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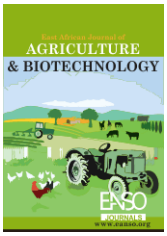

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Original Article

Perceptions of Small-Scale Farmers and Extension Officers Towards the Influence of Socio-Demographic Factors in the Utilisation of Digital Technologies for Dissemination of Agricultural Knowledge

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ABSTRACT

In recent years, digital technologies have emerged as powerful tools to enhance communication, knowledge sharing and decision making in the agricultural sector. Various agricultural digitisation tools are used, including messaging on mobile phones, social media, use of specialised apps by extension officers and small-scale farmers in the dissemination of agricultural knowledge. However, limited research exists on specific perceptions, challenges and opportunities related to the adoption and utilisation of these tools amongst small-scale farmers and extension officers. Previous studies show that different extension approaches result in different adoption levels by farmers. The research was based on the perceptions of small-scale farmers and extension officers towards the use of digital tools in the dissemination of agricultural knowledge in Bomet County, Kenya. The study was guided by these objectives; to assess impact of socio-demographic factors on farmers' and extension officers' views on digital tools in agriculture, to compare perceptions of sustainability of digital tools among farmers and extension officers, to explore perception of farmers and extension officers on the constraints on digital tools' utilization and to compare perspectives of farmers and extension officers on upscaling digital tools in agriculture in Bomet County, Kenya. Ex-posto-facto and comparative research designs were used in the study. A total of 246 respondents were sampled using multi-stage cluster sampling, with simple random sampling and an interview schedule and questionnaire were used to collect data. The data collected was organised and analysed using frequencies, percentages and means. The inferential statistics were analysed using Pearson's correlation r, then presented in tables, bar charts, graphs and figures. The study concluded that socio-demographic factors greatly influenced digital adoption, highlighting the need for inclusive, well-designed interventions to support marginalised farmers. Policymakers should implement digital strategies that enhance access, provide relevant training, and deliver locally tailored content to meet the diverse needs of marginalised communities.

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INTRODUCTION

The rapid advancement of digital technologies has led to a significant shift in agricultural practices worldwide, offering promising tools for improving productivity, efficiency, and access to information. In Kenya, particularly in rural counties such as Bomet, small-scale farmers face a multitude of challenges, including limited access to timely agricultural information, inadequate extension services, and a reliance on traditional methods of farming. While the government and various stakeholders have initiated several interventions aimed at improving agricultural productivity, the integration of digital tools in the dissemination of agricultural knowledge remains relatively underutilised in many regions.

The increasing availability of mobile phones, internet access, and other digital tools presents an opportunity to bridge the gap between farmers and agricultural experts. However, there is limited research on how small-scale farmers and extension officers in Bomet County perceive the use of these digital tools in the context of agricultural knowledge dissemination. In addition, there is a lack of insight into the challenges faced by farmers and extension officers in adopting and utilising these technologies.

Previous studies have highlighted the potential of digital tools in enhancing agricultural extension services. For instance, a study by Ochieng *et al*. (2015) found that mobile-based agricultural extension services in Kenya improved farmers' access to critical information, thereby enhancing their decision-making capabilities and overall productivity. Similarly, Mwalupaso *et al.* (2021) observed that digital platforms facilitated communication between extension officers and farmers, fostering a more efficient and timely transfer of agricultural knowledge. However, these studies often focus on broader regions or more urbanised areas, leaving a gap in understanding the unique challenges and perceptions of small-scale farmers and extension officers in rural counties like Bomet.

Additionally, while digital tools have shown promise in improving agricultural practices, there is a need for deeper exploration into the barriers that hinder their adoption, including infrastructural challenges, digital literacy, and perceptions of the

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usefulness and accessibility of these tools. Studies by Kiptot *et al.* (2019) and Ndirangu *et al.* (2013) have pointed out that farmers in rural areas may not always have the necessary resources or skills to effectively engage with digital platforms, thereby limiting the impact of such interventions.

