



## FINAL REPORT

The Rapid Needs Assessment Study  
for the Sustainable, Climate Adapted,  
and Digitally Enabled Agriculture for  
Enhanced Food Security in Kenya Project



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## Acknowledgments

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This report summarizes the findings and recommendations of the Rapid Needs Assessment Study for the Sustainable, Climate Adapted, and Digitally Enabled Agriculture for Enhanced Food Security in Kenya Project, conducted by the AgriBora team. The report was prepared under the overall direction of Kizito Odhiambo, John Lewis, Lilian Faith and Joackim Apondo.

The team gratefully acknowledges the support for this work by the leadership of ACWICT, Senior Management of the County Government of Busia, Kisumu, Homa Bay, Kilifi, and Nakuru. Special thanks to county liaison persons for assisting the team in organizing the county visits. The team would like to thank the staff of ACWICT, especially Constantine Obuya, Paul Opiyo, and Steven Kimetu. This study would not have been possible without their intense and trustful cooperation.

The report benefited from invaluable suggestions from farmers and officers of the five counties' Departments of Agriculture. We are grateful to the stakeholders who participated in the interview process for their active engagement and insightful input. We acknowledge the financial support of The Foreign, Commonwealth & Development Office (FCDO) for the study.

## Acronyms and Abbreviations

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<b>ACWICT</b>	African Centre for Women, Information and Communications Technology
<b>CIDP</b>	County Integrated Development Plans
<b>HQ</b>	Headquarter
<b>ICT</b>	Information and Communication Technology
<b>ICT4AD</b>	Information and Communication Technology for Agricultural Development
<b>IVR</b>	Interactive Voice Response
<b>KALRO</b>	Kenya Agricultural and Livestock Research Organization
<b>KCSAP</b>	Kenya Climate Smart Agriculture Project
<b>KII</b>	Key Informant Interview
<b>NARIGP</b>	National Agricultural and Rural Inclusive Growth Project
<b>ODK</b>	Open Data Kit
<b>SACCO</b>	Savings and Credit Cooperative Organization
<b>SMS</b>	Short Message Service
<b>ToTs</b>	Trainer of Trainers
<b>USSD</b>	Unstructured Supplementary Service Data

## Executive Summary

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The African Centre for Women, Information, and Communication Technology (ACWICT) is implementing the Sustainable, Climate Adapted, and Digitally Enabled Agriculture for Enhanced Food Security in Kenya. The project is a scale-up of the UK Government-funded Digital Agriculture for Accelerated and Inclusive Post COVID-19 Economic Recovery Project in Laikipia County. Despite the challenges, the project beneficiaries, including farmers, require relevant digital agricultural content to increase agricultural productivity and adapt to climate change. However, there is a need for a rapid assessment to understand the needs critically, challenges, and opportunities in using locally relevant agricultural content for improved productivity and improving the livelihoods of underserved farmers in the five counties.

Kenya's agricultural activities and practices occur at the county, sub-county, and ward levels. Assessing the situation at these lower levels was deemed essential to provide insights into the digital capacity constraints, challenges, and opportunities concerning access and use of digital agricultural content at the county level where agricultural activities occur. The study team visited five (5) counties to undertake capacity assessments. The counties where the review took place were Busia, Kisumu, Nakuru, Kilifi, and Homa Bay. While the study of these five counties provides case study insights, the emerging issues imply that the findings and recommendations can be useful beyond those studied.

Although national public institutions and county governments are mandated to provide agricultural information and knowledge to farmers and stakeholders, several private-sector organizations also give the farmers digital agricultural content. While there are active engagements between the national institutions, county agricultural departments, and farmers on the critical digital content provision, there are notable gaps in accessing and interpreting or using the information due to low digital literacy among most farmers. This situation has created inadequate awareness of the existing digital agricultural content and platforms and their value among farmers since they do not know how to access or use the information.

Based on the needs assessments, it is proposed that, in the short term, capacity building in digital literacy will be essential for improving the access and use of existing digital agricultural content for decision-making along the value chain. Investing more resources in digitization can be a quick and sustainable solution for the aging county extension staff. It will prevent information loss through staff attrition while planning other inclusive approaches. In addition, raising the awareness of the content can enhance access and use of the information among relevant stakeholders. Ensuring that critical stakeholders working in these counties collaborate will assist them in achieving their goals more efficiently.

The study findings inform the recommendations in this report through a diverse engagement with different stakeholders. However, implementing these recommendations will depend on the buy-in from relevant institutions and stakeholders. It will also be essential to engage higher-level policy-makers to present the findings to ensure support for improving agricultural statistics and that required resources are allocated. As a way forward, the project is encouraged to expedite the implementation of the findings and recommendations.

# Key Findings

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## Demographics

The survey covered 456 respondents from five counties of Busia, Homa Bay, Kilifi, Kisumu, and Nakuru. There were more male respondents than females comprising 55% and 45%, respectively. Most of the farmers interviewed were below 50 years, and about 5% were over 65 years. The Key Informant Interviews (KIIs) were administered to 75 respondents evenly distributed across the five counties. Most key informants were subject matter experts, mainly agricultural extensionists at county officials working at the HQ or ward levels and champion farmers who are Trainers of Trainees (ToT).

Most farmers had at least a secondary level of education (44%), and only four farmers didn't have primary education. Most farmers were practicing subsistence farming (63%). Among the respondents, 36% reported entirely relying on income from agricultural activities, and 64% partially depending on income from agricultural activities. Most (96%) of the farmers said they were involved in production part of the agricultural value chain, while less than 5% of the respondents undertook other value chain activities.

## User needs identification

More than half of the respondents expressed a high need for digital skilling. Those with a high demand for general or basic digital literacy are 55%, medium at 29%, and low at 16%, respectively. The requirement for intermediate digital skills was high at 48%, medium at 38%, and low at 14%, while advanced digital skills were high at 56%, moderate at 31%, and low at 13%.

About 81% of respondents reported owning a smartphone, and 56% of respondents said access to digital agricultural platforms to get online information. The standard agricultural information accessed from the platforms included general farming at 91%, livestock farming at 74%, and crop farming at 55%. About 64% of the respondents observed that digital agricultural information benefits farmers.

## Internet connection and usage frequency

Most respondents, about 80%, reported connecting to the internet mostly using smartphones. Regarding the frequency of internet connection, 71% of respondents reported using the internet daily. About 41% of the respondents often went online to look for information on agriculture.

The infrastructure needs include improving internet connection speeds, installing internet connections, and acquisition of computing devices in different parts of the

counties. Whereas most people indicated that internet access and voice connection to the telecommunication network are relatively good across the five counties, there were cases where rural or last-mile connectivity is poor or unavailable.

