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The Extent Contribution of Independent Variables to the Knowledge and Adoption of Mobile Agro-advisory Services by the Farmers in Udupi District of Karnataka State of India

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Authors' contributions

This work was carried out in collaboration among all authors. Author Navinkumar designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author BD and managed the analyses of the study. Author THR managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The study was conducted during 2016-17 in Udupi district of Karnataka state of India. The farmers who are registered for mobile agro-advisory services for receiving all agricultural information through SMS were considered as a target group for the study. There were 4000 registered Agro-met Advisory users and 1400 registered users in KVK. Among those registered farmers 40 farmers from each existing three taluks *viz.* Udupi, Karkala & Kundapur were selected as respondents for the study. Thus the sample size of the study comprises of 120 respondents. The contribution of selected

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independent variable with the knowledge and adoption were analysed. It could be observed from the results that, 'F' value (6.412) obtained was significant at one per cent level of significance indicating that all the independent variables put together contributed significantly to the variation in the extent of the knowledge level of the farmers. The coefficient of determination (R^2) was 0.5316, which revealed that the variation in the extent of knowledge about mobile messages by the farmers was together explained by all the independent variables selected for the study. It could be observed from the results that, 'F' value (5.160) obtained was significant at one per cent level of significance indicating that, all the independent variables put together contributed significantly to the variation in the extent of adoption of mobile agro-advisory services by the farmers. The coefficient of determination (R^2) was 0.408, which revealed that the variation in the extent of adoption of mobile agro-advisory services by the farmers was together explained by all the independent variables selected for the study. Hence, the present study helps the Krishi Vignan Kendras (KVKs) and Government for further improvement in providing mobile agro-advisory services to the farming community.

Keywords: Mobile; regression; knowledge; adoption; significance.

1. INTRODUCTION

The rapid development and increasing global distribution of new information and communications technologies such as the internet, email and mobile phones have transformed the way economies operate and the way individuals, societies and states interact with each other. ICT is an essential instrument when it comes to reducing poverty, rural development, driving social and economic development and supporting democracy and good governance, education and health care. It enables better access to knowledge for sustainable development and opens up new ways of involving a large population in decision-making processes. Mobile phone technology, in particular, has brought about lasting change and has transformed ICT in developing countries into a highly dynamic sector. The dissemination of ICTs in developing countries provides much opportunity to transfer knowledge and information by private companies and government departments. Use of ICTs in agricultural extension services, particularly the use of mobile phone services, helps in providing information on the market, weather, transport and agricultural techniques. ICT could play an important and potential role in increasing the reach to agricultural extension. In terms of India where farmers explore the use of a voice message to provide interactive access to appropriate and timely agricultural/ horticultural knowledge and information from experts by use of mobile phones. Now, mobile phones are being adopted by rural communities in India to get knowledge and information about agriculture as well as weather disaster. Knowledge and innovation are being widely regarded as key drivers of economic growth and with the clarity that ICTs are deeply involved in knowledge flow and innovation. Access to appropriate information and knowledge is an overriding factor for successful natural resource management (NRM) planning, implementation and evaluation processes, and it is known to be one of the most important determinants of agricultural productivity. Some of the problems in the adoption of mobile agro-advisory services such as lack of practical exposure, followed by, incomplete messages, clarification is difficult if any doubt arises. Hence, the study was conducted in Udupi District of Karnataka State. The farmers, who were receiving agricultural messages to their mobile phones in Udupi District, constitute the population of the study. The KVK and ZAHRS Udupi has regularly send the voice messages to the registered farmers about whether forecasted information (Temperature, Rainfall, wind speed and wind direction, Relative Humidity etc.), new technologies, training and other extension participation activities and all other agricultural information. Therefore, the research had been carried out to know the extent contribution of selected independent variables to the knowledge and adoption of mobile agro-advisory services by the farmers of Udupi District of Karnataka.