This study explores how socio-demographic factors shape the attitude of small-scale farmers and extension officers towards adopting digital tools for the dissemination of agricultural information. It highlights the need for locally relevant solutions that reflect the unique social and environmental setting. The objective of the study was to compare the perceptions of small-scale farmers and extension officers towards the influence of socio-demographic factors in the utilisation of digital technologies for the dissemination of agricultural knowledge in Bomet County, Kenya.

RESEARCH METHODOLOGY

Study Design

Ex-post-facto and comparative research designs were used in this study. *Ex-post-facto* are research studies conducted after the fact or examining the effects of variables and events that have already occurred. It was used in this study to assess the impact and effectiveness of digital tools that have already been implemented in disseminating agricultural information. It examined the independent variables and their impact on the dependent variable. Small-scale farmers with the perceptions that already exist on digital tools were compared with the dissemination of information. Comparative research design was used to study the similarities and differences between the perception of small-scale farmers on the use of digital tools and that of extension officers. It was used to compare the relative effects of variables across cases.

Location of Study

The study was conducted in Bomet County. Bomet County is one of the 47 counties in Kenya. It has a population of 939,761(KNBS, 2022). Agro-ecological zones vary across the country, ranging from LH_0, LH_1, LH_2, LH_3, UH_1, UM_1, UM_2, UM_3 and UM_4. Hence, a variety of crops and animals can be grown. The rains start towards the end of March and continue intermittently up to the end of December. The annual rainfall is between 1000mm and 1650mm. The temperature levels range from 16ºC to 24ºC, with the coldest months between February and April, while the hot seasons fall between December and January. The driest season is mostly from January to February (Bomet County Spatial Plan, 2022). The map of the study area is depicted in Figure 1.

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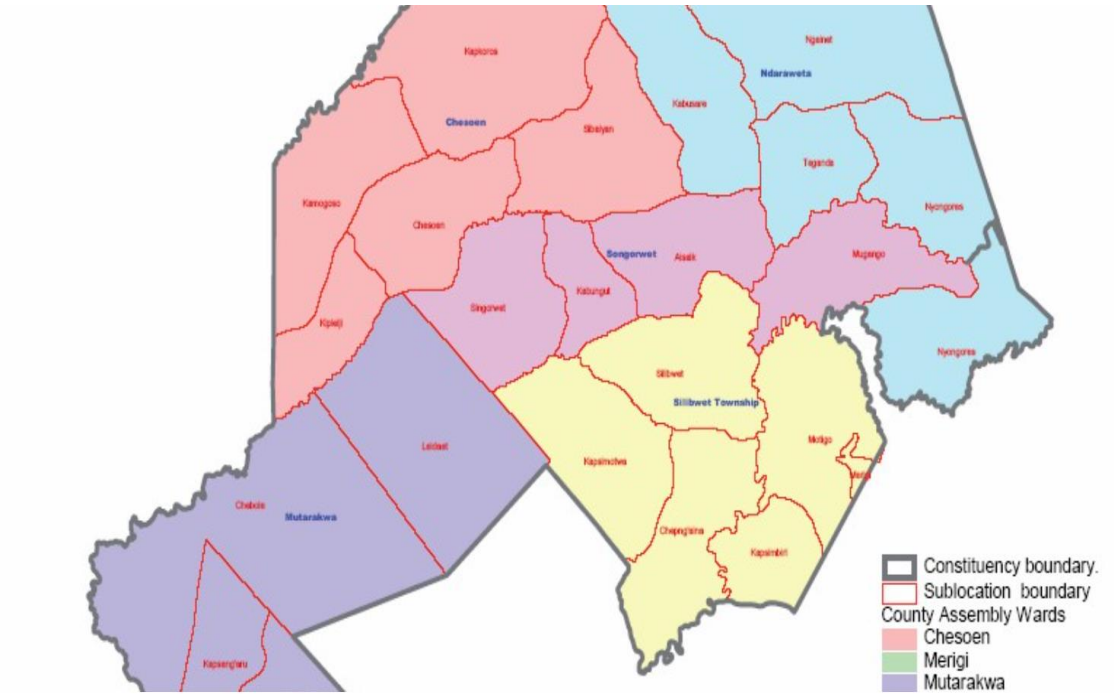
Figure 1: Bomet Central Sub-County Map showing Wards



Target Population and Sampling

This study had two target populations; small-scale farmers and extension officers. There are 152,384 small-scale farmers in Bomet County (KNBS, 2022). The other target population is extension officers. There are 30 extension officers in Bomet County. They were chosen to participate in the research since they are in contact with the small-scale farmers, hence they have the information required for the study. Small-scale farmers were also chosen in the study since they are involved in the production.

