MAKERERE UNIVERSITY

COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES.

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF AGRIBUSINESS AND NATURAL RESOURCE ECONOMICS

INFORMATION FLOW (USE OF ICT) AMONG SWEET POTATO SILAGE USERS IN LIVESTOCK MANAGEMENT IN KAMPALA METROPOLITAN AREA

BY

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DECLARATION.

I, OPOKA JAMES hereby declare that this special project report is my own original work towards my bachelor's degree in Agribusiness management and to the best of my knowledge, it holds no material previously published by another person nor been accepted for the award of any other degree of Makerere University or any other University.

Signature.....Date.....19th September, 2025.....

OPOKA JAMES

APPROVAL

This special project report is to be submitted to Makerere University, School of Agricultural Sciences, for consideration with my approval as by supervisor.

Sign..... Date.....19/09/2025.....

Dr. Norman Kwikiriza

Department of Agribusiness and Natural Resource Economics.

DEDICATION

This research is dedicated to my beloved parents, whose unwavering support and encouragement have been the cornerstone of my academic journey. To Dr. Norman Kwikiriza, your resilience and innovation continue to inspire meaningful research and development in agriculture. And to all those who believe in the power of knowledge to transform communities, this work is for you.

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First and foremost, I extend my deepest gratitude to the Almighty God for the gift of life, strength, and guidance throughout the course of this academic journey.

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I am also grateful to the farmers, whose participation and openness made this study possible. Your insights and experiences were the heartbeat of this research.

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ABBREVIATIONS

Apps	Applications
A' Level	Advance Level
Dr	Doctor
GDP	Gross Domestic Product
ICT	Information and Communication Technology
ICTs	Information and Communication Technologies
IPC	International Potato Centre
KCCA	Kampala Capital City Authority
O' Level	Ordinary Level
PhD	Doctor of Philosophy
SMS	Short Message Service

SPVS	Sweet Potato Vine Silage
TV	Television

ABSTRACT

This study investigates the role of Information and Communication Technologies (ICTs) tools in facilitating information flow among sweet potato silage users in livestock management within Wakiso District, Uganda. As livestock farming evolves from subsistence to commercial practice, the integration of ICT tools have become essential for improving productivity, market access, and resource management. The research explores the current status of ICT adoption, evaluates the economic benefits of digital tools in livestock feeding, and identifies barriers hindering effective implementation. Data were collected through structured questionnaires and interviews with farmers, extension officers, and other stakeholders. Findings reveal that while ICT tools such as mobile phones, radio, and social media like WhatsApp, Instagram, tik tok are increasingly used, adoption remains uneven due to poor networks, and high internet cost. The study concludes that targeted interventions such as farmer training, improved network and reduced internet cost are critical to unlocking the full potential of ICTs tools in livestock management. These insights are vital for stakeholders aiming to enhance agricultural productivity and sustainability in Uganda

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Livestock farming is a vital component of Uganda's agricultural sector, contributing significantly to the country's economy, food security, and employment opportunities (Bamwesigye et al., 2020). With a population of over 43 million people, Uganda's demand for livestock products such as meat, milk, eggs, and hides is steadily increasing. The livestock sub-sector accounts for about 15% of Uganda's Gross Domestic Product (GDP) and employs approximately 70% of the rural population. The country is home to over 14 million cattle, 12 million goats, and 5 million sheep, making it one of the largest livestock producers in East Africa (Waiswa et al., 2021).

Uganda's livestock sector consists of cattle, goats, pigs, sheep, rabbits, and other animals (Waaswa & Satognon, 2020). The sector is characterized by high utilization of family labour, ownership of small pieces of land, high reliance on natural pastures to feed animals and ownership of a large number of local animal breeds. When it comes to the use of labor in livestock rearing activities, 99.1% of livestock keeping households depend on family members for labor in livestock husbandry activities (Bamwesigye et al., 2020).

The average land size owned by livestock owning households is 2.2 hectares, with exception of the communal grazing areas percentage (Waiswa et al., 2021). According to Waiswa et al., (2021), only 2.49% of livestock owning households in Uganda cultivate pastures for feeding animals which shows a high level of reliance on natural pastures. These factors are an indicator of the small herd sizes owned by the greatest percentage of Uganda's livestock farmers and the subsistence nature of Uganda's livestock sector.

Sweet potato (Ipomoea batatas) is a staple crop in many tropical and subtropical regions, including Uganda (An, 2004). While the tubers are widely consumed, the vines are often discarded or used as a low-quality feed supplement for livestock. However, sweet potato vines have been recognized as a valuable resource for livestock feed, particularly when ensiled (Muthivhi, 2019). Sweet potato vine silage (SPVS) is a nutritious and cost-effective feed supplement that can improve the productivity and health of livestock, especially during periods of feed scarcity. SPVS is rich in protein, energy, and fiber (dry matter) and it also

contains various minerals and vitamins, making it an excellent feed supplement for ruminant livestock (Negesse et al., 2016).