### Access to technology and use of digital content

Among those interviewed, 42% confirmed that they regularly accessed online agricultural information, of which 66% could access agricultural information using their own devices, while 58% said they could charge their devices without power challenges.

The extent of the need for online agricultural information and digital agricultural platforms was reported as high at 59% and 47%, respectively. On the relevance of digital content, 66% want them simplified, 47% tailored or personalized, and 42% translated into local languages. Those who could apply the knowledge from available online sources were 57%. The most preferred mode of information dissemination channel was the Short Messaging System (SMS) at 74%. The preference for other dissemination approaches are mobile applications 35%, phone calls 38%, and face-to-face 34%. The radio and television stations were preferred by 22% and 17% respectively. While 48% are aware of the sources for digital content, only 34% consistently use the information for farming practices.

### Digital Content Value Proposition

The available online agricultural information is user-friendly according to 52% of the respondents, and 68% agreed that the content is valuable and essential. About 57% of the respondents indicated that their activities and practices significantly depend on online agricultural information.

Subsequently, 54% said that they were willing to pay for the online agricultural information, and 47% confirmed that they could pay for online information. About 47% did not commit to the affordability of charges for accessing online content in agriculture.

### Awareness of digital agricultural platforms and Information sources

Among the respondents, 52% indicated that they are aware of existing digital agricultural platforms disaggregated by gender, 54% males and 49% females. On the different sources through which farmers get agricultural information, 42% of the respondents cited radio and 37% television. Other sources included friends or family members at 34%, county agricultural extension workers/officers at 33%, community members at 28%, mobile phones at 18%, internet at 31%, and other channels at 9%.

The demand for different types of information is general farming at 80%, livestock farming at 61%, crop farming at 52%, markets access at 48%, fertilizers and other farm inputs at 43%, availability of seeds at 39%, pesticides at 34%, latest technologies at 33% and information on the potential disaster was last.

## Social networking sites and group membership

Among the available social networking sites, WhatsApp and Facebook are the most preferred sites at 76% and 66%, respectively. Farmers also use YouTube and other social media sites such as Twitter, TikTok, Instagram, LinkedIn, and Snapchat. Among the farmers interviewed, 34% reported belonging to a farmer group, with females taking a higher percentage than males.

## Way Forward

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### Establishment of a Partnership and Collaboration Framework

There is an urgent need to create and establish a framework that will stimulate effective working relationships between the content generators, infomediaries (content curators and publishers), and farmers for each of the five counties. In line with the study findings, this assessment recommends that the successful implementation of the project will require an intentional approach to bring the stakeholders together and ensure the project resources work best as a catalyst and initial support for stakeholders' engagement. After that, create a framework that engages the commercial, NGO, government-run institutions and extension, market linkage agents, and financial service actors to develop and disseminate the available and new content continuously.

### Digital Literacy Capacity Building

The need for capacity building on digital literacy to complement extension services is critical and significant in the five counties, and a means to achieve satisfactory levels of digitization in the agriculture sector. In addition, capacity building for the county technical staff, awareness creation about available digital solutions in agriculture, and provision of tablets and smartphones are some of the main areas required for the project to improve access to digital content in the counties.

### Investment in Digital Infrastructure

There is insufficient ICT equipment, tools, and resources in all five counties, including servers, laptops, and digital devices. While the provision of digital devices could be outside the scope of the project, there is a need to ensure that the county extension officers acquire such machines and tools. In addition, there is limited or no internet in some cases, particularly at the county, sub-county, and ward head offices. Therefore, there is urgent to identify and connect the county management to affordable internet service providers such as Mawingu and Community Networks. In addition, the project should play a key role in helping to establish the relationship between commercial internet service providers and the management of the counties. One approach to establishing such collaboration can be through existing mechanisms such as Corporate Social Responsibility (CSR) arrangements. These approaches can improve internet connectivity and availability at the county, sub-county, or community level.

### Proactive Planning

High-valuable content can be best achieved through participatory approaches to steer collaboration and enrich the content. A shift is required from organizing physical events and silo content development to 100% digitization and content bundling. The project implementation process should leverage the user needs assessment report,

findings, and recommendations as a guide to ensure the users' actual needs are met and addressed for a more significant impact. In addition, intentionally plan the digital capacity as a sensitization process. Further, the project should document the processes involved in the implementation as a framework that can guide the project's scalability. During the design phase of future projects, it is vital to identify critical models and parameters to assess technical risks and uncertainty. The models can also be used to provide additional metrics that are associated with the project purpose and implementation plan.

# CHAPTER 1: Background

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Digital technology is a powerful catalyst for inclusive economic and sustainable development and growth. However, farmers in most developing countries face challenges using digital content as the primary source of agricultural information (Molotsi & Makombe, 2019). Poor network coverage, power cuts, low digital penetration, and high levels of digital illiteracy are the critical barriers to using digital technologies entirely (Visser, 2014). In addition, limited internet connectivity and limited access to local relevant digital content have persistently remained challenging in developing countries (Ochieng et al., 2017).

Promoting the adoption and creating awareness of digital technologies among marginalized communities can boost their digital resilience, facilitate effective participation in the knowledge economy and foster positive economic development and growth. Towards this end, the African Centre for Women, Information, and Communication Technology (ACWICT) is implementing the Sustainable, Climate Adapted, and Digitally Enabled Agriculture for Enhanced Food Security in Kenya. The project is a scale-up of the UK Government-funded Digital Agriculture for Accelerated and Inclusive Post COVID-19 Economic Recovery Project in Laikipia County. Phase one of the project was implemented between December 2020 to June 2021.

The overall objective of the first phase was to increase access and use of locally relevant digital content and resources for sustainable agriculture and food security among farmers in Laikipia County. Specifically, the project aimed at enhancing farmers' digital literacy skills in accessing and utilizing digital resources for sustainable agriculture and food security in Laikipia County while providing relevant digital agricultural content aligned to priority information needs identified as farmers' pain points. Further, it aimed to create awareness of the existence and benefits of agricultural digital platforms among farmers in Laikipia County; and facilitate establishing an information resource center in partnership with the Laikipia County Government department of Agriculture. Following the successful implementation of Phase One of the project in Laikipia County, ACWICT has received funding from FCDO to scale up the project in Laikipia County and conduct a needs assessment study in five (5) additional counties of Kilifi, Nakuru, Kisumu, Homa Bay, and Busia in Kenya.

