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Understanding the relationship and determinants of farmers knowledge on ICT in agriculture

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Abstract
Information Communication Technology (ICT) encompasses a wide range of services and technologies crucial for economic development, particularly in agriculture and rural areas. Mobile phones are widely utilized by farmers for communication and accessing agricultural information, including market prices and advisory services. Despite its benefits, barriers to adoption persist, such as lack of training and infrastructure. Nonetheless, ICT plays a significant role in advancing human civilization, utilizing various technologies like computer programs and communication networks. Against this backdrop, a study was conducted in Karnataka to explore the relationship and determinants of farmers' knowledge on ICT in agriculture. The result revealed that, Educational status, Information seeking behavior, Extension agency contact, Mass media exposure, Innovativeness, Possession of modern electronic gadgets, and Internet usage displayed positive and significant associations with knowledge at a one percent level. R^2 value was 0.486 which indicated that 48.60 percent variation in the knowledge was explained by the given fourteen independent variables and remaining 51.40 percent of the variation in dependent variables unexplained.

Keywords: Determinants, ICT, knowledge and relationship

Introduction
Information Communication Technology (ICT) is a comprehensive term encompassing a diverse array of services, applications, and technologies, facilitated through various types of equipment and software. These tools are increasingly recognized as pivotal for the economic development of nations. The information is vital for development of agriculture and wellbeing of the rural masses. The fact has been well recognized in the form of a number of initiatives taken to disseminate information on agriculture and related aspects by government, non-government, private and co-operatives. Mobile phones were found as the most widely accessed tool among the farmers for communication and for accessing agriculture-related information particularly for the marketing of produce. Researchers also reported that, Majority (71.70 %) of the respondents were aware of mobile advisory services by APMC (Agricultural Produce Market Committee) in regardof agricultural commodity prices and market for the various commodities and Almost two-thirds (65.00 %) of the respondents were aware of KCC service. (Manjuprakash *et al*., 2017) [4].

Further, it was also reported that, more than half (53.30 %) of the respondents comprehended that ICT are potentials in agricultural sectors. The reason might be due to that government and corporate sectors are in to cyber extension service mode by developing various apps to support agriculture and allied sectors. The enormous growth of ICT renders great support to the farmers in decision making. ICT could also help to manage resources effectively through resource management system. Farmers felt that ICT could be imbibed to implement precision farming successfully through various technologies like GPRS, sensors, remainders, forecast and warnings. (Manjuprakash *et al*., 2020) [3]. Syiem and Raj (2015) [7] reported mobile as the most frequently used ICT. According to them, the Mobile phones were widely used by the farmers for social communication, contacting middle men for the marketing of produce and contacting experts on real time basis for getting agricultural advisories. Major barriers for adoption of ICT based extension services were lack of training, poor infrastructural development and poor network connectivity. (Nagesh and Saravanan, 2019) [6].

However, ICT has a significant impact on the advancement and growth of human civilization. Computer programmes, databases, communication networks, analysis and design methodologies, programming languages, artificial intelligence, knowledge bases, etc. are some of the technologies utilized in ICT. (Dutta and Anand 2023) [5]. In this background, the current investigation was made in Karnataka to understand the relationship and determinants of farmers' knowledge on ICT in agriculture.

Research Methodology

Koppal district in Karnataka as the focal point of this study was selected deliberately. The study covered four blocks within the district viz., Koppal, Gangavathi, Kustahi, and Yalaburga. A sample of 120 respondents was chosen using a multi-stage random sampling technique, with 15 individuals selected from two villages in each of the four blocks. An ex-post facto design was adopted to meet the research objectives. Primary data collection involved the use of a pre-tested and comprehensive interview schedule. Subsequently, data analysis and interpretation were conducted using computer-based statistical software, specifically the Statistical Package for Social Sciences (SPSS). Statistical techniques such as correlation analysis, multiple regression analysis, and stepwise multiple regression analysis were applied to analyze and interpret the data.

