



Assessing Use of Information Communication Technologies among Agricultural Extension Workers in Kenya Using Modified UTAUT Model

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Abstract

Government agricultural extension officers in Kenya are mandated with providing agricultural information to farmers. ICTs have the ability to provide better linkage between agricultural experts and farmers for timely and appropriate technical advice to enhance agricultural productivity. Several models have been developed by various researchers to explain ICT adoption in various fields. The Unified Theory of Acceptance and Use of Technology (UTAUT) was developed by consolidating eight famous Models/Theories in the Information Systems discipline. This study aimed at investigating the factors that influence use of ICTs by government agricultural extension officers within Kiambu County of Kenya by utilizing the UTAUT model. To achieve this, four hypothesis were

proposed to test the relationship between the independent and dependent variables. The variables of the study were Performance Expectancy, Effort Expectancy, Facilitating Conditions and Social Influence. The research undertook a survey where a census of agricultural extension officers in Kiambu County was done. Questionnaires were utilized on the target population where 144 questionnaires were distributed and 104 were used in analysis.

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Correlation analysis was used to analyze the data and determine relationships between variables with the major determining factors being the correlation (R) and the p-value of significance. The results show that there were statistically significant, strong positive relationships between Improved Productivity, Facilitating Conditions and Management support and that of usage of ICTs.

Based on the findings of this study, it is recommended that for success in implementation of ICT projects in the Extension Directorate, the extension workers need to be sensitized on ways ICTs could lead to higher productivity at their work places in addition to training on basic ICT technologies that they could easily utilize in their line of work. Further, it is recommended that the Ministry rolls out appropriate ICT infrastructure and ICT support staff in the Extension offices. This will go a long way in encouraging utilization of ICTs.

Keywords: ICT Acceptance; UTAUT; ICT Usage; ICT in Agriculture

1. Introduction

Information and communications technologies (ICT) have been of great significance in the development agenda of most countries due to their critical role in facilitating socio-economic development [1]. [2] defined ICT as technologies involved in collecting, processing, storing, retrieving, disseminating and implementing data and information through microelectronics, optics and telecommunications and computers. During the past decade, there has been an exponential growth in the use of information and communication technologies (ICT) which has made pervasive impacts both on society and on our daily lives [3]. The use of technology in the various sectors has increased rapidly throughout the world. In the agriculture sector, weather information systems, internet, e-agriculture, agricultural information databases and other applications are used commonly in extension services. Agriculture is a major contributor to the Kenyan economy with the agriculture sector contributing about 30 per cent of the Gross Domestic Product (GDP), more than 60 per cent of the total export earnings generating about 45 per cent of government revenue [4]. Agricultural Extension is an informal education process that assists farmers in improving their farming techniques and methods, increasing production efficiency and income, bettering their standard of living and lifting their social and educational standards [5]. Agricultural extension plays the important role of providing a link between agricultural researches and farming communities to promote the adoption of new technologies and innovations by rural communities.

According to [6] trained extension officers with access to online agricultural content databases would be of great help to disseminate the same information to farmers in their areas. Frontline extension workers who are a direct link between farmers and other actors in the agricultural knowledge and information system are well positioned to make use of ICT to access expert knowledge or other types of information that could be beneficial to farmers [7]. The role of ICT to enhance food security and support farming cannot be ignored. Its role in agriculture, which includes use of computers, Internet, geographical information systems, mobile phones, radio and television — was endorsed at the World Summit on the Information Society [8]. However, Prior research has established that the root cause of failure in Information Technology projects is found in users' perceptions and attitudes. The various models and concepts that have evolved in the developed countries to explain and predict user acceptance behavior have not been validated in developing nations such as Kenya. For successful

implementation of the information technology into the agriculture sector, user acceptance issues need to be investigated.

Extension workers are mandated with providing agricultural information to farmers. They have skills and the ability but they need a better way to acquire and disseminate information. Extension agent to farmer ratio in Kenya is estimated at 1:2,000 [9]. This is way too low and there is need to come up with innovative ways to address this challenge. Developments in ICTs offer ample opportunities to accomplish this challenge. Technology transfer efforts in agriculture sector must harness the huge potentials of ICT to provide better linkage between agricultural experts and farmers for timely and appropriate technical advice to enhance agricultural productivity and improve living standards of farmers. It is believed that ICTs can improve extension services if the extension workers would accept and use ICTs to improve themselves and farmers.