## 1.1 Needs assessment study context

Digitalization enables farmers to manage agricultural activities more effectively (Fountas et al., 2020). The rapid assessment study explores the needs, challenges, and opportunities in using locally relevant agricultural content to improve productivity and the livelihoods of underserved farmers in the five counties. In addition, the study will

seek to understand the relevance of the existing digital content models used in the agricultural sector and examine potential models around already developed agricultural-based solutions and documented models for sustainable creation and dissemination of locally relevant digital content in the project goal. Further, the study seeks to identify barriers to access to locally relevant, gender-sensitive, development-oriented digital content, including e-government services among the underserved farmer community of the five counties. The study will additionally identify local radio and television stations and their reach to evaluate their effectiveness in creating awareness among underserved farmers in the five counties. Also, hold and document introductory meetings with key stakeholders (community-based organizations, co-operatives, value chain associations, agricultural input distributors, and other private sector organizations) engaged in the process.

## 1.2 The purpose and scope

The Rapid Assessment study aims to map out knowledge and information digital assets, including their Use and relevance for the agricultural communities in the counties studied. In addition, to make recommendations that can provide relevant interventions. The main objectives of the rapid assessment are as follows:

- Identify user needs for access use & relevance of the digital agricultural content
- Stimulate demands for the Use, access, & relevance of digital agricultural content
- Identify relevant interventions & digital tools to address the needs of the users
- Identify the existing structure of the digital ecosystem

## 1.3 A brief description of the assessment

This study aligns with ACWICT's overall ICT for Development (ICT4D) objective of promoting women and youth access to and knowledge in ICTs for sustainable development. In addition, to provide equal opportunities to access and use information/knowledge for social, economic, and political advancement, mainly focusing on high potential but disadvantaged women and youth, including marginalized, vulnerable, and underserved women from informal urban settlements and rural communities. In this context, ACWICT's digital goal aims to promote digitalization as an enabler for connecting the agriculture ecosystems and sustainably integrating Governments, Markets, and Villages into strategic value chains. For ACWICT to achieve its goal and digital strategic objectives, the underpinning principle is to underscore the critical role that data plays in the inclusive agricultural transformation by promoting standards to strengthen systems, best practices, and open data among governments and industry. In addition, effective management of data is central to providing evidence-based policy and ensuring quality data exists to help track progress, make informed decisions, and enable transparency and accountability. Therefore, ACWICT priority initiatives support and provide solutions

that improve access and use of digital content for better livelihoods. Developing available digital content and platforms and data-driven Use Cases for county governments is an important initiative for the agricultural sector. These two initiatives' overarching enablers are a collaborative approach to strengthening access, use, and relevance to digital agricultural content. The rapid needs assessment study area comprises five (5) selected counties of Nakuru, Kilifi, Kisumu, Busia, and Homabay. The rationale for choosing the five counties is discussed in Chapter 3 under methodology.

The study assessed the digital economy's status in the five counties, including potential demand and relevant intervention. The rapid assessment findings contribute to the digitization activities, identifying the county-level constraints and recommendations. The underlying assumptions on digitization actions in the counties are therefore clarified. Consequently, this rapid assessment study identified capacities and gaps for content generation and dissemination at all levels and content management needs. In addition, map out the existing structure and digital ecosystem, critical actions needed to address the identified capacity gaps, and recommendations on the support required for improving the digitization of the agricultural sector in the five (5) counties.

This report highlights the needs, demands, and relevant interventions concerning digital agricultural content access, use, and relevance. The study also focused on identifying gaps in existing digital ecosystem structures in the selected counties. Further, the study recommended ways of addressing the short, medium, and long-term gaps based on priority areas. In addition, the gap analysis points to certain key priority intervention areas, which provide direction for capacity building and access to digital content in identified priority areas.

Following on from the FAO (2016) report, farmers need the most current local and global information about advances in agricultural technologies, weather patterns, market information, and consumer preferences to support them make suitable decisions on what to grow, when, how, and where to market it for a profit. According to the resulting composite indicators, Kenya is a significant digital Hub in East Africa, with advances in establishing a formidable digital ecosystem in the continent (Baumüller, 2016). The ecosystem has shown revolutionary growth with prospects of stimulating more digital services. For instance, there has been a notable impact on smallholder farmers' financial services by enabling savings and credit facilities on their mobile phones. Looking closely at the individual counties' digital enablement indicators, Busia, Nakuru, Homabay, Kisumu, and Kilifi counties, have several agricultural potentials that, when explored appropriately, will improve the market stability and sustainable food production within the counties. However, the farmers in these counties have varied challenges and opportunities in accessing and using digital content in their farming practices and activities. For instance, in 2019, a report from Busia County found that access and adoption of digital agriculture content are still deficient (Adego, 2019). On the other hand, in Nakuru County, approximately 70% of

smallholder farmers use digital agricultural information for extension services (Kirui et al., 2021). While some parts of these five counties have fully developed in terms of mobile network infrastructure, the knowledge of available digital agriculture is still not well known by most farmers (Wanjoh, 2015).

## 1.4 Demand digital agricultural content and services

Digital technologies enable farmers to make effective decisions and actions that improve agricultural performance (Trendov et al., 2019). The level of digital literacy is highly correlated to the demand for digital content and services (Ash et al., 2010). However, rural farmers in developing counties such as Kenya experience an information gap (Ginige et al., 2016). On the other hand, all the five counties where the assessment was conducted have well-developed County Integrated Development Plans (CIDPs), an essential planning and management framework for aligning the development priorities, including a digital strategy. The successful implementation of the CIDPs will provide a roadmap for required changes, capacity development, and collaboration leading to the provision of quality digital services. While there is no single best approach specific to addressing the challenges in the five counties, centralized bundling of digital services has many advantages concerning costs that can be leveraged to reduce per-unit costs and convenience. There are also advantages associated with accessing and sharing services in a single platform that is available to all stakeholders. A centralized platform has structures including the digital infrastructure, access, and use, ensuring equitable distribution of information and services (Mallinguh, 2017).

This report undertakes a rapid needs assessment regarding digital infrastructure and institutional and human capacities for accessing and using digital agricultural content to generate evidence of sustainable, climate-adapted, and digitally-enabled agriculture for enhanced food security in Kenya. The diagnostic also focuses on the existing gaps in the current digital platforms, providing recommendations for addressing these gaps in the short, medium, and long term based on findings and prioritization. In addition, the gap analysis points to certain key priority intervention areas that provide the project with direction for the future.

## CHAPTER 2: Mapping of Actors in the Digital Agricultural in the selected Counties

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Digital agricultural content and services are provided by the public and private sector actors, who are mandated or interested in generating or disseminating such content. Because of the interconnectedness of the various value chains, it is essential to consider how, for example, efforts to improve the quality of access and use of digital services and content. The potential impact of digitizing agriculture is unmistakable. Farmers are the primary links in the agricultural value chain, sometimes called the 'first mile.' As farmers live in dispersed rural areas, it isn't easy to reach them physically. In many counties in Kenya, costly extension approaches are used to 'educate' farmers on farming practices (Akuku et al., 2019). With the increase in internet and mobile network connectivity and coverage, digital approaches are rapidly changing the sector.