2. METHODOLOGY

The study was conducted during 2016-17 in Udupi district of Karnataka. The farmers, who were receiving agricultural messages to their mobile in Udupi District, constitute the population and target samples for the study. The farmers those who had already registered their mobile

number for availing agricultural information through Agro meterology centre, ZAHRS and KVK Brahmavar and any other source of information related to agriculture and allied information receivers were served as respondents for the study. There were 4000 registered Agro-met Advisory users and 1400 registered users in KVK. Using simple random sampling technique forty farmers from each existing three taluks *viz.* Udupi, Karkala & Kundapur were selected as respondents for the study. Thus the sample size of the study comprises of 120 respondents. In the present study, Ex-post-facto research design was employed, because the phenomenon had already occurred and the researcher does not have any control over independent variables. Considering the objectives of the study, knowledge and adoption were considered as dependent variables and age, education, family type, occupation, landholding, annual income, scientific orientation, extension contact, extension participation, mass media participation, innovative proneness, achievement motivation and risk orientation were considered as independent variables. A draft interview schedule and questionnaire in which various knowledge and adoption of mobile agro-advisory services related questions were framed. The schedule was distributed to agricultural extension experts and the modifications suggested were incorporated. The modified instrument was pre-tested in a non-sample area. In the light of pre-testing, necessary changes were incorporated. The data was collected with the help of pre-tested structured interview schedule. The researcher personally visited the respondent farmers to obtain the data. The respondents were assured of the secrecy of the data and were encouraged to give unbiased answers. The collected data were analysed multiple regression of selected dependent and independent variables by using the SPSS software.

2.1 Operationalization and Measurement of the Dependent Variable

The details of operationalization of dependent variables selected for the study and their measurement are given in the succeeding paragraphs.

2.1.1 Knowledge

The “Teacher made test” suggested by Anastasi (1961) [1] was employed to measure the knowledge level of respondents. All the important information sending to farmers through messages were listed separately in consultation with the experts. The questions and answers were carefully framed. The answers elicited from the farmers were quantified by giving ‘1’ score to correct and ‘0’ to wrong answers.

Based on the response obtained, the knowledge level was quantified by using frequency and percentage.

2.1.2 Adoption

It refers to the adoption of information sent to the farmers through mobile messages. All the important operation messages were listed. A total number of 45 questions were listed by consulting with experts and were quantified, by giving ‘2’ score to full adoption,’1’score to partial adoption and ‘0’score to non-adoption.

Based on the responses obtained, the adoption level was quantified by using frequency and percentage.

2.2 Operationalization and Measurement of Independent Variables

2.2.1 Age

Age is the basic characteristic related to a person's maturity, physical wellbeing and motivation which may influence on adoption. Age is operationalized and measured as the completed years in the life of respondents at the time of interview. The respondents were classified into young, middle and old based on age in years using general classification.

Category	Age in years
Young	<35
Middle	36 to 50
Old	>50

2.2.2 Education

It is the process of producing the desirable changes in the behaviour of an individual. It refers to the number of years of formal education acquired by the respondents. In this study scale developed by Trivedi [2] was used with slight modifications to measure the educational status. The scoring pattern was as follows:

Level of education	Score
Illiterate	0
Primary School	1
Middle school	2
High School	3
Pre-University College	4
Graduate and above	5

2.2.3 Family type

This is referred to the two way classification of a family as a single or joint family. Joint family system is the representative family type in rural India, which believed in cooperative living and shared responsibilities. To analyze this variable, scores of 1 and 2 are given to nuclear family and joint family respectively.

Type of family	Score
Nuclear family	1
Joint family	2

2.2.4 Occupation

Occupation means the activity undertaken for deriving income required for the livelihood. Occupation of the farmers was one from which a family derived the maximum share of annual income. For scoring this variable, the scale developed by Pareek and Trivedi [3] was used with little modification.

Category	Scores
Agriculture / Horticulture	1
Agriculture+ Animal husbandry	2
Agriculture+ Labour	3
Agriculture+ Business	4
Others	5

2.2.5 Landholding

It refers to the number of acres of land possessed by the farmer. The criteria prescribed by the Karnataka Land Reforms Act 38 to 1966 (Part-B) 99 and 1995-96 under sections 2(a) 32 was adopted whereas one acre of irrigated or garden land was equated to 3 acres of dry land.

Categories	Area (in acres)
Marginal	up to 2.50
Small	2.51 to 5.00
Medium	5.01 to 10.00
Big	Above 10.00

2.2.6 Annual income

Annual income refers to the total income earned by the respondent both from farming and off-farm employment in a year. The actual income obtained by the respondents was considered for the analysis. The respondents are categorized into three groups based on mean and standard deviation.