This study aimed at establishing the extent to which the agricultural extension subsector is benefiting from ICTs by investigating the level to which extension workers are utilizing ICTs in their line of work to provide better linkage between agricultural experts and farmers. An understanding of the factors associated with ICT use in agricultural extension will enable the development of strategies to promote ICT use and increase the effectiveness and efficiency of information use by the extension workers.

2. Literature Review

The continuing quest to ensure user-acceptance of information systems and technology (IS/IT) is an ongoing management challenge [10]. It is a field that has been explored by the IS research community to the extent that IS/IT adoption and diffusion research is now considered to be among the more mature areas of exploration within the IS discipline [11,12]. This has led to the use of a wide range of exploratory techniques examining diverse systems and technologies in many different contexts such as the societal, industrial, organizational and individual applying a diverse range of theories and models.

The concept of acceptance has been addressed and defined by various researchers in different ways. [13] For example described acceptance as “basically the question of whether the system is good enough to satisfy all the needs and requirements of the users and other potential stakeholder”. [14] defined acceptance as “the intention to adopt an application”. This definition is very concrete but it could be argued that it is too short to define the nature of acceptance. [15] defined acceptance as “a phenomenon that reflects, to what extent potential users are willing to use a certain system”. Both [14] and [15] talks about the adoption/use of the system but neither of them require a manifestation with actual behaviour. A number of models have been developed in the IS/IT adoption and diffusion research such as the Theory of Reasoned Action (TRA) [16] and Technology Acceptance Model (TAM) [17]. These were some of the earliest models developed and form a foundation for many models that have been developed later. Each model has its own independent and dependent factors for user acceptance and there are some overlaps [18]. Other theories in technology acceptance field include Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB), Combined Theory of Planned Behavior/Technology Acceptance Model (CTPB- TAM), Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT). In all of these

models, intention and/or usage is the key dependent variable. The call for a modified model that incorporates both human and social variables led to the development of an extended TAM and eventually the Unified Theory of Acceptance and Use of Technology model.

3. The Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT), developed by [12], aims to explain user's intentions to use ICT and subsequent usage behaviour. From the model, four key constructs are theorised to influence usage intention and behaviour. Eight famous Models/Theories (TRA, TPB, TAM, MM, C-TPB-TAM, MPCU, IDT and SCT) in the Information Systems discipline were consolidated to form the Unified Theory of Acceptance and Use of Technology (UTAUT) model [12]. The combinations of the constructs and moderating factors increased the predictive efficiency to 70%, a major improvement over previous TAM model rates. This study sought to test the strength of the hypothesized relationships mentioned in the theoretical model and the appropriateness of the model in predicting users' use of ICT in Agricultural Extension knowledge management. Four constructs are theorized by the UTAUT model as predicting Information Systems usage behaviour; Performance expectancy, Social Influence, Facilitating conditions and Effort Expectancy.

Performance expectancy is defined, as the degree an individual user believes that using ICT will assist in enhancing his/her performance [12]. In previous acceptance studies, the performance expectancy construct is consistently a strong predictor of intention [19,20,21,12,12]. In the context of agricultural extension's acceptance of ICT, performance expectancy suggests that individuals will find ICTs useful because they enable them to access and disseminate information quickly, at a time and place of their convenience, and on the device of their choice. Further, based on these definitions, it can also be defined as an individual's expectation that using ICTs in their daily extension duties can help them more in acquisition and dissemination of up to date knowledge and improve their performance in their duties.

Effort Expectancy is related to the degree of simplicity associated with the use of ICTs. Effort expectation is a consideration in user acceptance and use of IT systems in Kenya. A study by [22] on Usage, Obstacles and Policies in adoption of E-commerce in Kenya, it was determined that users prefer email systems to postal service because email is easier to use. It was further observed that users of e-commerce prefer to send email photo attachments to potential customers rather than send samples through DHL International Ltd partly because it takes less effort to send emails than parcels. This supports the argument that users tend to accept a technology that is easier to use.

Social Influence is defined as the extent to which an individual user perceives that important other believe he or she should use ICT. [23] In the theory of interpersonal behavior defined social factors as the individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations. The environment in which an individual is operating in highly influences their decision to use and IT or not. Cultural and religious factors also play a major role in this. In the context of agricultural extension's acceptance of ICT, the social influence construct suggests

that social influence such as colleagues, superiors, juniors etc will strongly affect an extension worker's intention to accept and use ICTs in course of their work.

