



Computer Literacy Levels among Agricultural Extension Officers in Botswana

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Abstract

The study examined the computer literacy levels among extension officers employed by the Ministry of Agriculture in Botswana. The research was motivated by the growing demand for digital competence among extension workers as agriculture increasingly relies on ICT for effective service delivery. Data were collected from 185 agricultural extension officers from ten out of the 10 districts in Botswana through convenience sampling. Participants completed a questionnaire that assessed computer ownership and access, proficiency in executing computer-based tasks, personal and professional use of computers, and overall interest in computer-related applications. Quantitative data were analysed using percentages to determine literacy levels and cross-tabulations to identify

patterns in computer use across demographic groups. The findings indicated that extension officers were inclined to adopt or integrate ICT tools into their work (51.9%). While they demonstrated a basic understanding of computer literacy (56.8 %), they exhibited moderate proficiency in using ICT application software (55.1%). Bridging existing gaps in advanced ICT skills and infrastructure is essential to fully harness digital tools for more effective and sustainable agricultural service delivery. Targeted in-service training and improved ICT infrastructure, including internet connectivity and technical support, are critical to enhancing digital readiness and professional efficiency.

Introduction

Botswana, similar to many countries worldwide affected by the COVID-19 pandemic, has recognised the importance of digital transformation as a catalyst for economic growth. The pandemic underscored that countries that had already embarked on or accelerated digital transformation efforts were better positioned to navigate the disruptions and challenges associated with the crisis (Jelinek et al., 2022; Mohamed, 2023). In particular, such countries experienced an increase in productivity and efficiency across both public and private sectors. Moreover, digital initiatives contributed to improved quality of life and increased citizen satisfaction by fostering greater civic engagement and participation. In response, Botswana's leadership has strategically opted to leverage these emerging opportunities by positioning the country as a leader in digital innovation within sub-Saharan Africa. This vision is being pursued through the accelerated digitalisation of public services and key economic sectors, reinforcing the nation's commitment to inclusive and sustainable development through technological advancement.

In 2020, the Government of Botswana launched the SmartBots strategy, a national digital transformation framework aimed at improving citizens' quality of life, stimulating private sector innovation, and creating a more responsive and efficient public service (Mphale, Gorejena, & Nojila, 2024). One of its key components targets the agricultural sector—long considered central to Botswana's socioeconomic stability and food security. By embedding digital solutions into agricultural systems, the government seeks to enhance productivity, efficiency, and sustainability across the agricultural value chain. Within this context, agricultural extension officers play a pivotal role as intermediaries who transfer knowledge, promote innovation, and bridge the gap between modern technologies and farming communities.

The digitalisation of agriculture demands that extension officers acquire competencies in information and communication technologies (ICTs), particularly in computer literacy and the use of digital tools. These competencies are essential for effectively executing technology-enabled extension tasks and improving service delivery to farmers. The shift from traditional, face-to-face advisory services toward ICT-supported models is already reshaping extension work (Keba, Moremedi, & Zwane, 2023; Padmaningrum et al., 2024; Umunakwe, et al., 2025). Extension officers must now integrate digital platforms such as mobile applications, data-driven decision support systems, and online training tools into their practice. This transition requires a solid foundation of computer literacy and digital competence, both of which underpin effective use of emerging technologies in agricultural extension. Within this evolving paradigm shift, digital innovation and the acquisition of digital competencies are increasingly recognised as critical enablers of effective extension service delivery (Owolabi & Yekinni, 2022).

Computer literacy has been defined as the understanding of fundamental facts regarding computers and their use as a source of information (Fraillon & Duckworth, 2025; George & Fomsi, 2024). In the context of this study, computer literacy refers to the knowledge and

capability to effectively utilise computers and associated technologies, encompassing a spectrum of skills ranging from basic usage to advanced computing and problem-solving abilities (Ogunsola & Adesakin, 2020). It also includes higher-order competencies such as evaluating digital resources, managing files and media, and applying ICT tools to support decision-making. For agricultural extension officers, computer literacy encompasses proficiency in the use of ICT, the capacity for self-directed learning, and effectiveness in interpersonal communication. Extension officers are thus expected to contribute to achieving the standards of an information society in rural areas (Steinke et al., 2021). Elapata et al. (2023) argue that targeted ICT training enhances officers' competence and confidence, promoting greater acceptance of technology in agricultural communication and advisory services. In Botswana, as elsewhere in sub-Saharan Africa, digitalisation offers opportunities to improve the reach, speed, and quality of agricultural extension. However, these opportunities can only be fully realised if extension officers have adequate digital skills and access to the necessary infrastructure and resources.

