



Determinants of the use of Uganda's e-diary application in agricultural extension monitoring and supervision

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ABSTRACT

Information and Communication Technologies (ICTs) are increasingly recognized for improving service delivery, yet their role in monitoring and supervising agricultural extension services remains underexplored. This study examined the determinants of the use of the E-dairy ICT application, introduced in Uganda in 2019 to strengthen monitoring and supervision within the public agricultural extension system. Guided by the Unified Theory of Acceptance and Use of Technology (UTAUT), the study employed an exploratory sequential mixed-methods design involving 246 randomly selected extension workers. Structural Equation Modelling (SEM) in R and thematic content analysis were used to analyze quantitative and qualitative data, respectively. Results revealed low overall usage (22%), particularly among frontline extension workers. Technical capacity was the strongest determinant of use ($\beta = 0.562$), followed by attitudes ($\beta = 0.309$) and motivation ($\beta = 0.242$), while social influence negatively affected use ($\beta = -0.178$). The findings suggest the need for continuous technical training, decentralized support systems, and institutional facilitation to enhance ICT uptake. The study concludes that effective digital extension systems require not only technological investment but also strengthened human and organizational capacity to support sustainable agricultural service delivery.

Keywords: E-Diary Application, Use, Agriculture Extension Service, Monitoring, Supervision

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Introduction

Advancements in Information and Communication Technologies (ICTs) have accelerated government efforts to digitize service delivery, monitoring, and supervision across sectors globally. Governments in both developed and developing countries increasingly invest in digital infrastructures and platforms to improve efficiency, accountability, transparency, and coordination in public service systems (Sharmin *et al.*, 2017; Nassar *et al.*, 2019; Makini *et al.*, 2020; Yang and Ou, 2023; Karubanga *et al.*, 2024; Tandon and Kandathil, 2025). Globally, digital monitoring and reporting systems are increasingly being adopted in sectors such as agriculture, health, education, and social protection to

facilitate real-time information sharing, evidence-based decision-making, and institutional accountability. In developed economies, digital platforms have improved coordination, data management, and performance monitoring within public institutions. Similarly, in Sub-Saharan Africa, governments and development partners have promoted ICT-enabled systems to strengthen agricultural extension services, improve supervision, reduce operational costs, and support geographically dispersed extension structures (Aker and Mbiti, 2010; Trendov *et al.*, 2019). Countries such as Kenya, Rwanda, Ghana, and Ethiopia have implemented mobile-based agricultural platforms to support farmer advisory

services, extension reporting, supervision, and knowledge exchange. However, despite increasing investments in digital extension systems, evidence from Sub-Saharan Africa indicates that many ICT interventions continue to face challenges, including limited technical capacity, infrastructural constraints, weak institutional support, digital inequalities, and low utilization among frontline extension workers (Baumüller, 2018; Bonina *et al.*, 2021). These experiences suggest that the effectiveness of digital monitoring systems depends not only on technological availability but also on broader socio-technical and organizational conditions that shape their practical use and sustainability.

In agriculture, ICT-based platforms are increasingly promoted as tools to strengthen extension systems by improving information management, coordination, accountability, and monitoring of service delivery. Uganda has similarly embraced e-governance and digital transformation in sectors such as agriculture, education, and health (Gillwald, 2019). Within this agenda, the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) introduced the E-diary application in 2019 to support monitoring and supervision of agricultural extension services (Namyanya *et al.*, 2022). The application is a mobile and web-based reporting platform designed to capture extension activities and facilitate information exchange across local and national government structures.

Despite growing optimism surrounding digital technologies in development, critical ICT4D scholarship cautions against assuming that technology adoption automatically translates into development outcomes. Existing studies argue that digital technologies are socially embedded and shaped by institutional, political, and infrastructural inequalities that influence how technologies are adopted and used (Roztocki *et al.*, 2019). Recent debates further warn that digital policies and platforms may reproduce exclusion, deepen inequalities, or fail to achieve intended outcomes when contextual realities, governance systems, and institutional capacities are overlooked (Zamani and Vannini, 2025; Kleine and Braidó, 2024). Consequently, the effectiveness of ICT-enabled systems cannot be understood solely through assumptions of technological efficiency or innovation diffusion. Rather, there is a need to critically examine how digital tools are used in institutional settings, the constraints that affect their use, and the socio-technical

conditions that shape adoption and continued engagement.

Materials and Methods

This study was guided by the Unified Theory of Acceptance and Use of Technology (UTAUT), which explains technology use through four major constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions (Arenas Gaitán *et al.*, 2015; Marikyan and Papagiannidis, 2021). UTAUT was adopted to examine the continued and practical use of the E-diary application within Uganda's public agricultural extension system. In this study, performance expectancy was operationalized as users' motivation to use the application, effort expectancy as individual technical capacity, while social influence and facilitating conditions were conceptualized as institutional and interpersonal factors affecting application use.