Results and Discussion

Relationship of Independent Variables towards Knowledge

The findings presented in Table 1 indicate that, among the fourteen variables examined, seven displayed a positive significant relationship with knowledge. Educational status (X_2), Information seeking behavior (X_5), Extension agency contact (X_6), Mass media exposure (X_8), Innovativeness (X_9), Possession of modern electronic gadgets (X_{11}), and Internet usage (X_{12}) exhibited positive and significant associations with knowledge at a one percent level of probability. Conversely, Farming experience (X_4) showed a negative significant association, while Attitude towards e-media (X_{13}) displayed a positive significant association with knowledge at a five percent level of probability.

The negative significance of farming experience towards knowledge could be attributed to the farmers' extensive experience and older age, which might hinder their adoption of ICT and mobile phone usage due to their attachment to conventional information access methods. They may also prefer personal interaction with extension agencies over ICT interventions. On the other hand, Age (X_1), Occupational status (X_3), Social participation (X_7), Computer training undergone (X_{10}), and Perception of mobile phone in farming (X_{14}) showed non-significant relationships with knowledge.

Table 1. Relationship of independent variables towards knowledge

(N=120)

Variable No.	Variables	'r' value
X_1	Age	-0.106^{NS}
X_2	Educational status	0.569**
X_3	Occupational status	-0.143^{NS}
X_4	Farming experience	-0.184*
X_5	Information seeking behavior	0.575**
X_6	Extension agency contact	0.349**
X_7	Social participation	-0.025^{NS}
X_8	Mass media exposure	0.297**
X_9	Innovativeness	0.314**
X_{10}	Computer training undergone	0.047^{NS}
X_{11}	Possession of modern electronic gadgets	0.271**
X_{12}	Internet usage	0.626**
X_{13}	Attitude towards e-media	0.523*
X_{14}	Perception of mobile phone in farming	0.096 ^{NS}

Educational status exhibited a positive and significant association with knowledge at one percent level. Individuals with higher levels of education tend to actively seek out the latest information through various channels, thus contributing to their enhanced knowledge levels.

Conversely, farming experience displayed a negative significance at the five percent level towards knowledge level. As farming experience increases, farmers typically age, and their reliance on traditional information sources like friends and relatives becomes more pronounced. Consequently, they may have lower knowledge levels regarding ICT tools.

Information seeking behavior demonstrated a positive significance at the one percent level towards knowledge. Farmers, in their quest for information, are inclined to explore modern ICT tools as a means of obtaining relevant information, thereby contributing to their knowledge acquisition process.

Extension agency contact showed a positive significance at the one percent level towards knowledge. This can be attributed to the efforts of extension agencies in organizing demonstrations and trainings related to ICT tools usage, thus enhancing farmers' knowledge in this domain.

Similarly, mass media exposure demonstrated a positive significance at the one percent level towards knowledge. Exposure to mass media platforms enables farmers to better understand ICT tools and services, contributing to their knowledge.

Moreover, innovativeness exhibited a positive significance at the one percent level towards knowledge. Individuals with a high level of innovativeness are more likely to possess knowledge about ICT tools, given their propensity for adopting new technologies.

Possession of modern electronic gadgets also displayed a positive significance at the five percent level towards knowledge. Farmers owning modern electronic devices tend to engage more with ICT-enabled extension services, leading to a greater depth of knowledge regarding ICT tools.

Furthermore, internet usage demonstrated a positive significance at the one percent level towards knowledge. Access to the vast repository of information available online facilitates knowledge acquisition about ICT tools among farmers.

Additionally, attitude towards e-media showed a positive significance at the five percent level towards knowledge. A positive attitude towards electronic media aids farmers in acquiring more knowledge about ICT tools and services.

Farmers may not fully recognize the potential of mobile phones in farming activities. Their perception of mobile phones might be limited to basic communication purposes rather than utilizing them for accessing agricultural information or ICT tools. Hence, perception of mobile phone in farming (X_{14}) showed non-significant relationships with knowledge.