Facilitating conditions are defined as the degree to which a user believes that an organizational and technical infrastructure exist to support use of ICTs [12]. Behavioral intention construct originated from the Theory of Reasoned Action (TRA) by [16]. The construct is defined as "a measure of the strength of one's intention to perform a specified behavior" [24]. Research has shown that behavioral intention has a direct impact upon the individuals' actual use of a given technology [24]. This study aimed at investigating the factors that influence use of ICTs by government agricultural extension officers within the eleven Divisions in Kiambu County of Kenya by applying the Unified Theory of Acceptance and Use of Technology (UTAUT) model.

3.1 General Objective

To investigate the factors affecting the use of ICTs by agricultural extension workers in Kenya using the Unified Theory of Acceptance and Use of Technology (UTAUT) model by [12] & infer policy and strategies to improve use of ICTs by the extension workers.

4. Materials And Methods

The study was an empirical survey that targeted all extension workers in Kiambu County. The population was government agricultural extension officers across the country with the study being conducted among extension officers in Kiambu County located in Central Kenya. The County is expansive, and has 5 sub counties/Districts and 16 divisional offices with a total of 144 extension workers. A list containing the names of all the agricultural extension officers in Kiambu County at both Divisional and District levels formed the sampling frame. A census was conducted since the workers were few in number at 144. A structured questionnaire containing both closed and open ended questions was administered to investigate the various variables identified from the model. The questionnaire comprised of pre-formulated written set of statements adopted from [12] with a few modifications. The independent variables Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC) measure attitudes and perceptions. In order to successfully measure the extension worker's perceptions and attitudes, a 5 point likert scale was used with 1 being Strongly Agree and 5 being Strongly Disagree. The UTAUT instrument has been used by numerous researchers [25,26, 27]. The data collection procedure was through a self administered questionnaire. The researcher was however available to assist on any clarification that would be needed by the respondent. A visit was made to the district/divisional offices with copies of the questionnaire. Out of the 144 questionnaires issued 104 responded translating to a response rate of 72%. Coding and data entry was done using SPSS. Descriptive statistics including tables and graphs were used to analyze demographic data. Correlation analysis between the independent and dependent variables was done to check the strength of the relationships between the variables. The major determining factors were the correlation (R) and the p-value of significance.

4.1 Hypothesis

There is no relationship between the independent variables Performance Expectancy, Facilitating Conditions, Social Influence, Effort Expectancy and use of ICTs by agricultural extension workers in Kenya

5. Results

Exploratory factor analysis was conducted using SPSS to determine how a range of change items loaded onto factors derived from a combined data set (N=104). A total of seven factors emerged that explained 62.6% of the variance. After factor analysis, two of the factors contained in the theoretical model split to form two variables each. These were Performance Expectancy and Social Influence. The resulting variables were thus; Improved Productivity (perceived improved productivity on using ICTs), Improved Efficiency (perceived improved efficiency on using ICTs), Effort Expectancy (perceived ease in using ICTs), Facilitating Conditions (availability of ICT Infrastructure), Peer Influence and Management Support (Perceived management Support). The dependent variables was use of ICTs.

The results showed that more than half of the respondents were female (54.8%) and about 45.2% of the respondents were male. Of the 104 respondents, 10% of the extension workers interviewed were between 25 to 34 years, 27.9% between 35 and 44 years while those with above 45 years made up 61.5% of the total respondents. Respondents were asked whether they utilize ICTs in course of their work to acquire and disseminate agricultural information. 84.6% of the respondents agreed or strongly agreed to using mobile phones in course of their work. 83.6% of the respondents agreed or strongly agreed to using printed materials to disseminate agricultural information. 45.2% of the respondents do not use the internet to acquire and disseminate information at their work place. The respondents gave feedback as follows;