Digitization is a feasible and valuable way of ensuring content management, digital platforms, and learning model are effectively used. Indeed, it is a better way of sharing information among researchers, partners, value chain actors, farmers, and policy-makers. The findings confirm that the digital content is not well organized and structured appropriately for ease of access and integration into the daily operation of the value chain actors in the sector. Also, the results show that farmers, extension officers, and researchers spend a lot of time and resources organizing events to share agricultural content. Therefore, there is a need to digitize most of the agricultural content in the five counties where the study was conducted and develop platforms that can interact with the actors.

The mapping process showed that efforts to improve collaboration between the different actors require sufficient digital content activities. The mapping also highlights the critical aspects of capacity and infrastructure as essential for delivering quality digital content to farmers, including the integration and the need for coordination among content producers, infomediaries, and users. In addition, it is necessary to standardize the ingestion, sharing, and dissemination of the diverse content within the counties because of the interconnectedness of the various components of the agricultural content.

### 2.1 Mapping the digital agricultural content ecosystem in the five selected Counties

Over the years, both public and private international and local organizations have generated actual agricultural content through various programs and research activities. However, accessing and integrating knowledge and information with

different systems and platforms remains an enormous challenge. In addition, it is unknown who has what content, where these resources are hosted or published, and whether they are open/not. The assessment focused on finding the existing digital agricultural content resource base to establish the status and areas for improvement. Further, the study used quantitative and qualitative approaches to analyze the data collected. In addition, workshops with experts and stakeholder engagement were organized to assess, validate and discuss the findings regarding the openness of the digital agricultural content, including patterns from county to county among the five.

### 2.1.1 Content Generators, Infomediaries, and Users in the five selected counties

Identifying user needs requires engagement with the various users to align the demands with the requirements of those users. Different users have specific preferences and needs. For example, farmers' pain points differ among policy-makers and the private sector actor's conditions. Therefore, the content generators need to focus on developing specific and relevant digital content and services that address the particular needs of each stakeholder, including required digital skills. In addition, content disseminated should be supported with modern tools such as web portals, SMS, USSD, IVRS, and infographics to improve the uptake of the content they produce by different stakeholders.

Underlying content generation, digitization, and dissemination activities are essential aspects of digital capacity building, content management (curation and publishing), product and service development, and institutional and legal framework to guide the collaboration and interaction between the producers, intermediaries and users. In addition, the results show that digital infrastructure and penetration are required to support the processes from generation to dissemination. Further, using harmonized concepts and definitions across content management is vital to compare relevance and usability across multiple sources. These findings show that all actors or stakeholders involved in the content process require some capacity building. For instance, content generators require skills in metadata and ontology. As the primary generators of agricultural content, the agricultural research organizations and centers should collaborate with the county government agricultural officers to increase the availability and usability of the content they generate.

The study results identified that engaging with stakeholders and critical actors while focusing on the users is vital in ensuring the relevant generated and presented appropriately in a usable format. The leading generators of agricultural content are research organizations at the national and county levels. The content users include farmers, international development partners, policy-makers, and digital experts. Between content users and generators are intermediaries who convert the content into simplified and usable models and platforms for access, including downloading microdata. Figure 1 highlights the mapping of the various stakeholders.

## 2.1.2 Content Management Digital Capacity Constraints in the five selected counties

The different organizations responsible for generating and managing agricultural content have diverse institutional structures and arrangements at the national and local levels. However, the technical, human, and financial requirements are varied and unique. Most have serious capacity gaps. While some organizations generating, processing, and disseminating agricultural content in the five counties have robust digital systems and platforms for converting the content into usable products and services. Chapter four explains critical findings from the assessment in more detail.

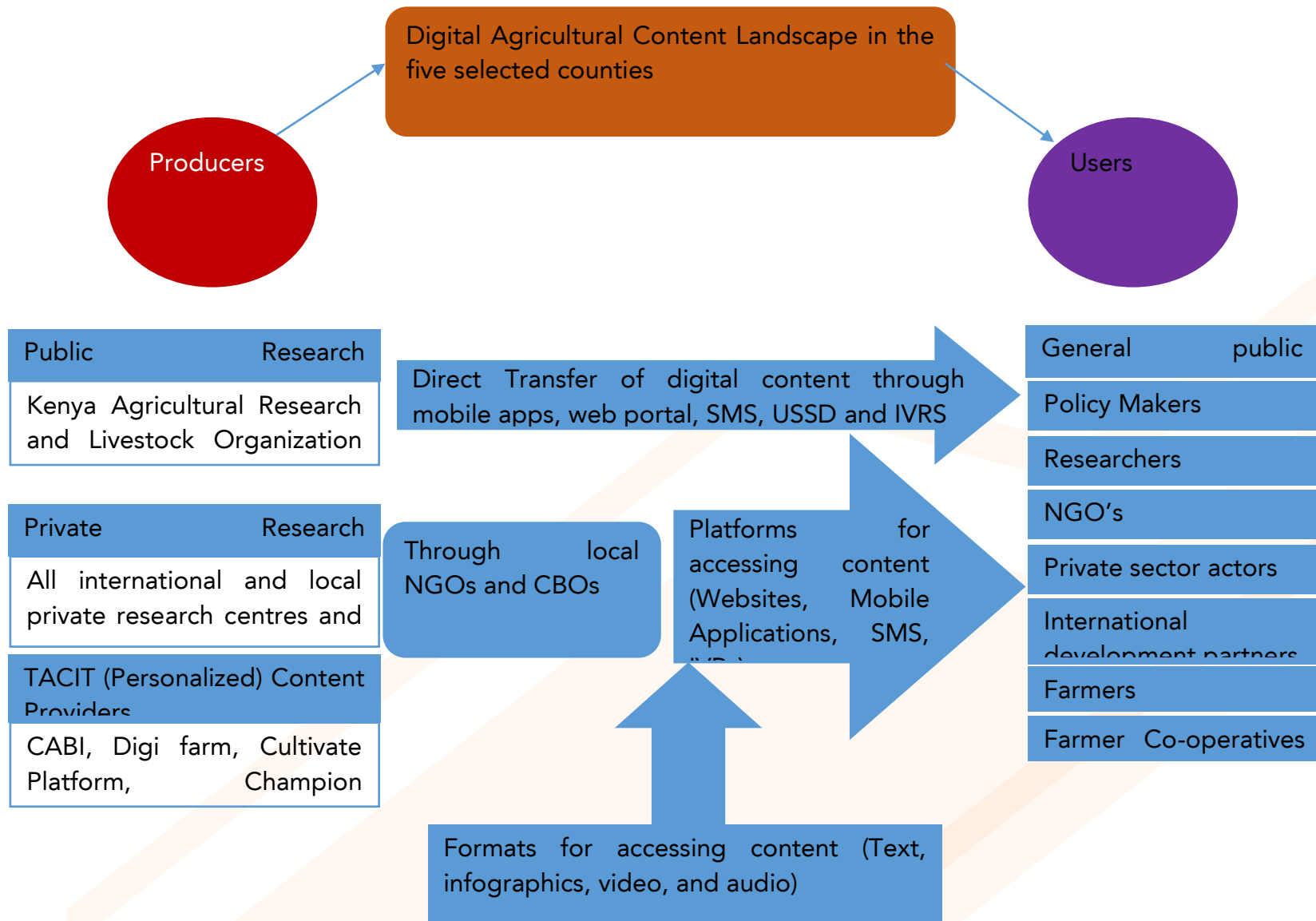


Figure 1: Mapping of Digital Agricultural Content Landscape and Flow in the five selected counties.