The study was conducted in six purposively selected districts in Uganda where the E-diary application had been operationalized by July 2024. These districts included Kasese, Rubanda, Kibaale, Kyenjojo, Oyam, and Serere. District selection was based on records obtained from the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), with a particular focus on districts with relatively high numbers of extension workers. Selecting districts with larger extension staff establishments provided broader experiences and insights regarding the implementation and practical use of the application across different administrative and agricultural contexts. The study targeted actors involved in Uganda's public agricultural extension system at national, district, and sub-county levels. An exploratory sequential mixed-methods research design was adopted to provide both contextual depth and empirical explanation of the use of the E-diary application. Participants' experiences, perceptions, and institutional realities were explored first, followed by quantifying the observed patterns using survey data. In the qualitative phase, data were collected to understand how the application was used. Insights generated from this phase informed the refinement of the quantitative survey instrument and the operationalization of key study variables.

Qualitative data were collected through six Focus Group Discussions (FGDs) involving 60 extension workers and ten Key Informant Interviews (KIIs). One FGD was conducted in each district, targeting frontline extension

workers, who were the primary users of the E-diary application. The KIIs included six District Production and Marketing Officers and four MAAIF officials responsible for ICT management, monitoring and evaluation, extension communication, and supervision of the E-diary system.

Quantitative data were collected from 246 extension workers selected from a target population of 367 staff across the six districts. The sample size was determined using Cochran's formula for survey studies, with a 95% confidence level and a 5% margin of error (Uakarn *et al.*, 2021). Proportionate stratified sampling was used to allocate respondents across districts, while simple random sampling was applied to select individual participants.

Data were collected using interview guides for qualitative inquiry and a semi-structured questionnaire for the survey. Variables assessed included attitudes, motivation, social influence, facilitating conditions, and technical capacity in terms of ICT knowledge and skills. Qualitative data were analyzed using thematic content analysis, while quantitative data were analyzed in R using descriptive statistics and Structural Equation Modelling (SEM) to examine determinants influencing the use of the E-diary application.

Results and Discussion

Socio-demographic profile of agricultural extension staff

Among the 246 agricultural extension staff who participated in the study, 72.8% were male. This reflects broader structural patterns in agricultural extension systems in many developing countries, where field-based roles have historically been dominated by men due to mobility requirements and established occupational norms. In terms of educational attainment, just over half of the respondents (50.8%) held bachelor's degrees, while 44.3% possessed diplomas. A small proportion had master's degrees (3.3%) and other post-secondary qualifications (1.6%). This indicates a generally well-qualified workforce, which is important for the effective adoption and use of digital tools such as the E-diary system. Staff with higher levels of education are more likely to interpret digital data, generate reports, and integrate ICT-based solutions into routine extension work, thereby improving service delivery. Regarding age distribution, most respondents (69.3%) were aged 40 years and below, with a mean age of 38.8 years. This relatively young

workforce is favorable for ICT adoption, as younger professionals tend to be more adaptable to technological innovations, consistent with the Unified Theory of Acceptance and Use of Technology (UTAUT) and Diffusion of Innovations theory. All participants were on permanent employment terms. In addition, 53.3% had 6–10 years of experience, 35% had 1–5 years, and 11.8% had over 10 years. This demonstrates a moderately experienced workforce familiar with extension service delivery challenges and supportive of the E-diary system's relevance across agricultural sectors.

Use of the e-diary application among extension workers

The findings indicate that actual usage remains very low at 22%, with some districts reporting no active users. Notably, supervisors do not use the system to monitor or support field staff, suggesting weak institutional enforcement. This low adoption reflects not only limited technical capacity among users but also inadequate supervisory engagement and follow-up, which are essential for sustaining ICT use in organizational settings.

FGD findings indicated a general decline in sustained use of the E-diary application among extension workers and their supervisors after initial training. In Rubanda District, an FGD participant reported, "*I stopped using it in training,*" suggesting early discontinuation of use even during the capacity-building phase. Similarly, a key informant observed,

The number of extension workers who are still using the system is very few compared to the number we started with, and I don't know, some are complaining that when the phone gets lost or blacks out, they cannot get back on the system.

This highlights both usage attrition and technical challenges related to device dependency and system recovery. The decline in continued use reflects reduced engagement after training, with many extension workers discontinuing use over time. This was largely driven by reliance on individual mobile devices, where loss, damage, or system failure resulted in loss of access to the application. Limited recovery options and weak reinstallation support further worsened the situation. As a result, data entry and reporting were disrupted, discouraging sustained adoption of the E-diary system in routine extension work.