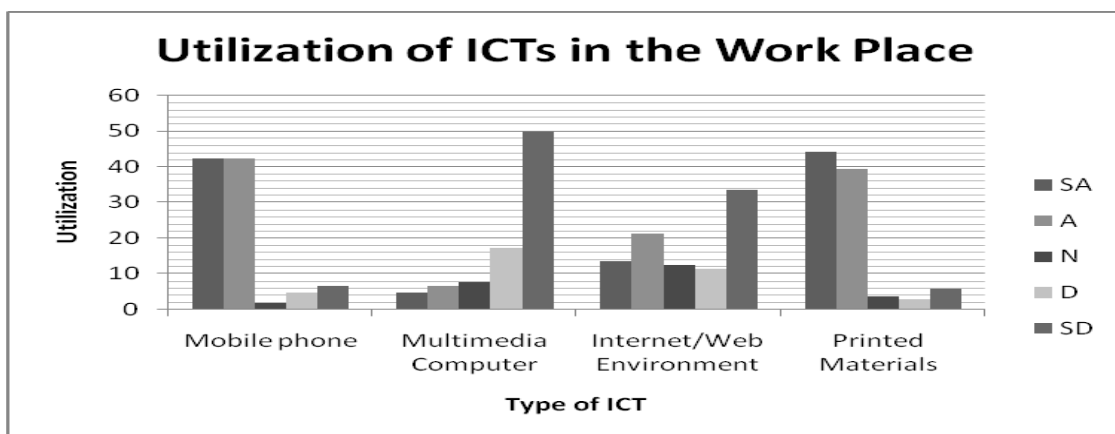


Figure 1: Utilization of ICTs in the Work Place

5.1 Relationships

Correlation analysis was performed on the data. "Pearson product-moment correlation provides numerical summary of the direction and the strength of the linear relationship between two variables"[28]. Pearson correlation coefficients (r) can range from -1 to 1 [28]. The sign out front indicates that if a positive correlation of one variable increases, it is followed by the other and vice versa. Although initially there were four constructs hypothesized to predict use of ICTs, six constructs emerged as predictors in the empirical findings of the study; Improved Productivity (perceived improved productivity on using ICTs), Improved Efficiency (perceived improved efficiency on using ICTs), Effort Expectancy (perceived ease in using ICTs), Facilitating Conditions (availability of ICT Infrastructure), Peer Influence and Management Support (Perceived management Support). From this research, several conclusions can be drawn based on the Hypothesis of the study.

Table 1: Dependent Variables Correlation Analysis

Derived Construct	Improved Productivity	Improved Efficiency	Effort Expectancy	Peer Influence	Mgt Support	Facilitating Conditions
ICT use	r =.613	r =.220	r =.517	r =.120	r =.552	r =.594
	P<0.001	P= 0.026	p<0.001	P= 0.231	P<0.001	p<0.001

The results show that among the seven independent variables, the most influential construct on ICT use was Improved Productivity (perceived improved productivity on using ICTs) (R=.613 P<0.001), followed by Facilitating Conditions (availability of ICT Infrastructure) (R=.594, P<0.001), Effort Expectancy (perceived ease in using ICTs) (R=.517, P<0.001) and Management Support (Perceived management Support) (R=.552, P<0.001). Improved Efficiency (*Using ICTs increases my efficiency at my work place*) was found to have a weak positive influence on Use of ICTs. There was no relationship between Peer Influence (*My colleagues and people who are important to me think I should use ICTs*) and use of ICTs.

Performance Expectancy

Hypothesis: H₀1: There is no relationship between Performance Expectancy and use of ICTs by agricultural extension workers in Kenya

Performance expectancy is defined as the degree to which an individual user believes that using ICT will assist in enhancing his/her performance [12]. From the results of the study, Improved Productivity (*Using ICTs increases my productivity at my work place*) has a high positive correlation with use of ICTs. Improved Efficiency (*Using ICTs increases my efficiency at my work place*) has a low positive correlation with Use of ICTs. Among the seven independent variables, the correlation coefficient between Improved Productivity and ICT Use is the highest which means that improved productivity provides the greatest indicator of technology adoption in the context of ICT use in Extension work. On the other hand, the independent variable Improved Efficiency has a weak positive influence on Use of ICTs. We therefore conclude that the agricultural extension

workers believe that ICT will assist in enhancing his/her performance. This influences their intention to use ICTs in their workplace. We therefore reject the null hypothesis H_01 and accept the alternative hypothesis there is a relationship between Performance Expectancy and use of ICTs by agricultural extension workers. These findings are consistent with prior studies by [29,12, 30] as well as prior models of TAM and TAM2 which showed that Performance Expectancy was the greatest predictor of ICT usage.