## CHAPTER 3: Methodology for Conducting the Digital Skilling Needs Assessment

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The assignment process follows the Theory of Change based on globalization and knowledge-based production to enable model testing, refinement, and scaling globally. This section highlights aspects of the technical approach and methodology applied in the study, including the county selection criteria, sampling procedure, data collection methods, and analysis.

### 3.1 The county selection criteria

While all the 47 counties in Kenya have internet connectivity to support some level of access and use of digital agricultural content, counties increasingly demand high-quality internet service. This increasing demand is because access and utilization of digital agricultural content activities in Kenya occur at the community where farming is practiced. For the project to succeed, beneficiaries, including farmers, require specialized and timely information to increase agricultural outputs, raise productivity, and adapt to climate change. Table 3 (Annex A) lists several factors to provide insights into the capacities, constraints, and challenges regarding accessing and using digital agricultural content at the sub-county level where these activities occur.

Drawing from Checklist developed and shown in Table 3 (Annex A), ACWICT proposed five (5) counties to scale up the project and reach more than one million farmers among the most vulnerable communities in Kenya. The counties' selection represented different assessment levels, including internet infrastructure and connectivity, agricultural contribution (GVA) to GDP, internet affordability, internet penetration rate, and presence of emerging technologies, among other factors.

The scoping study identified several variations across the 47 counties in Kenya, as shown in Annex A. The internet penetration rate and emerging technologies were critical factors used in the screening process to justify the selection of the five counties. While the screening of the counties can only provide insights, the emerging common issues imply that the analysis and recommendations are helpful beyond the counties selected. Therefore, three types of selection criteria were applicable, namely:

- Internet penetration rate
- Presence of emerging technologies
- Inclusivity

Based on the three criteria stated above, Kisumu and Nakuru were proposed in the high internet penetration rate category, while Kilifi and Homabay were in the medium category and Busia under low since there is a possibility of Community Network extension to Busia county through Siaya county. The summary is shown.

*Table 1: County selection criteria*

High Internet penetration rate + Presence of Emerging technologies in the county	Medium Internet penetration rate + Presence of Emerging technologies in the county	Low Internet penetration rate + Possible Emerging technologies connection in the county
Kisumu	Kilifi	Busia
Nakuru	Homabay	

## 3.2 Sampling Procedures

Typically, sampling enables selecting a comparatively small number of a representative subset from a pre-defined population to serve as a data source or respondents in a study (Wilson, 2016). This assessment study identified the population from which the sample size was drawn. The study's domain aligns with outlined sampling techniques (Eisenhardt, 1989; Yin, 2011; Creswell & Creswell, 2017; Peel, 2020). Studies suggest specific sampling guidelines in designing a sampling strategy or scheme because ensuring that sampling is consistent with the study's conceptual thinking is essential. In addition, the sample design meets the degree of assurance that all required data is accessible and provides representation. Also, the need to draw credible inferences and explanations from data guided the sampling design. This approach is vital for generalizing study conclusions to other populations, settings, and contexts.

### 3.2.1 Qualitative Method Population and Sample Size

The project documents show that it targets to reach 500 Training of Trainers (ToTs) as part of the beneficiaries in five (5) counties. The beneficiaries are distributed in five (5) counties. These Counties are Nakuru, Busia, Kisumu, Homabay, and Kilifi. These are the counties where the assessment data collection has been undertaken and, therefore, the selection of the respondents is purposively for this study based on a scientific selection criterion outlined in Table 2 and explained in the next section.

*Table 2: Sample Population and calculation of Population size for the quantitative study*

County	Population (HH size)	No of Sub-counties	Sample Size	Ward targeted	Number of households targeted
Nakuru	2,162,202 (616,046)	Eight (8)	158	Njoro	53
				Olkaria	53
				Soin	53
Kilifi	1,440,958 (298,472 )	Six (6)	77	Sokoni	26
				Mtepeni	26
				Kambe/Ribe	26
Homabay	1,131,950 (262,036)	Eight (8)	67	Kabondo West	22
				Kabuoch North	22
				Homa Bay Central	22
Busia	893,681 (154,225 )	Seven (7)	40	Amukura Central	13
				Bunyala Central	13
				Ang'urai East	13
Kisumu	1,155,574 (226,719)	Seven (7)	58	Kolwa East	19
				North Seme	19
				Muhoroni/Koru	19
Total	6,784,365.0 0 (1,557,498.00)				400
Sample Size					400

### 3.2.2 Determination of sample size

Yamane (1967) provides a simplified formula to calculate sample sizes.

$$n = \frac{N}{1+N(e)^2}$$

Where n is the sample size, N is the population size (here equivalent to 1,557,498 households), and e is the level of precision (here equivalent to 5% or 0.05).

$$n = 1557498 / (1 + 1557498(0.05)^2) = 400$$

A population proportionate to size is applied to determine the sample for each sub-county and equally sub-divided among its targeted wards. For the case of Nakuru: Sample size for Nakuru =  $(61,6046 / 1,557,498) * 400 = 158$ ; when equally divided by the three (3) wards, 53 households per ward were chosen. Three (3) wards per county are chosen due to resource and time constraints. However, the sample is still representative. A systematic random sampling procedure is adopted once enumerators reach a particular ward.

### 3.2.3 Qualitative Method Population and sample size

For the qualitative part, the selection of respondents is guided by the need to satisfy theoretical sampling reasons rather than statistical. The purposive sampling technique is used to identify the sample target population for this study. First, a list of all beneficiaries and subject experts in the five counties was generated to form a sampling frame. The list was then classified as experts and prospective beneficiaries per selected ward. The selection of participants for data collection is based on the role and knowledge of digital agricultural matters and practices.