The study adopted multi-stage cluster sampling with simple random sampling to ensure representativeness and minimise selection bias. Multi-stage cluster sampling is where the population will be divided into groups or clusters. One or more clusters were chosen at random and then everyone within the group/cluster was chosen. Bomet County was purposefully chosen for the study because it is predominantly rural, with agriculture as the main livelihood, making it a suitable setting for exploring digital technology adoption in farming. Bomet has five sub-counties. Out of the five sub-counties, one was chosen using simple random sampling to avoid geographic bias. At the sub-county level, one ward was chosen using simple random sampling. At the ward level, three villages were chosen using simple random sampling. This step-wise randomization ensured that farmers from diverse socio-economic backgrounds and farming practices were included. Snowball sampling was then used to identify farmers in the absence of an official farmer registry, leveraging the local knowledge of extension officers and village elders to reach participants actively engaged in farming.

The sample size of 246 small-scale farmers was determined to ensure sufficient statistical power for both descriptive and inferential analysis. A stratified proportionate sampling technique was used to determine the number of small-scale farmers to be included in the study from each village.

For farmers, the number was guided by Cochran's formula for sample size calculation with a 95% confidence level and a 5% margin of error, adjusted

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to account for potential non-responses. The inclusion of all extension officers in the sub-county (N=30) allowed for a census of this smaller, specialised population, maximising the reliability of comparative analyses between groups.

The local extension officer or village elder aided in the identification of the first small-scale farmer who met the criteria to be included in the study. That initial small-scale farmer referred the researcher to other small-scale farmers they knew, who, in turn, referred more small-scale farmers to the researcher until a suitable sample size was achieved.

Data Collection Instruments

An interview schedule was used to collect data from small-scale farmers. A questionnaire was used to obtain data from extension officers. An interview schedule is a list of questions used to guide an interviewee in research. A device consisting of a set of questions, which are asked and filled in by the interviewer in a face-to-face situation with the interviewee. An interview schedule was developed and used to collect data from small-scale farmers because not all small-scale farmers were literate. It consisted of the following six sections namely; Section A, which contained introductory remarks; Section B, which collected data on biographical information; Section C, which collected data on socio-demographic information; Section D, which collected data on sustainability of digital tools; Section E, which collected data on constraints and Section F, which collected data on upscaling of the digital tools.

A questionnaire was developed and used to collect data from extension officers because extension officers were literate and were able to answer questions without any assistance. The questionnaire consisted of five sections as follows: Section A, which contained introductory remarks; Section B, which collected biographical data; Section C, which collected data on perceptions towards digital tools; Section D, which collected data on constraints faced by small-scale farmers; and Section E, which collected data on digital tools upscaling.

Validation involved both content and construct validity procedures. Initially, the instruments were developed based on a comprehensive review of literature on digital technology adoption in agriculture and refined to align with the study objectives. Three subject-matter experts, a senior agricultural extension researcher, a rural development specialist, and a digital agriculture practitioner, reviewed the instruments for clarity, relevance, and coverage of all necessary variables. Their feedback was incorporated to improve item wording, sequencing, and alignment with constructs such as digital literacy, access to devices, and perceptions of adoption barriers.

A pilot test was conducted with 30 farmers and 30 extension officers in a neighbouring county with similar agro-ecological characteristics. The pilot assessed question clarity, response variability, and completion time. Reliability was measured using Cronbach's alpha, yielding coefficients of 0.82 for the farmer interview schedule and 0.85 for the extension officer questionnaire, indicating high internal consistency. Minor adjustments, such as simplifying technical terms and adding visual prompts for farmers, were made before the main data collection.