Category	Score
Low < (Mean - SD)	<38613.78
Medium (Mean ± SD)	38613.78-196886.22
High > (Mean + SD)	>196886.22

2.2.7 Scientific orientation

This referred to the degree to which a respondent is oriented to the use of scientific methods in decision making.

The scientific orientation of individual was measured with the help of a scale developed by Supe [4] with slight modification. The scale consists of six statements, in which the first five were positive statements and last one was a negative statement. The responses for each statement were rated on a five-point continuum namely, strongly agree, agree, undecided, disagree and strongly disagree with the scores of 4,3,2,1 and 0 for positive statements and 0,1,2,3 and 4 for negative statements respectively. The maximum score an individual could obtain on this scale was 24 and minimum was zero. Further, the respondents were grouped into three categories taking mean and standard deviation as measures of check and result were expressed in frequency and percentage.

Category	Score
Low < (Mean - SD)	<15.71
Medium (Mean ± SD)	15.71-21.49
High > (Mean + SD)	>21.49

2.2.8 Extension contact

Contact with extension agents/personnel refer to the degree to which an individual was having contact with extension personnel for getting information on mobile agro-advisory services and other agriculture-related information. This variable was measured in terms of frequency of contact of an individual with different extension agencies. The scoring procedure followed by Byrareddy [5] was adopted with slight modification. Further, the respondents were categorized into three categories taking mean and standard deviation as measures of check and result were expressed in frequency and percentage.

Category	Score
Low < (Mean - SD)	<2.40
Medium (Mean ± SD)	2.40-17.37
High > (Mean + SD)	>17.37

2.2.9 Extension participation

It is the degree to which the respondents participated in different extension activities like training, meeting, demonstration etc. The scoring pattern followed by Rattaiah [6] was used *i.e.,* 2, 1, 0 were assigned to Regular, Occasional and Never participation in extension activities respectively. Further, the respondents were categorized into three categories taking mean and standard deviation as measures of check and result were expressed in frequency and percentage.

Category	Score
Low < (Mean - SD)	<4.70
Medium (Mean ± SD)	4.70-9.62
High > (Mean + SD)	>9.62

2.2.10 Mass media participation

Mass media use refers to the extent to which the farmer is exposed and uses the different mass media channels of communication such as Newspaper, Farm Magazines, Farm Radio programmes, Television and Mobile sets. The procedure suggested by Trivedi [2] was followed with slight modification. The participation/utilization was sorted under three columns. *viz*. 'Regular', 'Occasional' and 'Never' will get a score of 2, 1 and 0 respectively. Based on the mean and standard deviation, the respondents are classified and placed under low, medium and high Mass Media utilization categories.

Category	Score
Low < (Mean - SD)	<5.65
Medium (Mean ± SD)	5.65-11.00
High > (Mean + SD)	>11.00

2.2.11 Innovativeness

It is the degree, to which a farmer is eager in adopting the innovation early in his field.

In this study the farmers' innovation proneness was measured by using scale constructed by Moulik and Rao [7] with slight modification. The scale consists of five statements, out of five statements number 1, 4, 6 and 7 were positive statements numbers and 2, 3 and 5 were negative statements. The response for each statement was rated on a five-point continuum *viz*., strongly agree, agree, undecided, disagree and strongly disagree with the score of 5,4,3,2 and 1 for positive statements and 1, 2, 3, 4 and 5 for negative statements. The maximum and minimum scores varied from 7 to 35 respectively. Further, the respondents were grouped into three categories using mean and standard deviation as a measure of check.

Category	Score
Low < (Mean - SD)	<22.95
Medium (Mean ± SD)	22.95-28.14
High > (Mean + SD)	>28.14

2.2.12 Achievement motivation

It refers to striving to do good work with a standard of excellence which may be task-related, self-related. The variable was measured by the scale developed by Reddy [8]. The scale consisted of seven statements to be rated on a five-point continuum namely strongly agree, agree, undecided, disagree and strongly disagree with the score of 5,4,3,2 and 1, respectively. The minimum and maximum scores varied from 7 to 35 respectively. High score revealed higher achievement motivation of the respondents. Based on the score obtained, the respondents were grouped into three categories using mean and standard deviation as a measure of check.