Information and Communication Technologies (ICTs) are gaining popularity among farmers worldwide. Initially, agriculture (especially in developing countries) was considered a traditional practice, just mainly fir subsistence (Chavula, 2014). However, due to the fast growing population of many nations, there's an increased demand for food which has forced many farmers to shift from subsistence to commercial farming. With the high demand, new technologies have been introduced to enable farmers cope with the demands of their population, including ICTs to enable quick flow of information between producers and consumers (Virendra Singh, Shweta Sankhwar, 2014). These ICTs have also improved marketing of farm produce, management of human resources and inputs on farms and also access to new technologies.

1.2 Problem statement

The use of information and communication technologies in livestock production has had a steady increase over the years (Saidu et al., 2017). However, there has been less documentation on the benefits and challenges of using ICT in the industry. According to Chowhan & Ghosh, (2020), ICT is more commonly used by educated farmers, leaving aside the rural uneducated farmers. This has created a gap between new technologies and smallholder rural farmers. This has made some farmers face significant challenges in accessing and sharing information on best practices, market trends, and technological innovations, hindering their ability to optimize silage production and compete favorably.

According to Lekopanye, (2017)farmers who have embraced the ICTs on their farms experience have first-hand access to new technologies hence giving them better opportunities to succeed and have better and faster access to markets. According to Kim, (2021), countries that dedicate resources towards ICT development experience increased production and competitiveness on international markets.

It is therefore of great importance to conduct this study in order to establish the status of ICT among the livestock farmers, its benefits and challenges so as to make the farming community informed.

1.3 Objective

The study aims to investigate the role of information and communication technologies in enhancing information flow among sweet potato silage users in livestock management in Wakiso District.

1.3.1 Specific objectives

i. To assess the current status of ICT use among sweet potato silage users in Wakiso District
ii. To assess the economic benefits of using digital technologies in livestock feeding for farmers in Wakiso District.
iii. To identify the barriers and challenges faced in implementing digital technologies in livestock farming

1.4 Research questions

i. What is the current status of ICT adoption among sweet potato silage users in Wakiso District?
ii. What are the benefits of using it’s in livestock management?
iii. What challenges do sweet potato silage users face in adopting and using ICT on their farms?

1.5 Significance of the study

The success of this study was of great importance to the stakeholders in the livestock industry as follows: The farmers shall know the best ICT platforms to use, through which they'll be able to maximize awareness and their knowledge. It provided insights to the extension officers on which ICT channel to promote more to the farmers in the District, hence fostering development. Policy makers, and other non-government agencies will know what channels to develop through providing subsidies and grants (respectively) in order to develop the livestock industry. The study was also of great importance to researchers by working as a source of citation during their research projects.

CHAPTER TWO: LITERATURE REVIEW

1.6 The status of ICT use among sweet potato silage users

In Uganda, the integration of Information and Communication Technologies (ICT) in agriculture has been pivotal in enhancing farming practices. A notable example is the adoption of sweet potato silage technology, which transforms sweet potato vines into nutritious livestock feeds. This innovation addresses feed scarcity, especially during dry seasons, and provides a sustainable alternative to traditional feeds.

Information and Communication Technology (ICT) has increasingly become a vital tool in agricultural development, playing a critical role in enhancing information dissemination, improving market access, and fostering innovation among farmers (Mdoda & Mdiya, 2022). ICT through internet, smartphones, and televisions have become a powerful tool to use in development of the livestock industry. In the context of livestock feeding, especially with the growing use of non-conventional feed sources such as sweet potato silage, ICT use is gaining attention, particularly in urban and peri-urban settings where access to traditional extension services may be limited.

1.7 ICT in Agriculture and Livestock Systems

ICTs, including mobile phones, radio, the internet, and social media platforms, are being integrated into agricultural systems to facilitate access to timely and relevant information (Lekopanye, 2017). Research shows that ICT tools improve decision-making, promote adoption of new technologies, and connect farmers to extension services and markets (Meena & Singh, 2013). According to Meena & Singh, (2013), ICT tools have a high potential to change livestock economies in developing countries. He argued that more and more software tools should be developed to aid in feed formulation and feeding, disease control, keeping track of produce and marketing of the products.

According to Virendra Singh and Shweta Sankhwar, (2014), the ICT devices that help facilitating farming activities include devices like radio, television, cellular phones, computers, tablets and networking, hardware and software systems. In the same way, Chowhan & Ghosh, (2020) reports that radio is extensively used to inform users on agricultural topics, including new and upgraded farming techniques, production management, and market information. This shows that farmers may take advantage of using radio in the absence of technology especially rural farmers. The Internet and web-based applications are extensively used in sharing and dissemination of agricultural knowledge, marketing of goods

and services. The study conducted by Neethirajan & Kemp, (2021) have shown evident that ICT is an effective solution to problems that militate against the development of agricultural industry, such as weak marketing linkages, poor information management, low productivity, low income and lack of diversity.

Sweet Potato Silage Use and ICT Adoption

Sweet potato silage is an emerging livestock feed resource in many developing countries due to its high yield and nutritive value (Muthivhi, 2019). Its use is particularly prevalent among smallholder livestock keepers, especially in urban and peri-urban areas. However, studies indicate low awareness and knowledge on silage-making techniques, which can hinder its adoption (Smit, 2014). ICT tools have the potential to enhance knowledge and practices related to sweet potato silage through mobile apps, SMS-based advisory services, and online videos and tutorials (Chowhan & Ghosh, 2020).