Data Analysis

The study generated both qualitative and quantitative data since both the questionnaire and interview schedule contained structured and unstructured items. Before analysis, all questionnaires were checked for completeness and accuracy, and the information was coded for processing. Data analysis was conducted using IBM SPSS version 25 software.

Descriptive statistics such as means, frequencies, and percentages were used to summarise demographic characteristics and key patterns in the data. Independent samples t-tests compared mean perception scores between farmers and extension

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officers, while Pearson's correlation coefficient (r) measured the strength and direction of relationships between socio-demographic variables, access to digital tools, and perceptions.

For the sections relating to the sustainability of digital tools, means and standard deviations were calculated, and t-tests determined whether differences between the two groups were statistically significant.

Barriers to digital tool use were examined using descriptive statistics to identify the most common constraints. Ranking methods were applied to prioritise these constraints, and cross-tabulations assessed variations across demographic groups.

Perspectives on scaling up digital tools were analysed by summarising Likert-scale responses with means and standard deviations. Group comparisons were made using t-tests, and thematic analysis of open-ended responses provided deeper qualitative insights.

All hypothesis tests were conducted at a 95% level of significance, with degrees of freedom determined according to the specific statistical test applied. This structured approach ensured that each part of the analysis was directly relevant to the study's aims and produced findings that were both targeted and actionable.

RESULTS AND DISCUSSIONS

Demographic Characteristics of Respondents

Understanding the demographic profile of respondents is essential as it provides context for interpreting their perceptions and the factors influencing their utilisation of digital technologies in agricultural knowledge dissemination. For small-scale farmers, demographic variables such as age, gender, educational level, household size, primary source of income, type of farming, income derived from farming, and land size were considered. For extension officers, demographic characteristics captured included age, gender, educational qualifications, years of experience, and job designation. These attributes help to contextualise the socio-economic environment within which digital technologies are adopted and utilised. The small-scale farmers and extension officers were requested to indicate their demographic information. A summary of these demographic characteristics is presented in Table 1. Table 1 shows the Demographic characteristics of small-scale farmers and extension officers who took part in the study.

Table 1: Demographic Characteristics of Small-Scale Farmers and Extension Officers

Demographic Variable	Small-Scale Farmers	Extension Officers
Age (Mean in years)	39.8	40.0
Gender (% Male / % Female)	50.2% / 49.3%	60.0% / 40.0%
Average Educational Level	Secondary	Tertiary
Household Size (Mean)	6.8	N/A
Major Source of Income	Farming	Government Salary
Type of Farming	Mixed farming	N/A
Monthly Income from Farming	KES 41,053	N/A
Average Land Size (in acres)	3.0	N/A
Years of Experience	N/A	4.2
Job Title	N/A	Extension Officer

Note. Percentages and means are rounded to one decimal place. N/A = Not Applicable.

The demographic data presented in Table 1 reveal notable differences and similarities between small-scale farmers and extension officers in Bomet County. On average, farmers were slightly older than extension officers, which may suggest a more traditional approach to farming and a slower adoption of digital technologies. The majority of farmers had attained only primary or secondary

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education, while most extension officers held diplomas or university degrees. This disparity in educational attainment could influence the level of digital literacy, with extension officers being more equipped to access and utilise digital platforms. Household size among farmers averaged around 5 members, indicating a potential labour force for farming activities, but also suggesting economic pressure that may affect their ability to invest in digital tools. The main source of income for farmers was agriculture, primarily through mixed farming, while extension officers relied on fixed government salaries. On average, farmers earned less from agriculture and operated on smaller land sizes, further emphasising the economic constraints that may hinder their access to and use of digital technologies.