Effort Expectancy

Hypothesis: H_02 : There is no relationship between Effort Expectancy and use of ICTs by agricultural extension workers in Kenya

Effort Expectancy is related to the degree of simplicity associated with the use of ICTs. This construct has theoretical foundation from the three Theories/Models used by [12]. From the results of the study, Effort Expectancy (*I find it easy to learn and use ICTs in my work*) was found to have a high positive correlation with use of ICTs. A possible explanation of the this positive correlation on use of ICTs could be because the extension officers were embracing ICTs not from a mandatory setting – the Ministry has not made it mandatory to use ICTs, but it's the extension officer's own initiative to embrace ICTs. As a result, their interest translates to them viewing ICTs as easy to learn and use. We therefore conclude that the agricultural extension workers find it easy to use ICTs. This influences their intention to use ICTs in their workplace. We therefore reject the null hypothesis H_01 and accept the alternative hypothesis there is a relationship between Effort Expectancy and use of ICTs by agricultural extension workers.

Social Influence

Hypothesis: H_03 : There is no relationship between Social Influence and use of ICTs by agricultural extension workers in Kenya

Social Influence is defined as the extent to which an individual user perceives that important others believe he or she should use ICT. From the results of the study, Management Support (The Management at my workplace supports the use of ICTs) was found to have a high positive correlation with Use of ICTs. Peer Influence (My colleagues and people who are important to me think I should use ICTs) has no correlation with ICT use. We therefore conclude that individual agricultural extension workers believe that important others believe he or she should use ICTs. This is especially so in regards to their managers. This influences their intention to use ICTs in their workplace. We therefore reject the null hypothesis H_01 and accept the alternative hypothesis there is a relationship between Social Influence and use of ICTs by agricultural extension workers.

Facilitating Conditions

Hypothesis: H_04 : There is no relationship between Facilitating Conditions and use of ICTs by agricultural extension workers in Kenya

Facilitating conditions are defined as the degree to which a user believes that an organizational and technical infrastructure exist to support use of ICTs [12]. Empirical findings for Facilitating Conditions (*There exists the necessary support and facilities needed for me to use ICTs at my work place*) were in line with the theoretical insights in the original UTAUT model [12] whereby Facilitating Conditions was found to have a high positive correlation with ICT use. This could be explained by the fact that the presence of an enabling environment and infrastructure support would make it easier for users to embrace and operate the ICTs. Facilitating Conditions has a positive correlation with Use of ICTs. We therefore conclude that the agricultural extension workers believe that there exists the necessary support and facilities needed for them to use ICTs in at their work place. This influences their use of ICTs in their workplace. We therefore reject the null hypothesis H_01 and accept the alternative hypothesis there is a relationship between Facilitating Conditions and use of ICTs by agricultural extension workers.

6. Research Limitations

Kiambu County is expansive, and has 5 sub counties and 16 divisional offices. Due to this wide geographical coverage, there were budget and time constraints. Further, administering the questionnaire to all the respondents was a challenge considering the nature of the extension workers' job which involves a lot of field work. The questionnaires were thus distributed by targeting the weekly departmental meeting day when the staff were usually in the office and not in the field.

7. Conclusion & Recommendations

The research model explained 56% of the variation in Extension Workers use of ICTs this was below the 70% of variance reported in the original model by [12]. It was however above the 40% commonly expressed in studies employing TAM [17, 20]. The study has determined that there are a number of strong correlations between Improved Productivity, Facilitating Conditions and Management support and that of usage of ICTs. The goal of the study was to apply the UTAUT model in understanding Use of ICTs among Extension workers. As such the results of the study can be seen as promising for further work to refine the method.

Based on the findings of this study, recommendations made were that, since Improved Productivity and Effort Expectancy have the highest influence on ICT use, it is recommended that for success in ICT implementation projects it would be important for the extension workers to be trained and sensitized of ways in which ICTs could lead to higher productivity at their work places. They should also be sensitized on basic ICT technologies that they could easily utilize in their line of work. It is also proposed that agricultural Extension workers undertake training on ICT programs to provide them with appropriate skills in computer and internet for improved efficiency and service delivery.

Facilitating Conditions were also found to be significant predictors of use of ICTs. Consequently, it is recommended that the Ministry rolls out ICT infrastructures and support staff in the Extension offices. This will go a long way in encouraging utilization of ICTs and encourage knowledge dissemination and sharing among all stakeholders in the Extension Directorate of the Ministry. By doing this, the Extension officers will feel that the

Management was supportive of them to embrace ICTs since the study also found that Management Support was a significant predictor of ICT Use. The government should also develop ICT policies and practices that would encourage use of ICT in the Agriculture sector and ICT tools should be made more accessible in Extension offices.

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