1.8 Economic benefits of using digital technologies in livestock feeding for farmers.

Digital technologies are revolutionizing the agricultural sector, and livestock production is no exception. The integration of ICT tools has the potential to improve productivity, optimize resource use, and enhance profitability for farmers, through faster distribution of information on new skills and technologies to farmers (Saidu et al., 2017). As global demand for animal products rises, there is a growing interest in how digital innovations can deliver tangible economic benefits, particularly in feed management, which constitutes the largest cost in livestock production (Meena & Singh, 2013). Below are the benefits of using Information and Communication Technologies in livestock production.

Numerous studies have demonstrated that the use of digital technologies in livestock feeding leads to measurable economic gains. These benefits include reduced feed costs, increased milk and meat yields, better feed conversion efficiency, and lower veterinary expenses due to improved knowledge on general management of the animals (Mdoda & Mdiya, 2022).

Additionally, mobile-based advisory platforms provide real-time guidance on ration formulation, market prices, and feed availability, which helps farmers make informed decisions and avoid financial losses (Meena & Singh, 2013). In developing countries, such digital services have been linked to increased farmer incomes and improved resilience to market fluctuations (Lekopanye, 2017). ICT in livestock production also contributes to increased economic growth. This happens when farmers get access to information, improve

on their production and hence contributing to economic growth (Virendra Singh, Shweta Sankhwar, 2014).

According to Saidu et al., (2017)Research in agriculture is to a higher extent facilitated by ICT. With much of the information stored and distributed through different ICTs, they are easily accessed by researchers and policy makers to develop new technologies for agricultural development. Rural life and activities are also made easier through enhancing distance learning. Soft wares that provide information on demand and supply enable farmers to have enough market knowledge and hence giving them the foundation for decision making. Through ICT, livestock farmers can create new opportunities by entering international markets and get in contact with new farmers to exchange relevant information regarding the livestock industry development. Through this, farmers can acquire new knowledge and techniques to improve their farms and the whole industry at large. Chavula, (2014) argued that ICTs have the potential to improve livestock productivity by sharing knowledge and information to farmers in rural areas.

The use of ICT enables entrepreneurs to access relevant and recent business information. This provides likelihoods for younger generation-agro based entrepreneurs to established their own network and websites regardless of time and place (Saidu et al., 2017) and (Chowhan & Ghosh, 2020). Consequently, they could advertise their products both in national and international markets. According to Saidu et al., (2017), ICT solves issues such as traceability, process control, transparency in market information, reduction in transaction costs, and identification as well as tracking of consumer needs.

1.9 Barriers and challenges faced in implementing digital technologies in livestock farming.

Despite the evident benefits, several challenges impede the widespread adoption of ICT technologies in livestock farming. In developing countries, accessing adequate and functional ICT services is a major concern to farmers, both in rural and urban areas. These challenges are discussed as follows

Technical and Infrastructure Barriers.

One of the primary challenges in adopting digital technologies in livestock farming is inadequate infrastructure. Unreliable electricity, internet connectivity, and mobile network coverage are often lacking in rural areas, especially in low- and middle-income countries

(Virendra Singh, Shweta Sankhwar, 2014). Many digital tools require stable connections and access to cloud-based platforms, making them less viable in areas with poor infrastructure. Additionally, compatibility and interoperability issues between various technologies can hinder seamless integration. Farmers often face difficulties connecting devices or systems from different providers, which limits their utility (Saidu et al., 2017).

Financial Constraints

High upfront investment costs are a major deterrent, especially for smallholder and medium-scale farmers. The cost of purchasing, installing, and maintaining ICT equipment such as smartphones and computers, can be prohibitively expensive for majority of livestock farmers in rural areas (Chavula, 2014). Limited access to credit or subsidies further exacerbates this challenge. Moreover, the economic return on investment may not be immediate, and without clear evidence of financial benefits, many farmers remain hesitant to adopt digital solutions (Saidu et al., 2017).

Knowledge and Skills Gaps

Digital literacy remains a critical barrier. Many farmers lack the necessary skills to operate, interpret, or troubleshoot digital tools (Virendra Singh, Shweta Sankhwar, 2014). Training and extension services often fail to keep up with technological advancements, leaving a gap in the transfer of knowledge from developers to end-users. In some cases, even when digital tools are available, farmers are not fully aware of their functionalities or potential benefits, leading to underutilization or misuse.

Socio-Cultural and Institutional Challenges.

Resistance to change, skepticism toward new technologies, and traditional farming mindsets can also hinder adoption. Social norms, age, gender, and educational background influence farmers' openness to digital farming tools. Older farmers, in particular, may prefer conventional methods and be reluctant to adopt unfamiliar technology (Chowhan & Ghosh, 2020).

Institutional support systems, such as policy frameworks, extension services, and digital infrastructure development are often inadequate or fragmented. The lack of coordinated efforts among stakeholders can lead to inconsistent messaging and poor support for farmers during the adoption process (Lekopanye, 2017).