These findings align with earlier studies such as those by Aker *et al.* (2011) and Van De Fliert *et al*. (2018), which indicated that age, education level, and income are significant determinants of digital technology adoption in agricultural contexts. Farmers with limited education and low income often face challenges in understanding and using digital platforms effectively. Conversely, the higher educational levels and formal training among extension officers position them as potential facilitators in bridging the digital divide. However, the effectiveness of this role depends on their experience and interaction with farmers. The data show that most extension officers had considerable years of service, suggesting strong field experience, yet their impact may be constrained if farmers lack the capacity or motivation to engage with digital tools. These results highlight the importance of targeted digital literacy programs and infrastructure development that consider the socio-economic realities of both farmers and extension agents.

Socio-Demographic Factors

Objective number one is stated as follows. *"To compare the perceptions of small-scale farmers and extension officers towards the influence of socio-economic factors on the utilisation of digital technologies for the dissemination of agricultural knowledge."*

Data for this objective was collected through structured questionnaires administered to two key stakeholder groups in the agricultural sector in Bomet County: small-scale farmers and agricultural extension officers. A multi-stage sampling technique was used. Stratified random sampling identified wards within the county, from which small-scale farmers were randomly selected. Purposive sampling was employed to identify agricultural extension officers within the Ministry of Agriculture and affiliated institutions. The questionnaire included closed-ended items using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), focused on perceptions regarding how demographic variables (age, gender, education level, income level, and farm size) influence the use of digital technologies for agricultural knowledge dissemination.

The collected data were coded and analysed using SPSS (Version 27)**.** Descriptive statistics (means and standard deviations) were used to summarise the general trends. Independent samples t-tests were employed to compare the perceptions between small-scale farmers and extension officers on each socio-economic factor. The significance level was set at $\alpha = 0.05$.

Table 2 presents the comparison of mean perception scores between small-scale farmers and extension officers regarding the influence of various socio-economic factors on the use of digital technologies.

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Table 2: Comparison of Perceptions Between Small-Scale Farmers and Extension Officers on Socio-Economic Factors Influencing Use of Digital Technologies

Socio-Economic Factor	Farmers M (SD)	Extension Officers M (SD)	t(df)	P
Age	3.12 (0.94	2.68 (0.88)	3.09	.002
Gender	2.97 (0.85)	2.85 (0.79)	0.91	.363
Education Level	3.44 (0.78)	4.01 (0.69)	-4.76	<.001
Income Level	3.02 (0.90)	3.48 (0.82)	-3.02	.003
Farm Size	2.88 (0.95)	3.21 (0.81)	-2.41	.017

$p < .05$ indicates a statistically significant difference.

Note: Scores based on a 5-point Likert scale; higher scores indicate stronger agreement

The results in Table 2 show statistically significant differences in perceptions between small-scale farmers and extension officers on four out of the five socio-economic factors analysed.

Age

In the study, age emerged as a statistically significant factor, with farmers reporting higher mean scores (M = 3.12) compared to extension officers (M = 2.68). This indicates that farmers perceive age as a more prominent barrier to digital technology adoption. Older farmers in Bomet County often have limited exposure to modern digital tools and low digital literacy, which contributes to discomfort, scepticism, and reluctance to adopt new technologies. This aligns with findings by Maredia *et al.* (2019), who observed that age is a consistent predictor of reduced digital engagement in rural settings, mainly due to generational gaps in exposure, experience, and confidence with technology.

Moreover, older farmers may lack access to digital training opportunities or support systems, unlike their younger counterparts, who are generally more adaptable to technological change. As a result, they often prefer traditional extension methods such as face-to-face visits or community meetings over digital platforms. This preference, combined with limited digital skills, exacerbates the digital divide within the farming community. Addressing this requires age-sensitive strategies, including simplified user interfaces, targeted digital literacy training, and hybrid extension models that blend traditional and digital approaches to support older farmers in gradually building confidence and competence in digital tool use.

Education Level

Education level was perceived as a more influential factor by extension officers (M = 4.01) than by small-scale farmers (M = 3.44), highlighting a notable difference in how the two groups view their role in digital technology adoption. Extension officers, through their professional experience and training, are more likely to recognise that education directly affects a farmer's ability to engage with and benefit from digital tools. They understand that individuals with higher educational backgrounds tend to be more receptive to innovation, are better equipped to navigate digital platforms, and can more easily interpret technical agricultural information.