Participants further noted that transfers to new administrative locations limited continued use, as the application does not automatically adjust user profiles or reporting structures to reflect new sub-counties, thereby constraining data capture in new work environments. This rigidity was associated with reduced motivation and increased dropout from system use. In addition, inadequate technical training emerged as a major barrier. One participant stated, *"the biggest challenge we always face with these applications is that the trainers come when they do not have enough time to train,"* implying insufficient training duration and depth, which undermines user competence and confidence.

In Kyenjojo District in particular, respondents also indicated that although the

application was launched and issues were raised, the lack of feedback and system responsiveness further discouraged continued use. Overall, these challenges collectively contributed to reduced adoption and sustained utilization of the E-diary application. Similar patterns of underutilization have been reported in other digital agriculture systems due to limited support (Pearce *et al.*, 2014; Drewry *et al.*, 2022; Thapa *et al.*, 2026).

Determinants of e-diary application use

Structural Equation Modelling (SEM) was used to determine the extent to which the selected predictor variables influenced the use of the E-diary application, as presented in Table 1 below.

Table 1. SEM regression coefficients predicting e-diary application use.

Predictor	B	SE	z	p	β
Motivation	0.273	0.100	2.735	.006	0.242
Attitude	0.366	0.097	3.780	< .001	0.309
Social Influence	-0.191	0.078	-2.442	.015	-0.178
Technical Capacity	0.684	0.065	10.509	< .001	0.562

R^2 (e-diary application use) = 0.770

The model demonstrated strong explanatory power, with an $R^2 = 0.770$ for E-Diary application use, indicating that 77% of the variance in usage was explained jointly by motivation, attitude, social influence, and technical capacity. Table 1 above presents the standardized and unstandardized regression coefficients, standard errors, z-values, and significance levels, with statistical significance set at $p < 0.05$.

Results further show that motivation had a significant positive effect on E-Diary use ($\beta = 0.242$, $SE = 0.100$, $z = 2.735$, $p = 0.006$), indicating that higher levels of motivation were associated with a greater likelihood of E-Diary use, controlling for other factors. Attitude also had a significant positive effect ($\beta = 0.309$, $SE = 0.097$, $z = 3.780$, $p < 0.001$) and emerged as the strongest psychosocial predictor, suggesting that favourable perceptions of the system substantially enhanced adoption. In contrast, social influence exhibited a significant negative effect ($\beta = -0.178$, $SE = 0.078$, $z = -2.442$, $p = 0.015$), indicating that external pressures or perceived expectations were associated with reduced likelihood of use in this context.

The null hypothesis stating that E-Diary use does not depend on psychosocial factors was therefore rejected. Similarly, the second null hypothesis was also rejected, as technical

capacity showed a strong and significant positive effect on use ($\beta = 0.562$, $SE = 0.065$, $z = 10.509$, $p < 0.001$) and was the most influential predictor in the model.

Overall, these findings confirm that both psychosocial and technical factors significantly influence the use of E-Diary applications among extension workers. This means that E-Diary application use among extension workers is influenced by both psychosocial factors (such as motivation, attitude, and social influence) and technical capacity (digital skills and ability to use the system). In other words, adoption is shaped not only by how users perceive and feel about the application, but also by whether they have the required skills to use it effectively, with technical capacity playing the strongest role.

These results are further illustrated in the Structural Model Diagram (Figure 1), which visually presents the magnitude and direction of the standardized path coefficients linking each predictor to E-Diary application use. The diagram confirms that technical capacity has the strongest positive influence, followed by attitude and motivation, while social influence exerts a negative effect. Overall, the model demonstrates strong predictive validity in explaining E-Diary adoption behaviour.