Data Privacy and Trust Issues.

Concerns around data ownership, privacy, and misuse are emerging barriers in digital agriculture. Farmers are increasingly cautious about sharing data with private tech companies or government agencies, especially when there are no clear guidelines on how data is used or protected (Mdoda & Mdiya, 2022). This lack of trust can deter farmers from engaging with digital systems that collect or analyze farm data.

CHAPTER THREE: METHODOLOGY

1.10 Study Area.

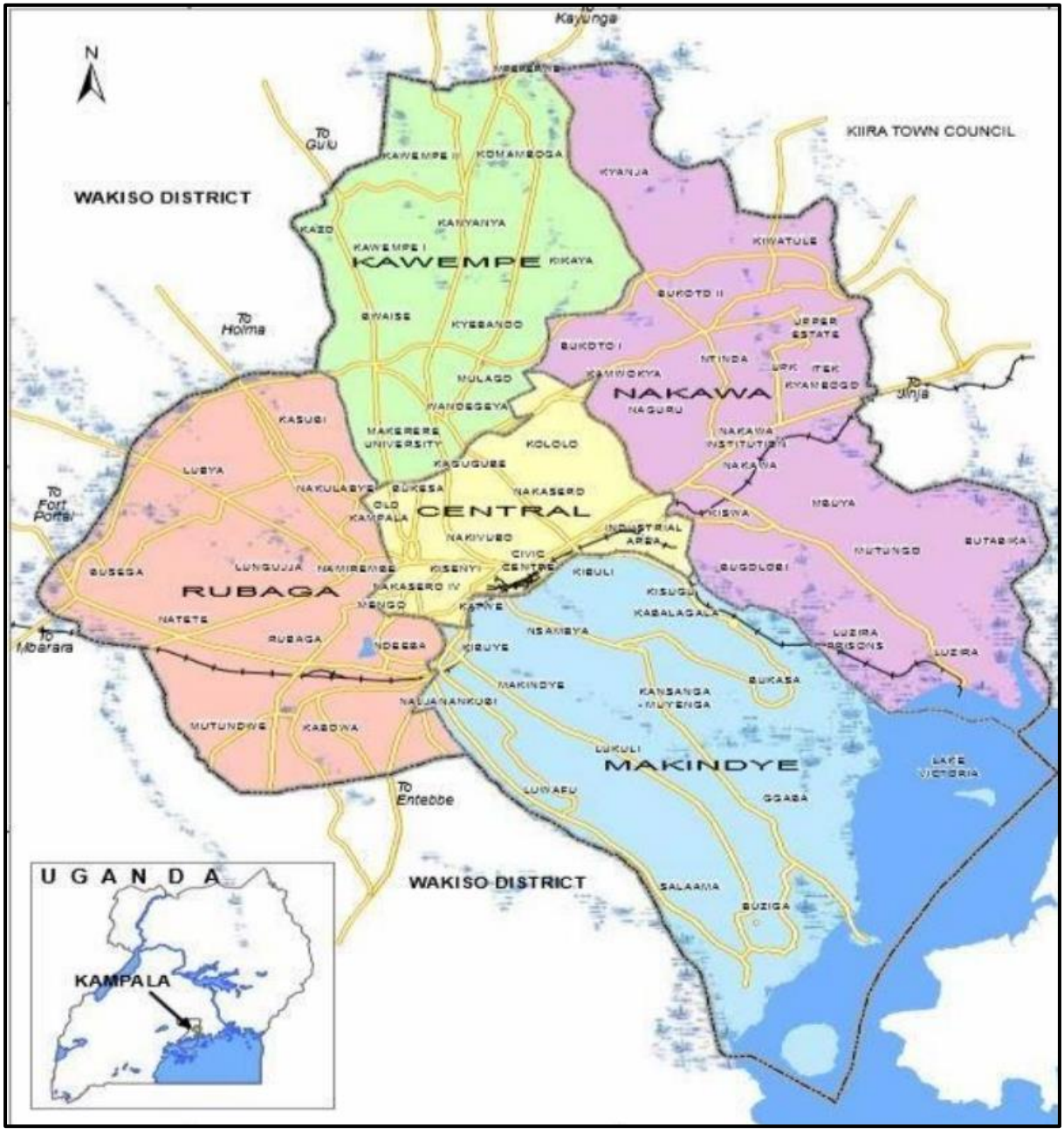
This study was conducted in Central Kampala and Wakiso District, representing urban and peri-urban areas in Uganda with significant livestock farming activity. These locations were selected due to their dynamic mix of urbanization, proximity to markets, increasing population density, and growing demand for animal-source foods, all of which have implications for the adoption and utilization of improved livestock feeding practices such as silage use.

Central Kampala is the capital and largest city of Uganda, forming the core of the Kampala Capital City Authority (KCCA). It is characterized by high levels of urbanization, limited land availability, and a dense human population. Despite its urban nature, Kampala remains a key hub for informal and small-scale livestock keeping, particularly zero-grazing dairy and poultry enterprises. Livestock farmers here often face significant challenges, including high feed costs, limited grazing space, and pressure from land use changes. As such, the need for efficient and space-conserving feed preservation methods like silage is particularly pronounced.

