.000				
Pseudo R^2	0.70				
Log likelihood	-19.8				

3.6 Constraints of mobile application adoption in agriculture

The different problems in the adoption of mobile application were accessed among farmers using index score method. The reasons were ranked from 1 to 5. Lack of digital awareness was found to be the major impediment for the adoption of mobile application among farmers. It was followed by constraints like, language barrier, less confidence on information provided by mobile based application, limited two way communication and complexity in use of mobile application and poor internet communication as shown in the table 4.

Table 4: Constraints on adoption of mobile application in agro-advisory service in Devchuli Municipality

Reasons	Score	Rank
Lack of digital awareness	0.765	I
Language barrier	0.746	II
Less confidence in information on mobile application	0.682	III
Limited two way interaction and complexity on use	0.654	IV
Poor internet connections	0.582	V

3.7 Discussion

The major areas on mobile based application in agro-advisory services were cultivation practice, plant protection, post-harvest, modern agriculture technology, market, weather forecast, insurance, subsidy, and training. Similar finding resulted by some of the research. A study reported smartphones and mobile networks can be used for live market feeds, SMS marketing, supply of practical information, forecasting. With smartphones, internet services, mobile networks widespread all over the country, they can prove to be a promising means for dissipation of information in rapidly altering and modernizing farming system of Nepal (Paudel et al., 2018). ICTs have been facing the problems of sustainability, affordability, ease of use, accessibility, scalability and availability of relevant content in appropriate language (Saravanan, 2010), though the effective accessibility, applicability and delivery of content might increase the ICT use by farmers which might be significant for enhancing agriculture (Singh, 2014).

Age has negatively associated with the adoption of mobile application. This is possibly because with increase in age, farmer's learning behavior relatively decrease, and their risk-taking ability get decreases in the succeeding year of age and prefer the easiness and comfort which might hasten the learning and adoption behavior. Mishra et al. (2020) report that one unit increase in age decreases the probability of adoption by 1.1 percent. In the study area there were positive association between year of schooling and adoption of mobile based application. Mishra et al. (2020) reports that one year increase in year of schooling will decreases probability of adoption by 2.6 percent although this is not true in the study area. Aryal and Singh (2023) reports there was positive association between year of schooling and adoption of ICT in agriculture extension but they were weekly correlated.

Lack of digital awareness, lack of language barrier, less confidence on information provided by mobile based application, limited two-way communication and complexity` in use of mobile application and poor internet communication were constraints in adoption among farmers. The some of the research cites language barriers, technological complexity, and unfriendliness to farmers as barrier to farmers using ICT including mobile based application. Aryal and Singh (2023) reports complexity in use, lack of idea, knowledge and awareness, limited interaction on service provision, lack of user-friendly mobile application as some of the impediments in the adoption of ICT in agriculture extensions.

4. Conclusion

Our study aims to determine the use of mobile based applications in agro-advisory services and identify the major determinants of its adaptation. From the findings of the study, we can draw the three major conclusions (i) the major area on mobile based application in agro-advisory services were cultivation practice, plant protection, post-harvest, modern agriculture technology, market, weather forecast, insurance, subsidy, and training, (ii) the year of formal education and the age of respondents were major determining factor on the adoption of mobile based application, (iii) lack of digital awareness were major impediments of adoption of mobile based application on agro-advisory services. Hence this fact should be taken as an input for policy formation of mobile application in agriculture extension in local bodies to strengthen the agriculture.

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