Information from organizations providing digital services to farmers and other agricultural stakeholders has been obtained. Preliminary desk review and consultations within the agricultural network were instrumental in identifying and accessing the prospective respondents, many of whom had participated in the digital agricultural processes or interacted with the practitioners working in the digital agricultural space. The respondents' availability and willingness to participate in the interview were vital in the selection process.

The selection of interviewees depended mainly on the ability to illuminate concepts, develop a deeper understanding of the subject and respond extensively to the questions. In practice, interviewees must meet the following sampling criteria (Eisenhardt et al., 2016): The requirements are (a) must be responsible for influencing the initiation, development, and execution of the different aspects of digital agriculture in the county, (b) has the expert knowledge and authority to operationalize digital agricultural practices, tools, content and approaches and (c) has a general interaction with the digital agricultural practices and actions, experience and responsibility to support its execution.

#### **Inclusion and exclusion criteria**

In consultation with Ward Agricultural Officers (WAO), the respondents were identified in line with the stated criteria. Inclusion criteria are characteristics the prospective respondents must have to qualify to be included in the study. Exclusion criteria are those characteristics that disqualify prospective respondents from inclusion in the study. From the desk review and prior consultation with relevant stakeholders, the criteria for inclusion and exclusion are defined by the respondent's role, involvement, and knowledge of digital agricultural matters.

#### **Data Collection Procedures**

The consultancy team used various tools to collect secondary and primary data from qualitative and quantitative data/information. The main methods used include:

- Questionnaires to the beneficiary (ToTs) and non-beneficiary surveys
- Group Discussions
- Key Informant Interviews

- Observations and field notes
- Secondary sources (Various Reports, published and unpublished articles)

Where language barriers occurred, local interpreters were employed. The primary data collection tools were survey questionnaires and Key Informant Interviews (KIIs). These tools assisted in visualizing the findings from the assessment and during the validation and report activities. In addition, the Group Discussions (FDGs) were used to clearly articulate the opportunities and gaps in the five counties that this project can help close. As much as possible, separate but similar groups of men and women held discussions to help identify the capacity constraints underlying the agricultural data ecosystem in the five counties.

## **Approach**

Specifically, the needs assessment exercise aims to identify user needs, stimulating demands for use, access, and relevance of digital agricultural content, including suggesting relevant intervention, digital tools, and the digital ecosystem's existing structure. The approach included a fishbone analysis to identify the main problem and root causes, including a SWOT analysis. Other quantitative and qualitative research methods are also applied.

### **i. Fishbone Analysis**

Identifying and determining user requirements, constraints or gaps, and opportunities requires an evaluation of the main problem and the root causes. A fishbone diagram shows the cause and effect and analyzes the leading causes underlying the five counties' quality and demand for digital agricultural content. Subsequently, evaluating the possible solutions helps identify supply and demand sides and pipelines, opportunities, and partnerships. This approach is critical during the stakeholder verification workshop to encourage participants to think about the problems related to the digital agricultural content ecosystem and the constraints that underpin the problem and start a discussion of possible solutions, their prioritization, and sequencing of activities to address these constraints.

### **ii. SWOT Analysis**

The SWOT analysis provides an analytical framework for evaluating a problem and helps identify critical areas that need attention in terms of threats and where there are opportunities for building on and expanding areas of strengths. The consultancy team used a SWOT assessment of individual (users) and institutional and County Governments' capabilities, both the internal (strengths and weaknesses) and external (opportunities and threats) aspects affecting the access and Use of digital agricultural content in the five counties. The study team classified these findings based on the information obtained during the KII and group discussions at the different levels (county, sub-county, and village/ward).

### iii. Focus Group Discussion and Validation Workshops

The validation workshops held during the finalization phase of the study enabled all the relevant stakeholders to engage in the issues, identify priorities, and jointly map a way forward. The workshops also served as a networking opportunity for key players to interact and assist in initiating the setup of the demand/supply engagement structures. The workshops also allowed stakeholders to interact and discuss the assessment study findings. The discussion included aspects of Open data/content policies and frameworks, capacities (financial and human) access and use, technologies and architectures, and governance.

### iv. Identify critical partners working in the agricultural and related digital space

It is recognizing the critical partners in the agricultural digital area that guided the study by assessing the organizations/institutions, different agricultural content management arrangements, roles and responsibilities, lines of accountability, and the commitment to production, management, and usability of agricultural content. The methodology includes four aspects to assess the critical users and partners. (a) understanding and identification of institutional infrastructures of partners; (b) the resource dimension, that is, the resources required to produce, access, and use agricultural digital content (financial, human, and physical); (c) the initiatives dimension of what is being implemented in each of the five counties to close the agriculture content gap, especially those that seek to bridge the agricultural content gap by transforming county digital agricultural system. This study focuses on the approaches and practices used to produce, access, and use agricultural content.

### v. A framework for mapping collaboration Stakeholders

Agricultural content is typically generated or created by different organizations and actors mandated to perform such activities for business or the public. However, the users also include other content producers and innovators responsible for content curation and dissemination. The design for collaboration highlight the critical aspects of capacity and infrastructure essential for delivering quality agricultural content to users, including the principles and frameworks/models under which such partnership can operate and the need for coordination among relevant actors. The consultancy team will begin by identifying existing working groups and consortium members to create a country-led collaboration structure for the different working groups.

### vi. Development and Coding of the tool

The study employed a mixed-method approach with a structured questionnaire developed and administered at the household level, while Key Informant Interviews

(KIIIs) obtained relevant qualitative data. Once the questionnaire was created, it was encoded using a combination of software tools. These tools included the KoBo design suite, XLS Form, and validator for advanced coding. The critical techniques employed in encoding included cascading select, formulas, constraints, relevant skip patterns, and advanced quality controls to take care of the unique data requirements for this exercise. The digitized template was then validated, a standard server provisioned in the KoBo cloud, and the tool deployed with the names of the enumerators encoded.

### vii. Training of enumerators

The enumerators' training was held at different venues across the five counties. The enumerators were trained on using mobile-based data collection tools and survey methodology, including how to ask questions and administer the questionnaire. The enumerators were taught on Kobo-Collect as the tool for encoding the data collection instruments. The training was followed by role-plays from the enumerators to familiarize and test the data collection tool. Once they were comfortable with the processes, they loaded their phones with the finalized forms bearing the tool on Kobo collect app and were ready for the data collection.

### viii. Field Exercise

The research team and the trained enumerators collected the field data in Busia, Kisumu, Homa bay, Nakuru, and Kilifi counties. The Household survey respondents were drawn from 15 wards spread across the five counties above, three wards in each county. In total, 456 respondents were interviewed for the quantitative survey and 75 for KIIs. A structured questionnaire was used to collect data from the randomly selected households. The data collection process was through face-to-face interviews.