Adjacent to Kampala, Wakiso District encompasses several peri-urban and rapidly urbanizing areas, including suburbs such as Kira, Kasangati, and Entebbe. Wakiso serves as a transitional zone between fully urban Kampala and rural hinterlands, and it is one of the fastest-growing Districts in Uganda. Livestock farming in Wakiso is diverse and more widespread compared to central Kampala, with relatively more space for agricultural activity. Farmers here typically engage in dairy, piggery, poultry, and small ruminant farming, often combining traditional and modern feeding practices. The peri-urban context offers opportunities for silage adoption due to more available land and growing awareness of feed conservation strategies.

Both areas are part of the broader Kampala Metropolitan Area and share similar agro-ecological and market access conditions. They are strategically important for understanding how urbanization impacts livestock production systems and the adoption of sustainable feed technologies. Studying these two contrasting yet interconnected regions provides valuable insights into the drivers, challenges, and potential of silage use in both densely populated urban centers and rapidly transforming peri-urban environments(Kamukama et al., 2024).

Map of the Area of Study.



Source: Kampala City Statistical Abstract, 2019.

1.11 Target population

The study population consisted of livestock farmers in Kampala Metropolitan Area who practice sweet potato silage in livestock feeding and management. The population also comprised actors in the flow of information system such as extension workers, input

providers, local leaders and concerned government officers who have a role that influence ICT tools adoption/use in livestock management. The category was appropriate because they were intimately involved with consumption of sweet potato silage technology and how ICT shortens the gap in sharing and accessing information in livestock production systems.

1.12 Sample size determination and sampling.

A stratified simple random sampling was used for the study. The sampling frame included every livestock farmer in the Kampala Metropolitan Area, that covers Kampala, Wakiso, and Mukono districts and these folks were the ones using sweet potato silage. A list was got together from district veterinary and extension registers, plus farmer groups and cooperatives, and even input suppliers. After got rid of the duplicates and checked that they were actually using sweet potato silage right now for managing their livestock, they were stratified by district. Then, inside each of those groups the respondents were picked through a simple random draw, using computer-generated numbers for that. Each district was allocated proportionally so that got respondents based on their share of the eligible users. A sample of 21 farmers was used in the study.

1.13 Research design

A descriptive research design was used to obtain the required quantitative and qualitative data. This research design is used to obtain information concerning the current status of the phenomenon and to describe what exists with respect to conditions and it therefore was the best choice for my study. Emphasis was put on both smallholder and large scale urban and peri-urban farmers dealing in livestock.

1.14 Data and data types.

Primary data was collected through the use of structured questionnaire with both open and closed ended questions administered to the respondents through a one to one interviews.

The questionnaire was administered to the respondents in the districts of Kampala Metropolitan area that is Kampala, Wakiso and Mukono Districts in the month of July. The data collected was on demographic characteristics of respondents namely age, years of formal schooling, assessment of the current status of ICT tools use, assessment of the economic benefits of using ICT tools among sweet potato silage users among others.

1.15 Data collection and analysis methods

Pretested semi-structured questionnaires and situational interviews were used to collect data, ensuring that the responses obtained adequately address all study objectives.

The questionnaires were collected, sorted, and coded before entering them into excel, which is a statistical package that was be used to generate, mean and standard deviation. Statistical summaries of the results were displayed in tables of frequencies and percentages, to aid in interpretation. Also, tables for mean, for standard deviation were generated to aid in results interpretation.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

In this chapter, results and discussion for all study objectives are discussed based on the effect of independent variables on the dependent variable of each objective.

1.16 The demographic characteristics of sweet potato silage using farmers.

Table 1 shows the frequencies and percentages of different demographic characteristics of sweet potato silage users. The higher the frequency and percentage, the higher the usage of sweet potato silage users under a particular variable.

Table 1: The frequencies and percentages on the demographic characteristics of sweet potato silage users.

Variables	Frequency	Percentage (%)
Sex of respondents		
Male	15	71.4
Female	6	28.6
Age bracket of Respondents		
Youths (18-35)	4	19.1
Adults (36-60)	11	52.4
Seniors (61 and above)	6	28.6
Education Level		
PHD	1	4.8
Master's degree	2	9.5
University degree	6	28.6
Diploma	5	23.8
Tertiary level	1	4.8
A level	2	9.5
O level	4	19.1
Marital status		
Married	17	81.0
Single	2	9.5
Windowed	2	9.5
Primary occupation		
Farming	13	61.9
Agribusiness	5	23.8
Civil service	1	4.8
Other sources	2	9.5

Results in the table above shows that more men 71.4% use sweet potato silage than women 28.6%, there are more adults 52.4% than youths 19.1% and seniors 28.6%, most of the interviewed farmers had a university degree 28.6%, Diploma 23.8% and O level certificate 19.1% while a few had a PHD 4.8%, master's degree 9.5%, tertiary certificate 4.8% and A level certificate 9.5%. Furthermore, results show that 81.0% of the respondents were married, while others were either single 9.5% or widowed 9.5%, most of the farmers, farming was their primary occupation 61.9%, Agribusiness 23.8%, civil service 4.8% and other sources 9.5%.