Despite the strategic emphasis on digital transformation, there is limited empirical evidence on the computer literacy levels of agricultural extension officers in Botswana. Existing studies across North, West, Central and East Africa have mainly focused on farmers' and extension workers technology adoption and general ICT awareness (Bakari, Man, Nawi, & Shah, 2023; Ifeanyi-Obi & Corbon, 2023; Owolabi & Yekinni, 2022). Few studies, in Southern Africa, have examined extension officers' digital readiness, particularly their computer literacy and use of ICT in service delivery. Consequently, there remains a significant research gap in understanding how extension officers in Botswana are adapting to the digital transformation agenda. This lack of empirical data constrains the design of effective capacity-building initiatives and limits the ability of policymakers to align national digitisation efforts with the on-the-ground realities of the agricultural sector.

Assessing the current computer literacy levels among agricultural extension officers is therefore essential. Such assessment will identify existing gaps in skills, infrastructure, and access, which in turn can inform the development of targeted training programmes and digital inclusion strategies. Furthermore, understanding the determinants of ICT adoption among extension officers—such as availability of resources, institutional support, and attitudes toward technology—can help design more effective interventions that enhance the use of digital tools for agricultural communication and information management.

In addition to its practical importance, this study addresses a research gap in the literature concerning the role of digital competence in transforming agricultural extension systems in developing countries, specifically in Southern Africa. While ICT integration in agriculture has been widely studied, less attention has been given to the individual capacity and preparedness of extension officers to use computers effectively as part of their professional duties. This oversight is critical because digital transformation is only as effective as the digital literacy of the people implementing it. Extension officers who lack basic computer skills or access to digital resources may struggle to adopt and promote technology-based solutions, thereby limiting the impact of digital initiatives in rural areas.

The main objective of this study is to assess the computer literacy levels of agricultural extension officers in Botswana and to identify factors influencing their ability and willingness to utilise computer technologies in their professional roles. Specifically, the study seeks to assess the level of computer literacy among extension officers and to identify the challenges and opportunities affecting the effective use of computers in extension service delivery.

By addressing these objectives, the study contributes to ongoing national and regional efforts to strengthen digital competence among agricultural professionals. The findings are expected to provide valuable insights for policymakers, extension managers, and training institutions to design evidence-based interventions that enhance digital skills development. Ultimately, improved computer literacy among extension officers will enable more effective knowledge dissemination, support data-driven agricultural decision-making, and promote the sustainable digital transformation of Botswana's agricultural sector.

Methodology

The study was conducted in Palapye, Central District, Botswana. Palapye is situated between Latitude 22° 32' South and Longitude 27° 7' East. The study participants were selected in-service extension officers from the Ministry of Agriculture. The data were collected with the aid of a structured questionnaire. A convenience sampling method was chosen to collect data, targeting extension officers attending the electronic crop management system implementation socialisation as participants. The data collection technique was done by giving a questionnaire directly to the participants.

The computer literacy levels of the extension officers were measured based on four indicators. The indicators included the utilisation of computer applications, computer-related enquiries, computer knowledge assessments and factors influencing computer usage. Extension officers were asked to indicate their level of frequency of using the listed computer applications as "almost every day", "3-4 times per week", "1-2 times per week", "rarely" or "never used". Computer skills were measured on a 4-point Likert-type scale of "none", "basic", "intermediate" or "Advanced". Similarly, for measuring computer knowledge, a 4-point Likert-type scale of "1", "2", "3", or "4" was used to represent "novice", "basic", "intermediate" and "advanced" respectively. The frequency distribution table, percentage, averages and graphical representation were used to achieve the research aim.

A total of 218 semi-structured questionnaires were distributed through Google Sheets; 28 participants did not respond. Additionally, five responses were discarded for being more than 50 per cent incomplete and containing several missing data points in various sections. Consequently, a total of 185 questionnaires were analysed.