Category	Score
Low < (Mean - SD)	<21.63
Medium (Mean ± SD)	21.63-26.70
High > (Mean + SD)	>26.70

2.2.13 Risk orientation

Risk orientation was operationalised as the degree to which a farmer is oriented towards risk and uncertainty and has the courage to face the problems in farming.

Risk orientation was measured with the help of risk orientation scale developed by Supe [4]. This scale includes six statements, out of which number 2, 3, 4 and 6 are positive statements while number 1 and 5 are negative statements. The respondents for each statement are rated on a five point continuum, namely, strongly agree, agree, undecided, disagree and strongly disagree with the scores of 5,4,3,2 and 1 for positive statements and 1,2,3,4 and 5 for negative statements, respectively. The maximum

score an individual could obtain on this scale was 36 and minimum was six. Further, the respondents were categorized into three categories taking mean and standard deviation as measures of check and result were expressed in frequency and percentage.

Category	Score
Low < (Mean - SD)	<18.73
Medium (Mean ± SD)	18.73-23.76
High > (Mean + SD)	>23.76

2.2.14 Multiple regression analysis

Generally, a number of antecedent variables simultaneously contribute or influence the consequent variable as in the case under study. It is of immense practical value to the extent to which the antecedent variables, individually or jointly could predict or contribute towards the consequent variable. This can be seen by multiple regressions. If Y is the dependent variable and x_1, x_2, x_3……x_n are the independent variables, the multiple regression equation is given by:

$$Y=a+b_1x_1+b_2x_2+\ldots\ldots\ldots\ldots+b_nx_n$$

Or

$$Y=a+\sum b_nx_n$$

Where,

a = Intercept constant
b_1, b_2, b_3,……b_n are the partial regression co-efficient.

3. RESULTS AND DISCUSSION

3.1 Contribution of Socioeconomic and Psychological Characteristics of the Respondents with their Knowledge

Multiple regression analysis was carried out to determine the extent of the contribution made by the independent variables and to identify those variables which contribute significantly towards the variation in the extent of knowledge of the farmers. The results of the multiple regression were presented in Table 1.

It could be observed from the results that, 'F' value (6.412) obtained was significant at one per cent level of significance indicating that all the independent variables put together contributed significantly to the variation in the extent of knowledge level of the farmers. The coefficient of determination (R^2) was 0.5316, which revealed that the variation in the extent of knowledge about mobile messages by the farmers was together explained by all the independent variables selected for the study.

The result presented in Table 1 revealed that three characteristics of the farmers out of thirteen variables *viz.,* age, education and innovativeness found to be significant in explaining the variation in their knowledge level. It is referred that increasing unit of these variables results in turn increase in level of Knowledge of the respondents. Hence, these variables could be considered as good predictors of knowledge the farmers. The value of coefficient of determination (R^2 = 0.5316) indicated that all the thirteen variables together explained 53.16 per cent of the variation in the knowledge level of respondents. Since, 53.16 per cent of the variation could be explained in the present study by thirteen variables. It implied that other unidentified variables are contributing to the knowledge level farmers. The 'F' value was found to be significant at 0.01 level of probability. The probable reason for majority of the farmers was under young age might be that most of the old age people are not able to use mobile phones. Another reason may be young age farmers are enthusiastic and have more use of mobile phones for getting information related to agriculture and allied activities. In the present scenario, almost everybody is found to be literate due to the awareness brought by the government on the importance of education. As Udupi district farmers are highly educated, they can use the electronic gadgets and information available from various sources including KVKs and other concern departments. The farmers are receptive to any of the technological breakthrough in terms of crop production for higher returns. Also, the level of education of the respondents helped them to understand and try new technologies which are disseminated to them.

3.2 Contribution of Socioeconomic and Psychological Characteristics of the Respondents with their Adoption

Multiple regression analysis was carried out to determine the extent of the contribution made by the independent variables and to identify those variables which contribute significantly towards the variation in the extent of adoption of mobile agro-advisory services by the farmers. The results of the multiple regression analysis were presented in Table 2.