### ix. Application of Digital principles for Development

This project is part of the DAP and premised on digital principles for development to drive meaningful stakeholder analysis and mapping and identify user needs. In addition, a rapid assessment of the digital transformation drivers (enablers and barriers) is critical to support the selected counties in resolving the challenges in the digital agricultural space.

## 3.2 Data Analysis

Data analysis occurred after collecting all the data (Onwuegbuzie & Teddlie, 2003). After adopting a mixed-method approach to data collection, quantitative and qualitative data analysis techniques were used concurrently. The foundations of representation and legitimation for conducting mixed-method data analysis are considered in extracting adequate information from the data. This approach

ensured the validity of the data. Studies posit that using a mixed-method for data analysis is more affluent and comprehensive than stand-alone data analysis techniques and enables the researcher to understand the studied phenomenon better in generating extra meaning and quality interpretation of data.

## CHAPTER 4: Findings of the Assessment

This assessment examined different themes to understand the digital ecosystem in five counties of Busia, Kisumu, Nakuru, Kilifi, and Homabay. Although these five counties comprise diverse governance structures and arrangements of the department of agriculture, their operations, constraints, and needs are identical. Therefore, the findings from the five counties provide case study insights and the emerging common issues implying that the analysis and recommendations are helpful beyond the assessed counties. Apart from the need for additional content, other areas where there is a need include reliable internet connectivity, resources to procure internet services and data bundles, and digital skills. A summary of the findings from the assessment across the different areas of the needs assessment study is presented.

### 4.1 Descriptive Statistics

A descriptive statistic was used as an analytical technique for quantitative data analysis. Descriptive statistics have been used to analyze the demographic data and summarize the responses. Quantitative data was collected from five (5) counties in Kenya. The total sample size was 400, and 456 responded, which is more than a 100% response rate. A larger sample size of 456 instead of the calculated 400 was used to reduce any possible variances in the target sub-population disproportionately. Seventy-five (75) key informants were selected for qualitative data collection, with a response rate of 100%.

#### 4.1.1 Demographics

The respondents' characteristics of the 456 respondents interviewed across the five counties are 250 were male representing 55%, while 206, representing 45%, were female. Youths (aged 18-35 years) and middle-aged adults (36-50 years) constituted most respondents, with a 40% representation in each category. Adults within the age bracket of 51-65 years and above 65 years formed 15% and 5% of the respondents, respectively. The demographic characteristics of the respondents are presented in terms of gender and age group. Table 3 shows the age distribution and percentages of each age bracket or category.

*Table 3: Age distribution of the respondents in the quantitative study per county*

Age Bracket	County											
	Busia		Homa Bay		Kilifi		Kisumu		Nakuru		Overall	
	n	%	n	%	n	%	n	%	n	%	n	%
18-35	12	22	39	49	38	49	33	45	61	36	183	40

	County											
	Busia		Homa Bay		Kilifi		Kisumu		Nakuru		Overall	
36-50	26	47	25	31	22	28	26	36	84	49	183	40
51-65	13	24	15	19	16	21	9	12	15	9	68	15
above 65	4	7	1	1	2	3	5	7	10	6	22	5
Overall	55	100	80	100	78	100	73	100	170	100	456	100

### a. Distribution by gender per county

Based on the population and household numbers, Nakuru had the highest respondents, followed by Homa Bay, Kilifi, Kisumu, and Busia. In total, 55% of the respondents were males, while 45% were female. In Nakuru county, more males responded compared to females. However, in Homabay, more females responded compared to males. Nakuru county had the highest number of 170, comprising 107 male and 63 female respondents.

Figure 2: Shows the distribution of respondents who were interviewed by county and gender.

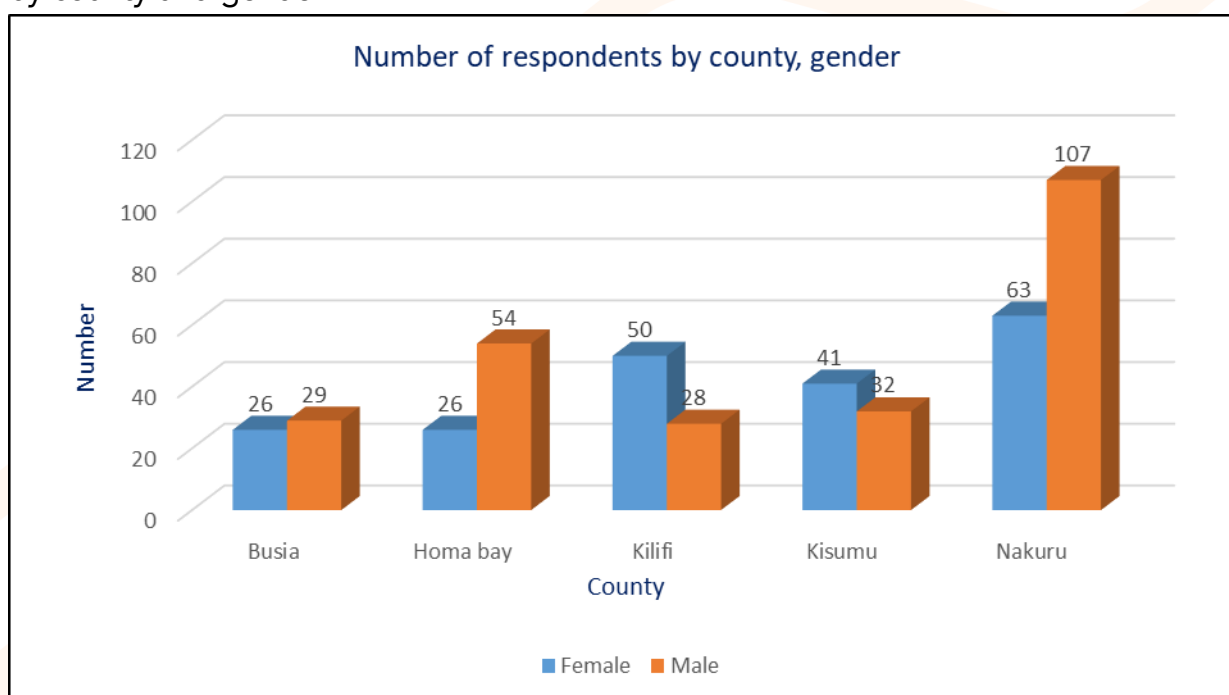


Figure 2: Distribution by gender per county

### b. The distribution by the level of education

Most respondents' highest level of education is Secondary (High School) at 44%, followed by the tertiary level at 26%, primary at 20%, university at 9%, and none at 1%, respectively. Figure 3 shows the distribution of the different levels of education attained in the five counties.