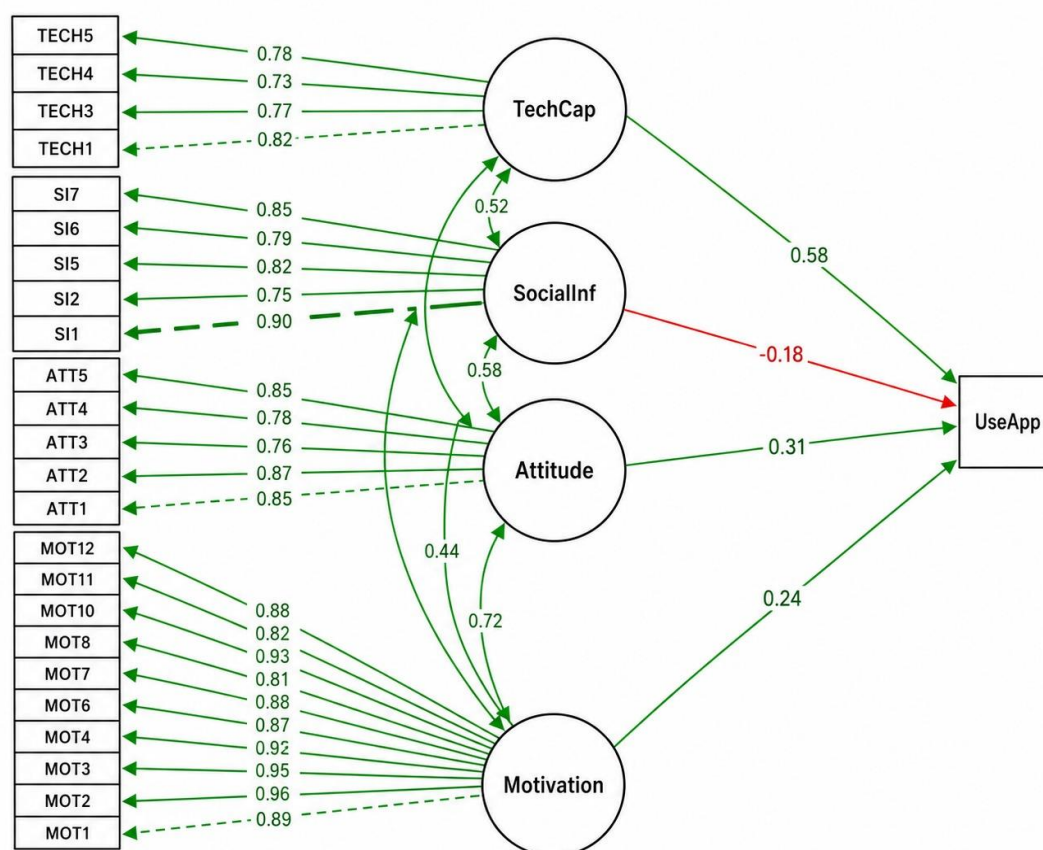
Structural model diagram

Fig. 1. Structural equation model showing standardized path coefficients for Predictors of E-diary application use.

The significant influence of technical capacity in this study aligns with [Hussaini et al. \(2021\)](#) and [Chouhan et al. \(2023\)](#), who emphasize that digital literacy is a critical determinant of ICT uptake among agricultural stakeholders. Similarly, the need for structured guidance and institutional support aligns with findings from [Abedi \(2024\)](#) and [Khatri et al. \(2024\)](#), who argue that targeted users require continuous technical assistance from implementing stakeholders.

The negative relationship between social influence and E-Diary use ($\beta = -0.178$) contrasts with traditional ICT adoption models, where social pressure typically enhances uptake. This finding suggests that weak supervisory engagement may have transformed social influence from a facilitator to a deterrent. This aligns with [Lorenz and Buhtz \(2017\)](#) and [Graf-Vlachy et al. \(2018\)](#), who note that social influence can be ineffective or counterproductive when institutional leadership is weak, but contrasts with [Nassar et al. \(2019\)](#), who found a positive effect in other contexts.

Consistent with this, the results support earlier studies showing that ICT adoption is shaped by factors beyond perceived usefulness, including user skills and resource availability ([Chukwuere and Ejoke, 2019](#); [Davis et al., 2021](#)). Overall, these findings demonstrate that while technical capacity is the strongest determinant of use, institutional, infrastructural, and managerial factors collectively shape adoption outcomes. This supports ICT adoption theory by showing that even when perceived usefulness is high, structural and organizational barriers can significantly limit effective utilization ([Zamani and Vannini, 2025](#)).

Conclusions

This study assessed the determinants of ICT use in monitoring and supervision of public agricultural extension services, using Uganda's E-Diary application as a case study. It examined the factors influencing the adoption and utilization of the system within the agricultural extension service delivery framework. Whereas digitalization of monitoring and supervision is essential for

enhancing efficiency, accountability, and service delivery by addressing the limitations of traditional approaches, including irregular field visits, delayed reporting, high operational costs, and limited coverage in remote areas, the study establishes that actual use of the application remains very low across all levels of extension service delivery, with variation across districts, indicating that ICT adoption is both limited and context-specific. This demonstrates that the availability of technology alone is insufficient to ensure uptake.

Key determinants, including limited technical capacity, weak institutional enforcement, inadequate ICT infrastructure, and insufficient training, explain the low utilization. These factors collectively shape user behaviour, leading to partial use of system functions. To improve ICT use, coordinated interventions are required. The Ministry of Agriculture, Animal Industry and Fisheries, in collaboration with relevant ministries, should develop comprehensive ICT-in-agriculture policies with clear guidelines, mandatory use frameworks, sustainable financing, and monitoring systems. Incentives for consistent reporting should also be introduced.

In conclusion, ICT use in agricultural extension monitoring is determined by interrelated technical, institutional, and capacity factors, and the E-Diary application's effectiveness depends on addressing these determinants through coordinated policy action and adequate resourcing.

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