This perception is supported by Tata *et al.* (2016), who found that education enhances digital competence and the likelihood of adopting new technologies. In contrast, farmers with lower levels of formal education may struggle with basic digital functions, leading to reduced confidence and limited engagement. As such, the findings underscore the importance of designing digital agricultural content and training programs that are accessible to users across different education levels, using simplified language, visual aids, and practical demonstrations to bridge the digital literacy gap.

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Income Level and Farm Size

Income level and farm size were perceived as more influential by extension officers than by small-scale farmers, indicating a notable perceptual divide between the two groups. Extension officers rated these factors significantly higher, likely due to their awareness of the financial and operational resources required for successful digital engagement. As Musingafi *et al.* (2019) point out, limited income can severely restrict access to essential digital tools, while Kumar *et al.* (2017) add that income affects not just initial access but also the long-term use and maintenance of digital services.

Extension officers understand the cumulative costs involved, such as purchasing smartphones, maintaining internet connectivity, and paying for agricultural applications, which are often overlooked or accepted as part of daily hardship by farmers. Many farmers may have adapted to operating within tight financial margins and thus may not fully recognise how these constraints directly limit their engagement with digital technologies. This gap in perception highlights the need for affordable, scalable solutions and targeted financial support to bridge the digital divide, particularly for resource-constrained smallholders.

Gender

The study found no statistically significant difference between small-scale farmers and extension officers regarding gender, suggesting a shared perception that gender is not a major barrier to digital technology use in Bomet County. This may indicate growing inclusivity in digital agriculture or reflect a consensus that other factors, such as age, income, or education, pose more immediate challenges. However, Witinok-Huber *et* al. (2021) warn that in many other contexts, women still face specific constraints, including limited access to devices and digital training due to entrenched gender roles. Therefore, while gender may not appear as a critical issue in this study, it should not be overlooked in broader digital inclusion efforts.

The comparative analysis also revealed a perceptual gap shaped by the different experiences of farmers and extension officers. Farmers tended to emphasise personal barriers, such as age-related discomfort with technology and lack of confidence, whereas extension officers focused more on structural challenges like education, income levels, and farm size. These differing perspectives highlight the need for comprehensive strategies that combine personalised digital literacy training with broader infrastructural and policy-level interventions. Addressing both individual and systemic barriers is essential for ensuring the inclusive and effective adoption of digital tools in agricultural extension.

Figure 1 shows the comparison of perceptions of small-scale farmers and extension officers towards socio-economic factors influencing the use of digital technologies.

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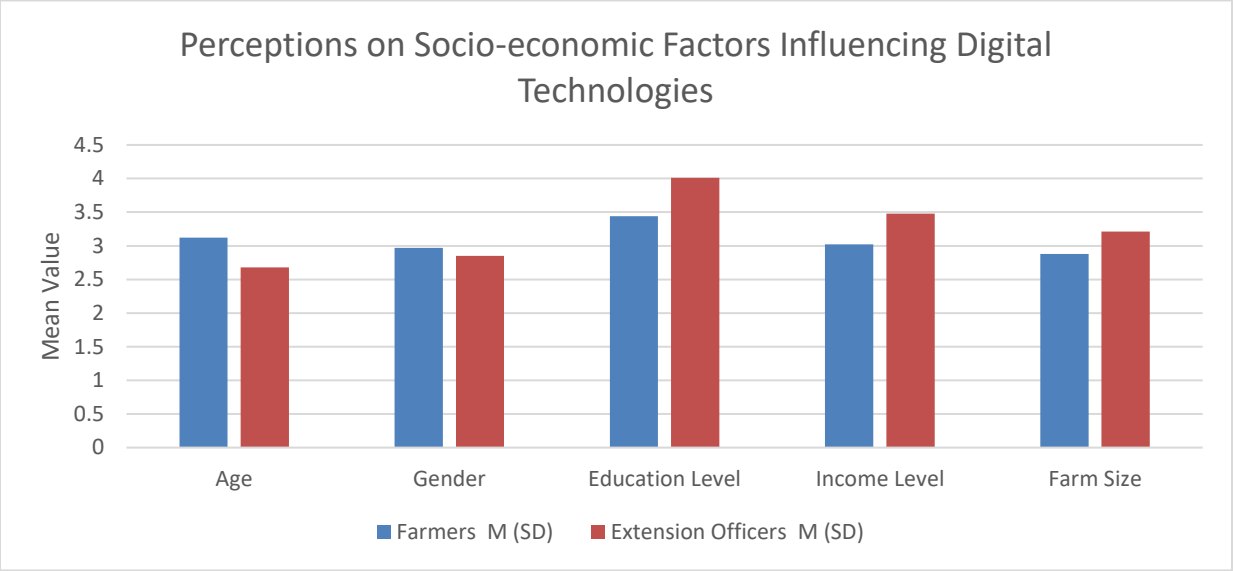
Figure 1: Comparison of Perceptions of Small-Scale Farmers and Extension Officers towards Socio-Economic Factors Influencing Use of Digital Technologies