A computer literacy questionnaire developed by Son et al., (2011) was adapted to collect data on the computer literacy levels of extension officers. The questionnaire consisted of five sections: Section I: Background Information; Section II: Utilisation of Computer Applications; Section III: Computer-Related Enquiries – "Do You" and "Can You?"; Section IV: Computer Knowledge Assessment – Ten Questions; Section V: Factors Influencing Computer Usage. This study focused on the questionnaire's sections examining extension officers' access to computers, their proficiency in executing computer-based tasks, their personal and work use of computers, and their interest in computing.

The distribution of participants across districts was as follows: 75 extension officers from Central, one from Chobe, three from Ghanzi, six from Kgalagadi, 13 from Kgatleng, 26 from Kweneng, nine from Ngamiland (Northwest), seven from North East, nine from South East, and 36 from Southern District. The questionnaire was administered in English.

Results and Discussion

Participants' Access to the Computer and Internet

Table 1 indicates that slightly over half (93 out of 185) of the participants reported having consistent access to a computer. This result corroborates that of Ifeanyi-Obi & Corbon (2023), that the majority of agricultural extension officers used digital tools, including computers, in their agricultural work and communication. However, only 45 (25.1 %)

extension officers indicated having internet connectivity. The extension officers identified the following sources for initially training on the use of a computer for the first time: trainer (60 %), co-worker (19.5 %), family (11.9 %), books (1.1 %), self-taught (1.6 %), among others.

Table 1: Participants' access to the computer and Internet

Computer profile	Variable	Total (%)
Regular access to a computer	Yes	50.3
Have Internet connectivity	Yes	25.1
Source of computer knowledge	Trainer	60
	Co-worker	19.5
	Family member	11.9
	Other	5.9
	Self-taught	1.6
	Books	1.1

Basic Computing Skills

As presented in Table 2, the majority of extension officers assessed their proficiency in computer literacy ($\bar{x} = 2.03$), internet literacy ($\bar{x} = 2.01$), and typing skills ($\bar{x} = 2.19$) as adequate. The results demonstrate that extension officers are knowledgeable in internet literacy, typing and computer literacy. This is particularly helpful as most farmers are often located in remote rural regions, and there is an insufficient number of extension officers to access them. These skills, with the growth of digital technologies, offer new opportunities for extension officers to connect and share vital information, especially for farmers located remotely (Olagunju, et al., 2021; Sa'adu, et al., 2022).

Table 2: Self-evaluation of basic computing skills

Computing skill	Mean	Standard deviation
Computer literacy	2.03	0.99
Internet literacy	2.01	0.99
Current typing skills	2.19	1.02

Proficiency in Word Processing Applications

Table 3 shows that the majority of extension officers assessed their proficiency in word processing applications as either basic or intermediate. Moreover, more than 46 per cent reported a lack of skills in using spreadsheet software, database software, web applications, search engines, and communication software. Additionally, approximately 57 % of the extension works indicated a lack of proficiency in utilising web search engines. This may be due to extension officers' unawareness of new ICT technologies or because they are limited by a lack of appropriate training to utilise these computer applications properly.

Table 3: Self-rating computer skills

Applications	None	Basic	Intermediate	Advanced
	----- % -----			
Word processing applications	15.8	64.1	14.7	5.4
Spreadsheet applications	47.6	37.8	11.9	2.7
Database applications	59.1	34.4	4.8	1.6
Presentation applications	45.7	38.6	12.5	3.3
Multimedia applications	62.3	27.9	6	3.8
Web design applications	85.5	11.8	2.2	0.5
Web search engines	57.3	31.4	6.5	4.9
Communication applications	46.7	40.8	10.3	2.2

Computer-Related Capabilities by the Extension Officers

Results in Table 4 show that out of the 185 extension officers, only 18.5 % had internet connectivity at home. Nearly all extension officers, 94.6 %, reported possessing an email account; 3.8 % have a personal webpage; 62.6 % are familiar with basic computer hardware functions; 62.2 % are unable to utilise keyboard shortcuts; 83.6 % indicated they do not use an internet-connected computer at work; 51.9 % utilise a computer for work-related tasks; 78.7 % found it challenging to learn from reading on a computer screen; and 70.7 % do not use websites to enhance their work activities. The findings are consistent with those reported by Nwabugwu et al (2019), that the majority of extension officers exhibited low levels of e-resource utilisation. This limited use may be attributed to various factors, including age, attitude towards technology, insufficient training and other contextual challenges.