Table 2: Multiple regression analysis of independent variables with knowledge

(N=120)

Variable No.	Variables	Partial regression coefficient	Standard error	't' value
X_1	Age	-0.477	0.446	-1.070
X_2	Educational status	0.363	0.228	1.595
X_3	Occupational status	-0.789	0.543	-1.454
X_4	Farming experience	0.046	0.031	1.465
X_5	Information seeking behavior	0.126	0.087	1.449
X_6	Extension agency contact	0.008	0.118	0.070
X_7	Social participation	-0.198	0.208	-0.949
X_8	Mass media exposure	-0.007	0.045	-0.145
X_9	Innovativeness	0.284	0.427	0.665
X_{10}	Computer training undergone	-1.039	0.848	1.225
X_{11}	Possession of modern electronic gadgets	0.134	0.531	0.252
X_{12}	Internet usage	1.793	0.829	2.162**
X_{13}	Attitude towards e-media	0.138	0.097	1.423
X_{14}	Perception of mobile phone in farming	-0.048	0.160	-0.298

****** - Significant at one percent level
* - Significant at five percent level
NS- Non-significant

R^2 = **0**.486
F = 7.091**

It could be discerned from Table 2 that the R^2 value was 0.486 which indicated that 48.60 percent variation in the knowledge was explained by the given fourteen independent variables and remaining 51.40 percent of the variation in dependent variables unexplained. The 'F' value was significant at one percent level probability. Thus, the cause & effect relationship between the dependent and independent variables are fitted at one percent level of significance. The fitted regression equation is given below,

$$Y_1 = -3.326 - 0.477X_1 + 0.363 X_2 - 0.789 X_3 + 0.046 X_4 + 0.126X_5 + 0.008 X_6 - 0.198 X_7 - 0.007 X_8 + 0.284 X_9 - 1.039X_{10} + 1.134 X_{11} + 1.793^{**}X_{12} + 0.138 X_{13} - 0.048 X_{14}.$$

From the equation it is clear that intercept Internet usage (X_{12}) is significant at one percent level.

Thus, if Internet usage (X_{12}) increases one unit from the mean level then the participation will increase 1.793 unit from the mean level. Use of internet to access the needy information is paramount importance, hence internet usage has positively correlated. Stepwise multiple regression analysis was carried out to eliminate the independent values whose contribution to the dependent variable was considered minimum and to select those variables to be used in the prediction equation. The results of stepwise analysis (Table 3) show that the maximum R squared value is obtained when two independent variables viz., internet usage (X_{12}), Educational status (X_2) were included in the model (i.e., model 2). These variables together contributed to 42.40 percent of the knowledge of farmers towards ICT tools in agriculture, which shows that the contribution by the eliminated variables was only to the tune of 6.20 percent. Hence, the unstandardized B coefficients of model 2 are to be used to predict the knowledge. (Table 4).

Table 3: Stepwise multiple regression analysis of independent variables with knowledge

Model No.	Variables	R	R^2	Adjusted R^2	Std. Error of the Estimate
1.	(Constant), Internet usage (X_{12})	0.626(a)	0.392	0.387	2.32697
2.	(Constant), Internet usage (X_{12}), Education status (X_2)	0.651(b)	0.424	0.414	2.27372

Table 4: Standardized coefficient beta values for model 2

Model	Unstandardized Co-efficient B	Standardised Coefficient Beta	't' values
(Constant)	-1.680		
Internet usage (X_{12})	2.670	0.447	4.524
Educational status (X_2),	0.516	0.254	2.567

** Significant at 0.01 percent level
* Significant at 0.05 percent level

The standardized coefficient beta values of the independent variables in model. (Table 4) indicate that a unit increase in internet usage, *ceteris paribus*, would result in increased knowledge by 2.67 units and *vice versa*. The internet is a part and parcel of ICT, hence, the farmer with high level of internet usage would more knowledge on ICT tools.

A unit increase in Educational status *ceteris paribus*, would result in an increase of 0.516 units of knowledge and *vice versa*. The educational status has directly related with increasing knowledge of any person. The farmers who possessed more educational status would have more knowledge on ICT tools.

The fitted equation, therefore, is as follows

$Y = -1.680 + 2.670X_{12} + 0.516X_2$

Conclusion

In case of ICT usage, out of 14 independent variables, eight variables *viz.*, Educational status, Information seeking behaviour, Extension agency contact, mass media exposure, Innovativeness, Possession of modern electronic gadgets, Internet usage and Attitude towards e-media were found to have positive and significant association with knowledge.R^2 value was 0.486 which indicated that 48.60 percent variation in the knowledge was explained by the given fourteen independent variables and remaining 51.40 percent of the variation in dependent variables unexplained.

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