Table 2: The mean and standard deviation of selected variables.

Variable	Mean	Standard Deviation
Age	50	14.06
Number of years spent in school	14.76	3.21
Household size	8.48	5.14
Year of using sweet potato silage	4.67	2.71

Discussions

From the table of results above, findings reveal that 71.4% of the farmers interviewed were men. This may be due to men owing and having access to more resources than women. This finding is consistent with Kibirige et al 2022 who found out that 70% of the interviewed sweet potato farmers in Vuvulane irrigated farms were men.

Results from the tables above also show that 52.4% of farmers were adults (36-60 years), this may be because human productivity is high between the ages of 36-60 years. This result is in line with the study on Assessment of adoption of improved sweet potato production technologies among farmers in Ohaji/Egbema local government area of IMO state, NIGERIA by Ozor et al 2020 whose findings revealed that the mean age of all interviewed sweet potato farmers in the study area was 36 years.

Also, the results from the table show that all farmers had attained formal education with the highest number of farmers, 28.6% of farmers having a university degree and the least 4.8% having a PHD, this may be due to sweet potato silage production requiring farmers to acquire and have some knowledge on its processing and storage. This finding is consistent with Kibirige et al 2022 and Egwuonwu et al. 2020 whose findings revealed that majority of the

farmers were literate with 95% and 51.6% of the interviewed sweet potato farmers having at least basic formal education knowledge.

Furthermore, results from the table show that 81.0% of the interviewed farmers were married. This is because most married people have resources at their disposal and can easily get assistance from their family members. This is supported by Ozor et al. 2020 study whose findings show that 65.0% of the respondents were married.

Lastly, results show that 61.9% of the sweet potato silage using farmers had their primary occupation as farming. This is because sweet potato silage production requires farmers to have all the required materials at their disposal for easy processing at a minimum cost. This finding is in line with Kibirige et al. 2022 study, whose findings revealed that 87% of the interviewed sweet potato farmers had no formal employment and were depending entirely on farming.

1.17 Assessing the current status of ICT tools use among sweet potato silage using farmers.

Results in table 1 show the ICT tools that farmers use, communication channels where farmers mainly get information from, and farmer training on ICT tools usage on their farms. The frequencies of different independent variables in the table show the number of sweet potato silage using farmers that used a given ICT tool, communication channel and those who received or didn’t receive training on ICT tools, the higher the frequency, the higher the rate at which sweet potato silage using farmers use a particular ICT tool, communication channel or received/didn’t receive training on ICT tools use.

Table 3: The ICT tools farmers' use, communication channels where farmers mainly get information from, and farmer training on ICT tools usage.

Description	Frequency (n=21)	Percentage (%)
ICT tool a farmer generally uses		
SMS	1	4.8
WhatsApp	13	61.9
TikTok	3	14.3
Instagram	1	4.8
Other ICT tools	3	14.3
Farmers who received information from other communication channels apart from formal trainings		
Calls	1	4.8
Internet	1	4.8
U tube	3	14.3
No other source.	16	76.2
Training on ICT tools		
Farmers who received training on ICT tools	10	47.6
Farmers who didn't receive training on ICT tools	11	52.4
Farmers who received training on ICT tools on:		
Daily basis	3	30
Weekly basis	1	10
Monthly basis	3	30
Quarterly basis	1	10
Rarely/not often	2	20

Results in table 3 show that most of the sweet potato silage using farmers use what's app 61.9% than any other ICT tool. This indicates that any increase in the access to ICT tools by sweet potato silage using farmers results in an increase in the use of what's app by farmers. From the table above, results also show that there are few farmers who use other ICT tools such as SMS 4.8%, Instagram 4.8%, TikTok 14.3% and other platforms 14.3%.

Results in table 3 further indicate that the number of farmers who didn't receive training on the use of ICT tools 19 (52.4%) is far bigger than the number of farmers who received training on the use ICT tools 11 (47.6%) at least once.

More from the result table 3, the number of sweet potato silage using farmers who received trainings on ICT tools usage daily and monthly basis was higher with 30% than the number of farmers who received training on ICT tools usage on a weekly basis, and quarterly basis while the 20% of farmers interviewed rarely received any training on the use of these tools.

Lastly, results from table 3 show that there are farmers who received information from other communication channels apart from formal training. From the number of farmers interviewed, most of the farmers received information from other sources 76.2% than from any other communication channel. Results also show that some farmers received information from communication channels such as calls 1 (4.8%), internet 1 (4.8%), U tube 3 (14.3%), and no other source 76.2%.

Discussions.

From table 3 of results, all interviewed farmers use ICT tools on their farms, that is SMS 4.8%, Instagram 4.8%, TikTok 14.3% and other platforms 14.3% and what's app 61.9%. This can be explained based on the fact that farmers want to economically and innovatively transform their farms by getting to access up to date information. This finding is consistent with (Margret et al. 2018) who stated that on average 18.2% of the households in northern Uganda use ICT tools to access food security information.