Table 4: Computer-related capabilities

Capabilities used	Yes (%)
Connect a computer to the Internet at home	18.5
Email account	94.6
Personal homepage on the Web	96.2
Basic functions of computer hardware components	62.6
Keyboard shortcuts	37.8
A computer connected to the Internet at school	16.4
A computer for teaching purposes	51.9
Learn something by reading it from a computer screen	78.7
CD-ROMs to supplement your learning/teaching	17.7
Websites to supplement your learning/teaching	70.7

Ability to Perform Other Computer Related Activities

The extension officers assessed their computer proficiency by responding to the items presented in Table 5. Although most participants reported being proficient in various computer-based tasks, over 50 % indicated an inability to perform specific activities such as installing software programs, writing files onto CDs, resizing photographs, recording and editing audio, creating basic databases using MS Access, developing simple web pages, and utilising web-based video conferencing tools for virtual meetings. This disparity between self-reported proficiency and actual ability to perform certain tasks among extension officers aligns with prior studies, indicating that self-assessments of computer and digital competence levels often overestimate actual skill levels (Ibrahim, et al., 2023; Pan, Reichert, Liang, de la Torre, & Law, 2025). Such findings highlight the persistent gap between general computer familiarity and the applied literacy skills required for effective use (Zakir et al., 2025). Consequently, this underscores the importance of structured and targeted ICT training programs for extension officers to ensure that the effectiveness of digital tools integration in agricultural extension services, consistent with previous recommendations by Ngeessa et al. (2025) and Akintunde & Oladele (2019).

Table 5: Competence in performing other computer-related functions

Item	Yes (%)
Turn on and shut down a computer	96.2
Copy, cut and paste the text into a document	91.4
Change the font style and size in a document	91.4
Start and exit a computer program	90.8
Print a document using a printer	86.3
Create a basic Word document	83.0
Minimise, maximise and move windows on the desktop	81.5
Move a file from a hard drive to a USB drive	77.2
Perform file management, including deleting and renaming files, etc.	76.9
Use a 'search' command to locate a file	75
Install a software program	72.3
Change the monitor brightness and contrast	68.5
Send and receive attachments through e-mail messages	64.7
Create a simple presentation using PowerPoint	58.7
Search for information online using a Web search engine	7.9
Scan disks for viruses	56.3
Download and save files from the Web (e.g., text, graphic, PDF files)	54.3
Create a basic Excel spreadsheet	53
Write files onto a CD	46.7
Resize a photograph	46.7
Use a video conferencing tool on the Web	30.3
Create a simple database using Access	21.7
Record and edit sounds	20.7
Create a simple Web page	9.8

Factors Affecting the Computer's Utilisation in the Workplace

Figure 1 illustrates the variables affecting computer usage in the workplace by extension officers, which include limited internet connection (54.6 %), insufficient computing skills among extension officers (54.1 %), inadequate facilities (37.3 %), and absence of computer-based tasks (30.3 %). These findings correspond with the studies by Bakari et al., (2023) , Sa'adu et al., (2022) and Ayisi Nyarko & Kozári (2021) which identified several barriers to the adoption of ICT platforms by extension officers in Nigeria and Ghana, including poor network connectivity, inadequate training, insufficient ICT infrastructure, absence of relevant policies, and other related factors. Similarly, Nwabugwu et al.,(2019), reported that limited access to e-resources, unavailability of necessary tools, and lack of

internet connectivity significantly impede the use of digital platforms by extension personnel in the Nigerian context.