The grouped bar chart highlights differing perceptions between farmers and extension officers regarding how socio-economic factors influence digital adoption. Farmers rated age as a more significant barrier (M = 3.12), suggesting that older individuals may feel less confident using digital tools—a concern reflected in Chapter Two (Maredia *et al*., 2019). In contrast, extension officers emphasised the role of education (M = 4.01), income (M = 3.48), and farm size (M = 3.21), consistent with literature linking these factors to greater access, awareness, and willingness to adopt technology (Tata *et al*., 2016). These perceptual differences underscore the need for digital strategies that go beyond access and address diverse user needs shaped by age, education, and economic capacity.

These findings highlight perceptual gaps between stakeholders that could influence how interventions are designed and communicated. Extension officers, often responsible for implementing digital initiatives, may overestimate or underestimate the importance of certain socio-economic barriers from the farmers' point of view. A participatory approach involving both groups in planning and training could help align strategies for more effective technology dissemination.

Pearson's Correlation Coefficient (r) Matrix

The study investigated whether there is a statistically significant difference between the perceptions of small-scale farmers and extension officers regarding the influence of socio-demographic factors on the utilisation of digital technologies for disseminating agricultural knowledge and skills in Bomet County**.**

To analyse this, a Pearson's correlation coefficient (r) matrix was generated to assess the strength and direction of relationships between various socio-demographic variables and the perceptions of the two groups (farmers and extension officers). The results are shown in Table 3. Table 3 shows the Pearson's correlation (r) matrix on perceptions towards socio-demographic influences on digital technology in the dissemination of agricultural knowledge.

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Table 3: Pearson's Correlation (r) Matrix on Perceptions Towards Socio-Demographic Influences on Digital Technology in the Dissemination of Agricultural Knowledge

Variables	Age	Education Level	Income Level	Gender	Access to Devices	Digital Literacy	Perception (Farmers)	Perception (Extension Officers)
Age	1.00	-0.28	-0.24	0.06	-0.30	-0.32	-0.29	-0.25
Education Level	-0.28	1.00	0.42	0.11	0.52	0.55	0.50	0.48
Income Level	-0.24	0.42	1.00	0.14	0.45	0.40	0.36	0.38
Gender	0.06	0.11	0.14	1.00	0.10	0.08	0.04	0.05
Access to Devices	-0.30	0.52	0.45	0.10	1.00	0.58	0.57	0.59
Digital Literacy	-0.32	0.55	0.40	0.08	0.58	1.00	0.62	0.64
Perception (Farmers)	-0.29	0.50	0.36	0.04	0.57	0.62	1.00	0.73
Perception (Extension Officers)	-0.25	0.48	0.38	0.05	0.59	0.64	0.73	1.00

Results in Table 3 Reveal the Following:

Age was found to have a moderate negative correlation with access to digital devices (r = -0.30) and digital literacy (r = -0.32), indicating that as age increases, the ability to access and effectively use digital tools decreases. This suggests that older individuals face more significant barriers in engaging with digital agricultural platforms. As highlighted in the thesis and supported by Maredia *et al*. (2019), older farmers often have limited exposure to new technologies and are less confident in navigating digital interfaces. These limitations may stem from unfamiliarity with smartphones, minimal prior training, or anxiety around using technology, which leads to disinterest or resistance. The study's findings underscore the need for targeted digital literacy programs that specifically address the needs of older farmers, who remain central to rural agricultural productivity.