Results in table 3 further show that most of the sweet potato silage using farmers use what's app 61.9% than any other ICT tool (SMS, Instagram, TikTok and other ICT tools). This is because what's app is easy, quick and cheap to use than any other ICT tools. This finding is consistent with (Nwangwu et al. 2022) who revealed that smallholder farmers perceived the use of mobile phones as easy, and cheap applications on their phones are more effective in accessing information on agricultural activities.

Farmers who received training on ICT tools 47.6% is far less than the number of farmers who didn't receive training on ICT tools 52.4%. This may be due to a few farmers owning smart phones and other devices to help them access information on these ICT tools. This finding is in line with (Winny Nekesa et al. 2016, Mirembe et al. 2023) who noted that the major challenges farmers face in accessing ICTs were inadequate funding and incapability of using ICT devices by farmers.

Results also show that some farmers got access to information from other communication channels apart from formal training. In this category, farmers who didn't receive information

from other communication channels 76.2% were more than farmers who received information from other communication channels such as calls, internet and YouTube. This significantly indicates that farmers learn and share more during practical sessions held during farm visits and interactions with fellow farmers. This may also be because of some farmers having no access to Radios, TVs, Manuals, Leaflets/ Flyers, and not being able to attend workshops. This finding aligns with (Fleur et al. 2021) who revealed that farmers prefer to learn from their peers and that on farm demonstrations are much valued tools to facilitate knowledge exchange amongst farmers.

1.18 Assessing the economic benefits of using ICT tools to livestock farmers in Wakiso

Results in table 4 show the economic importance of using ICT tools by livestock farmers in accessing production operations, marketing, and in reducing transaction costs on their farms. The frequencies of different independent variables in the table show the number of farmers that find the use of ICT tools to get access to production, marketing, and reduced transaction costs on their farms very important, extremely important, somewhat important, moderately important and not important. The higher the frequency, the higher the rate at which livestock farmers find using ICT tools on their farms very important, extremely important, somewhat important, moderately important and not important.

Table 4: The economic importance of using ICT tools by livestock farmers.

Description	Frequency	Percentage (%)
Economic benefit of ICT tools for production information to farmers;		
Not important	1	4.8
Somewhat important	3	14.3
Moderately important	2	9.5
Very important	7	33.3
Extremely important	3	14.3
Those not stated	5	23.8
TOTAL	**21**	**100**
Economic benefit of ICT tools for marketing information to farmers;		
Somewhat important	3	19.05
Moderately important	3	19.05
Very important	8	47.62
Extremely important	2	14.29
Those didn't state	5	23.8
TOTAL	**21**	**100**
Economic benefit of ICT tools for reducing transaction costs information to farmers;		
Not important	1	4.8
Somewhat important	5	23.8
Moderately important	5	23.8
Very important	4	19.0
Extremely important	1	4.8
Those didn't state	5	23.8

Results in table 4 show that farmers who find ICT tools for production information extremely important were 3 (14.3%), very important were 7 (33.3%), moderately important were 2 (9.5%), somewhat important were 3(14.3%) while some farmers found these ICT tools not important to them 1(4.8%). Still from the table above, results show that most of the farmers found ICT tools for marketing very important 8(47.62%), some found these tools extremely important 2(14.29%), some farmers said the ICT marketing tools were moderately important 3 (19.05%), while some farmer found these tools somewhat important 3 (19.05%).

Furthermore, objective 3 results show that most farmers found ICT tools for transaction costs information moderately important 5(23.8%), some found the somewhat important 5 (23.8%), some said these tools were very important 4 (19.0%), others found them extremely important 1 (4.8%), while the rest of the farmers found these tools not important to them 1 (4.8%).

Discussions

Results from the table above show that majority of the farmers found the use of ICT tools very important to them, that is 33.3% of the farmers found ICT tools for production information very important, 47.62% of the farmers found ICT tools for marketing information very important and 19.0% of the farmers found ICT tools for reducing transaction costs information very important. This is because these tools help farmers to be informed as they help in increasing the flow of information in both rural and urban areas. This result is in line with (Margret et al. 2018) who stated that the utilization of ICT tools by farmers for production and marketing information improves households' food security status by 38%.

1.19 Identifying the barriers and challenges faced in implementing digital technologies in Livestock farming.

Results in table 5 show the challenges livestock farmers mostly face in adopting and using ICT tools on their farms. The frequencies of different independent variables in table 3 show the number of farmers that were affected by a particular challenge, the higher the frequency, the higher the rate at which livestock farmers faced a particular challenge in adopting and using ICT tools on their farms.

Table 5: The challenges farmers face in implementing digital technologies in Livestock farming.

Description	Frequency	Percentage (%)
High internet costs	15	71.4
Inadequate devices	2	9.5
Limited Technical skills	2	9.5
Misuse by other users	1	4.8
Other Challenges	1	4.8
TOTAL	**21**	**100**

From the table of results above, most farmers faced a challenge of high network costs 15 (71.4%), meaning that any unit increase in the use of ICT tools such as what's app, TikTok and Instagram, resulted in an increase in the network costs incurred by livestock farmers. Results also show that farmers faced other challenges that limited their use of ICT tools, among which included inadequate devices 9.5%, limited technical skills 9.5%, misuse by other users 4.8% and other challenges accounted for 4.8%.