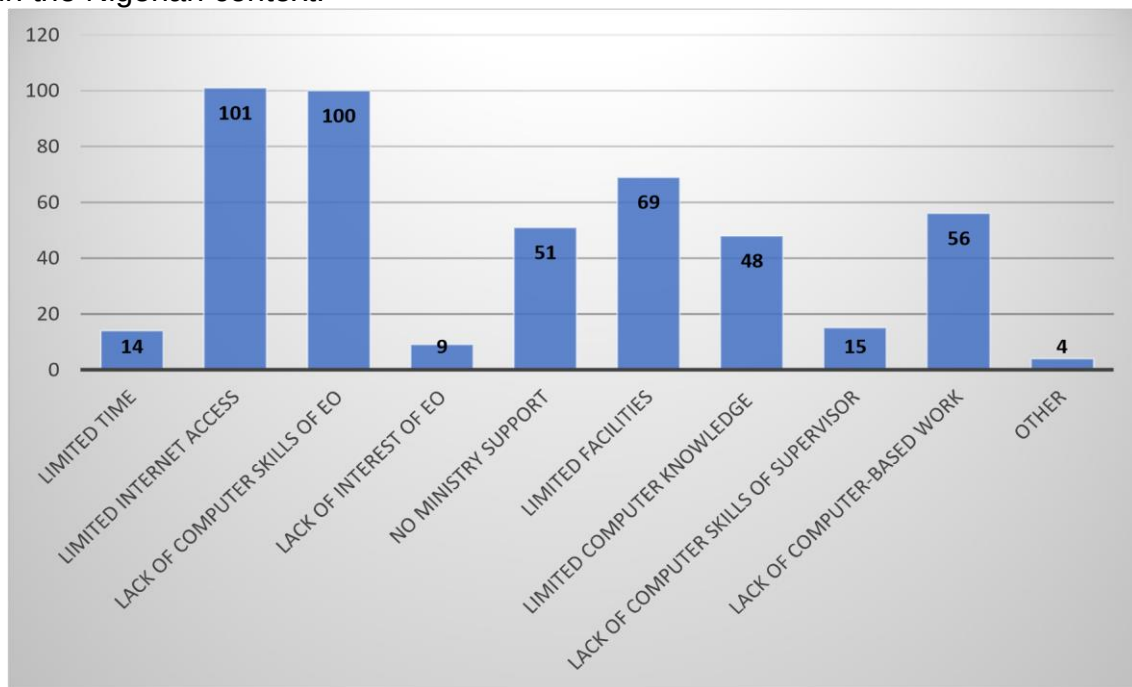


Figure 1. Factors affecting the computer's utilisation in the workplace (multiple choices)

Most extension officers exhibited positive attitudes toward the utilisation of computers. Table 6 presents the mean ratings reflecting the level of agreement among extension officers with various statements related to computer usage. A mean rating of at least 3.0 for the first and third items indicates that, while they were not entirely comfortable using computers, they showed a willingness to improve their knowledge and skills in computers and their applications. Participants also reported feeling uncomfortable using computers and perceived them as difficult to operate. The mean score of 2.0 for the statement, “I enjoy using computers,” further reflected their discomfort with computer use. Despite these challenges, extension officers acknowledged the importance of acquiring computer skills. These findings suggest that while extension officers recognise the value of computers in enhancing their work efficiency, their effective use is constrained by limited confidence and operational familiarity. Similar patterns have been reported in recent studies, where Owolabi & Yekinni (2022) found that extension officers acknowledged ICT’s potential and had positive attitudes, yet face limited adoption due to inadequate training. Recent work by Ngessa et al. (2025) further underscores the importance of system usability: their evaluation of a web-based dissemination platform showed that usefulness alone is insufficient unless systems are easy to use and accompanied by sufficient training and support, which in turn increases uptake among agricultural stakeholders. Together, these studies reinforce our findings that in-service training, practical skills development, and support are essential to effect positive attitudes towards effective use of computers in extension practice.

Table 6: Attitudes toward the use of computers

Item	Mean	Standard Deviation
Feel threatened when others talk about computers	3.72	1.46
Think that computers are difficult to use	3.55	1.52
Believe that it is important for me to learn how to use computers	2.96	0.80
I believe that training in computing should be included in the extension officers' in-service training	2.95	0.45
I would like to use computers in the workplace	2.91	0.49
I think that my work can be improved by using computers.	2.90	0.48
I am willing to learn more about computers	2.88	0.46
I think that my work can be improved by using computers.	2.90	0.48
I enjoy using computers	2.44	0.76
I feel comfortable using computers	2.23	0.97

Conclusion and Recommendations

Although extension officers have shown basic competence in core computing tasks, significant gaps remain in advanced applications, internet use, and integration of ICT into daily practice, such as communication tools, particularly virtual meeting software, search engines and multimedia applications. Limited access to infrastructure, inadequate training, and generational age differences further constrain effective use of digital tools. However, the general positive attitude of extension officers towards computer use indicates a strong potential for capacity-building interventions.

The Ministry of Agriculture should address the contextual need to enhance computer literacy by increasing access to computer facilities and implementing additional training initiatives. Such programmes should aim to equip extension officers with practical computer skills, facilitate peer-to-peer support, and encourage the exploration of diverse strategies and policy measures to deliver efficient, technology-enabled agricultural services.

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