Table 1. Contribution of socioeconomic and psychological characteristics of the respondents with their knowledge

(n=120)

Category	Regression coefficient (b)	Standard error	t-value
Age	.063	.018	3.496**
Education	.310	.159	1.954*
Family type	.196	.334	.587
Occupation	.227	.313	.725
Land holding	-.270	.197	-1.374
Annual income	2.220E-6	.000	1.978
Scientific orientation	-.043	.054	-.802
Extension contact	.051	.056	.906
Extension participation	.028	.071	.386
Mass media participation	.019	.072	.261
Innovativeness	.118	.072	1.652*
Achievement motivation	.048	.084	.575
Risk orientation	.014	.073	.187
R^2 = 0.5316			F= 6.412**

** Significant at 5% level of probability* *** Significant at 1% level of probability*

It could be observed from the results that, 'F' value (5.160) obtained was significant at one per cent level of significance indicating that, all the independent variables put together contributed significantly to the variation in the extent of adoption of mobile agro-advisory services by the farmers. The coefficient of determination (R^2) was 0.408, which revealed that the variation in the extent of adoption of mobile agro-advisory services by the farmers was together explained by all the independent variables selected for the study.

The Table 2 revealed that five characteristics of farmers out of thirteen variables *viz.,* age, education, annual income, extension contact and extension participation was found to be significant in explaining the variation in their adoption level mobile agro-advisory services. It is referred that increasing unit of these variables results in turn increase in level of adoption of the respondents. Hence, these variables could be considered as good indicators of adoption by the farmers. The value of co-efficient of determination (R^2 =0.408) indicated that all the thirteen variables together explained 40.80 per cent of the variation in the adoption. Since 40.80 per cent of the variation could be explained in the study by thirteen variables. It implied that there are other unidentified variables were also

Table 2. Contribution of socioeconomic and psychological characteristics of the respondents with their adoption

(n=120)

Category	Regression coefficient (b)	Standard error	t-value
Age	.230	.063	3.643**
Education	1.040	.396	2.624*
Family type	.848	1.086	.781
Occupation	-.484	1.210	-.400
Land holding	.191	.821	.232
Annual income	8.209E-6	.000	1.819*
Scientific orientation	.209	.158	1.325
Extension contact	.165	.070	2.362*
Extension participation	.477	.221	2.164*
Mass media participation	.052	.220	.236
Innovativeness	.447	.261	1.711
Achievement motivation	.634	.460	1.379
Risk orientation	-.260	.446	-.583
R^2 = 0.408			F= 5.160**

** Significant at 5% level of probability* *** Significant at 1% level of probability*

contributing to the adoption level of mobile agro-advisory services by the farmers. The 'F' value was found to be significant at 0.01 level of probability. The probable reason might be that the farmers are growing commercial crops along with agriculture and dairying so they are getting better income in agriculture and allied activities. An assured rainfall and irrigation facilities motivated the respondents to grow multiple crops in areca nut and coconut-based cropping system as a result of which farmers had better income. The probable reason for this type of result might be due to, their eagerness in solving their cultivation problems with extension workers and also interest in extension activities to gather recent information. The other reason could be that the extension workers credibility to attract the farmers towards them. In participating in the extension activities to gather the latest information and to learn about ICT tools from extension workers.

4. CONCLUSION

The value of the coefficient of determination (R^2 = 0.5316) indicated that all the thirteen variables together explained 53.16 per cent of the variation in the knowledge level of respondents. Since, 53.16 per cent of the variation could be explained in the present study by thirteen variables. It implied that other unidentified variables are contributing to the knowledge level farmers. The 'F' value was found to be significant at 0.01 level of probability. The value of co-efficient of determination (R^2 = 0.408) indicated that all the thirteen variables together explained 40.80 per cent of the variation in the adoption. Since 40.80 per cent of the variation could be explained in the study by thirteen variables. It implied that there are other unidentified variables were also contributing to the adoption level of mobile agro-advisory services by the farmers. The knowledge and adoption of mobile agro-advisory services by the farmers depend on many independent variables *Viz.,* Age, Education, Extension contact, Extension participation, Innovativeness etc. In the present study, the farmers were young therefore they were much innovative than the old age grouped farmers and they can easily operate the mobile and access all the information sent by the KVK and ZAHRS related to agriculture. The farmers were having more extension contact and participation, this leads to the farmers to gain more information about farming. Concerning the study, we recommend the results to policy makers, KVK and ZAHRS scientists and government line department for further modification in sending agricultural information and technologies through mobile agro-advisory services for the betterment of farming community.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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