Discussions

The results from the table above show that high network costs such as data costs are the major challenges livestock farmers face in adopting and using ICT tools. This may be due to lack of finance to load data always, poor connectivity and network and lack of knowledge on how to minimize these costs. This finding is in line with (Mirembe et al.2023) who found out that the key challenges constraining access and usage of ICTs among smallholder farmers include lack of digital skills, limited awareness of ICTs, high costs of devices and internet bundles.

Inadequate devices is the other major challenge livestock farmers face while adopting and using ICT tools on their farms, according to the results in the table above. This may be due to the remoteness of their farm locations, network congestion or use of very old, outdated devices. This result aligns with (Stella et al. 2024) who noted that foremost obstacles hampering the ICT adoption by farmers include inadequate devices, persistent communication network changes and electricity shortages.

Results from table 5 also show that misuse of ICT tools by other users is the other major challenge livestock farmer's face in adopting and using ICT tools on their farms. This may be due to the fact that farmers have no control on the use of these tools by other people resulting in uploading irrelevant information on the tools by some users. This information consumes livestock farmer's resources such as data resulting in high network costs. This finding is consistent with (Mirembe et al.2023) who noted that one of the key challenges farmers faced in accessing and using ICTs is lack of appropriate digital content.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

1.1 Conclusions

Basing on the results for objective 1 table, all of the interviewed farmers use ICT tools on their farms that is SMS 4.8%, Instagram4.8%, TikTok 14.3%, other platforms 14.3% and what's app 61.9%, 47.6% of farmers used other communication channels apart from formal training to access production, marketing and reducing transaction costs information especially farm visits/fellow farmers, and majority of the farmers didn't receive training on the use and benefits of ICT tools. Objective 2 results indicated that majority of farmers found the use of ICT tools very important to them, that is 33.3% of the farmers found ICT tools for production information very important,47.62% of the farmers found ICT tools for marketing information very important and 19% of the farmers found ICT tools for reducing transaction costs information very important. Results for Objective 3 revealed that most farmers faced a challenge of high network costs 15 (71.4%), meaning that any unit increase in the use of ICT tools such as what's app, TikTok and Instagram, resulted in an increase in the network costs incurred by livestock farmers.

1.2 Recommendations

I would recommend the government and other non-government organizations to support rural farmers to boost their access to the use, and adoption of ICT tools, this can be achieved by

improving communication networks, subsidizing ICT tools maintaining costs, and providing them with financial aid.

I would recommend an improvement in agricultural training and extension systems, with particular attention to less experienced and elderly farmers who may exhibit resistance to technological advancements and adoption of ICTs.

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APPENDIX

Questionnaire

A. BIOGRAPHIC DATA OF THE RESPONDENTS.

1. Name of the respondent/farmer.....
2. District .....sub-county/division .....Parish/Ward .....Village.....
3. Telephone Contact.....
4. Email address.....

B. GENERAL SOCIO-DEMOGRAPHIC INFORMATION

1. What is your age?.....

Gender? (1 = Male, 0 = Female)

2. What is your marital status?

(1 = Married, 2 = Single, 3 = Divorced, 4 = Widowed)

3. What is your highest education level (number of years spent in school)?
4. Are you the head of your household? (1 = Yes, 0 = No)
5. What is your household size?
6. What is your main occupation?

1 = Farming 2 = Civil service 3 = Private Service (non-agricultural) 4 = Private Service (mainly agricultural) 5 = Business 6 = Casual laborer 7 = Artisan work 8 = Student 9 = other (specify)

7. What is your professional/work title?

(e.g., Dr, Commissioner, Engineer, Accountant, Businessperson, etc.)

C. **USE OF ICT TOOLS**

1. ICT Tool Usage Table

ICT Tool	Use Generally (1=Yes, 0=No)	Use in Silage Business (1=Yes, 0=No)	Had Extension Training? (1=Yes, 0=No)	Frequency (Code)	Importance for Production Info (1-5)	Importance for Market Info (1-5)	Importance for Reducing Transaction Costs (1-5)
SMS							
WhatsApp							
TikTok							
Other Apps							
Instagram							
Other ICT Tools (specify)							

Frequency Codes: 1 = Daily 2 = Weekly 3 = Monthly 4 = Not very often

Importance Scale: 1 = Not important 5 = Extremely important

2. What challenges do you face using ICT channels for silage and livestock feeding?

1= Poor network 2=High internet costs 3=Inadequate devices 4=Limited technical skills 5=Misuse by other users

3. What do you rank as your first challenge?

4. What do you rank as your second challenge?

5. What do you rank as your third challenge?

6. If using WhatsApp, how many farming groups do you belong to?

7. How many of these groups share information about sweet potato silage?

8. Which other communication channels (apart from formal training) have you heard about sweet potato silage from in the last year?

1 =Radio 2=TV 3= Leaflets 4= Manuals 5=Songs/drama/skits 6= Farm visits

9. In the past year, have you received technical training on sweet potato silage?

1 = Yes 0 = No

10. How many people have you deliberately shared information about silage with since you started using it?

11. How many people do you estimate have adopted sweet potato silage because of your influence?