In contrast, education level demonstrated strong positive correlations across multiple dimensions—access to devices (r = 0.52), digital literacy (r = 0.55), and perceptions from both farmers (r = 0.50) and extension officers (r = 0.48). These results confirm that higher education enhances an individual's ability to engage effectively with digital tools. Tata *et al*. (2016) and Adhikari *et al*. (2017) similarly argue that education increases technological receptiveness, digital competence, and the confidence to apply knowledge in real farming contexts. Educated farmers are not only more inclined to understand and use digital platforms but also more likely to recognise the practical benefits of digital technologies for information access, farm planning, and decision-making.

Income level also showed moderate but consistent positive correlations with digital access (r = 0.45), digital literacy (r = 0.40), and perceptions among both farmers (r = 0.36) and extension officers (r = 0.38). This suggests that individuals with higher incomes are more likely to afford and maintain digital devices, internet access, and the necessary skills for using digital agricultural services. Birhan *et al*. (2020) and Kumar *et al*. (2017) support the view that income not only determines access but also long-term engagement with digital innovation. Wealthier farmers may also be more inclined to invest in such tools due to larger operations or a

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stronger orientation toward commercial agriculture, while extension officers may see financial stability as a foundation for adoption and innovation.

Interestingly, gender showed very weak correlations with all other variables in this study. This suggests that gender may not play a significant role in influencing access, literacy, or perception in Bomet County. However, as noted by Hailu *et al*. (2020), gender-based barriers often appear in more subtle forms, such as reduced access to training opportunities, increased household burdens for women, or cultural norms that discourage female participation in digital initiatives. Even in the absence of strong statistical correlation, these issues should still be considered when designing inclusive digital agricultural programs, especially to ensure that women benefit equitably.

The study revealed a strong positive correlation (r = 0.73) between the perceptions of small-scale farmers and extension officers, indicating a shared understanding of the value of digital tools. This alignment is important for building collaborative efforts to scale digital extension services. Furthermore, both groups' perceptions correlated positively with access to devices (farmers: r = 0.57; extension officers: r = 0.59) and digital literacy (farmers: r = 0.62; extension officers: r = 0.64), emphasising that access and competence are key drivers of digital adoption. Kliks *et al*. (2019) and Amegovu *et al*. (2016) highlight that such alignment across user groups promotes trust and cooperation, which are crucial for the effective and sustained implementation of digital agricultural innovations.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The study compared the perceptions of small-scale farmers and extension officers towards the influence of socio-demographic factors in the utilisation of digital technologies for the dissemination of agricultural knowledge. It revealed that age, education, income, gender, and geographic location significantly affect digital adoption. Older, less educated, low-income, and rural-based female farmers faced the greatest barriers due to limited digital literacy, poor access to devices and connectivity, and content that was often not locally relevant. Farmers with prior training and extension support showed higher trust and engagement.

These findings highlight the need for inclusive, context-specific digital strategies that address the diverse needs of farmer groups through tailored content, improved infrastructure, and expanded training to ensure equitable and effective adoption.

Recommendations

To address the challenges and improve digital dissemination of agricultural knowledge and skills, this study recommends the following;

- Promote inclusive access**:** Policymakers and stakeholders should prioritise the development of infrastructure and the provision of affordable digital tools, especially in rural areas. This will enable marginalised farmers to overcome access barriers and fully participate in digital agricultural initiatives.
- Tailor digital content: Service providers should design context-specific, locally relevant digital content that reflects the unique needs of diverse farmer groups. This will improve engagement, trust, and the practical application of shared agricultural knowledge.

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