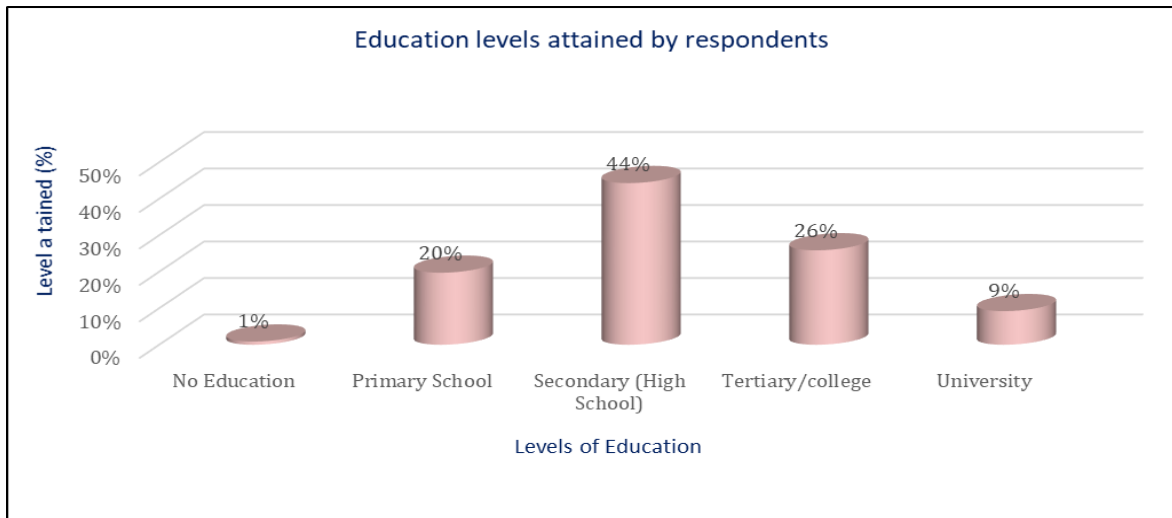


Figure 3: Overall Levels of Education

Figure 4 shows the distribution of education levels. Homabay had the highest number of secondary school levels in the specific counties at 56%, followed by Nakuru at 49%, Busia at 40%, Kilifi at 35%, and Kisumu at 33%, respectively. Busia had the highest number of respondents without formal education.

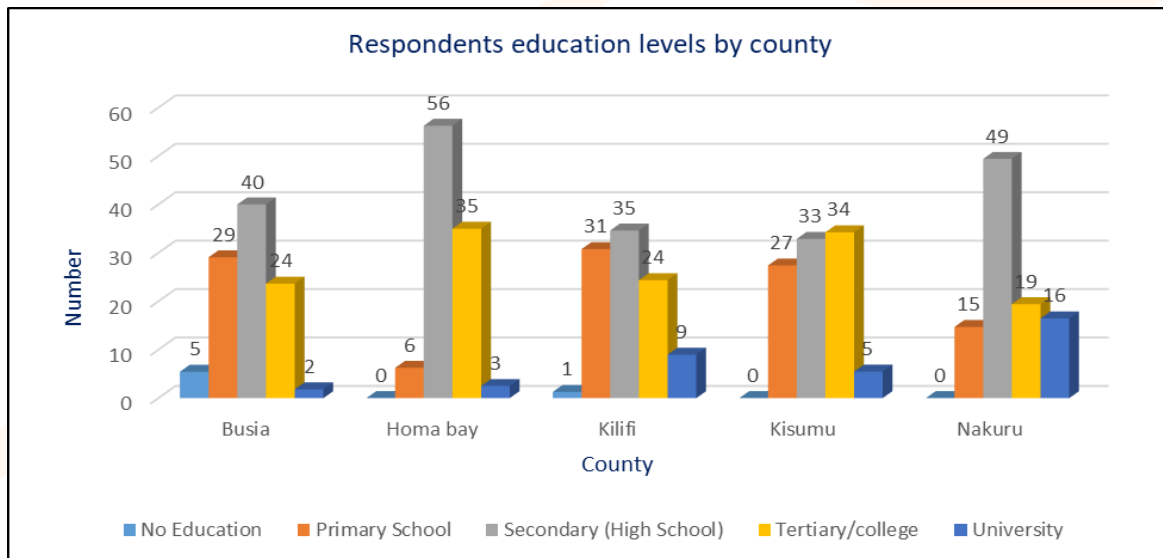
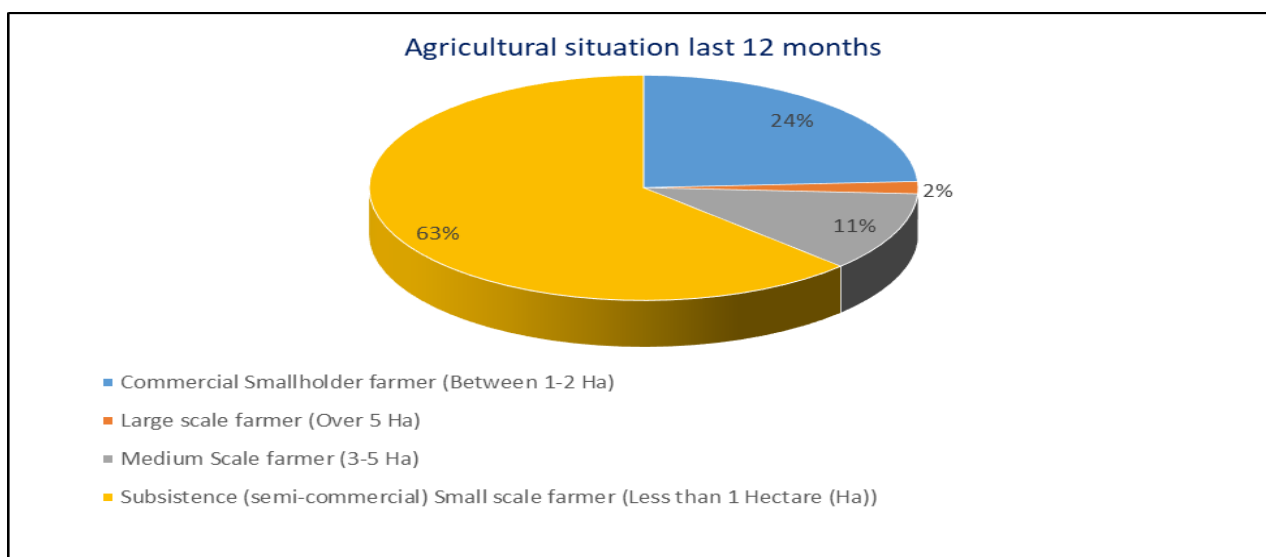


Figure 4: Levels of education per county

### c. Agricultural practices in the counties

In the last 12 months, most of the respondents (63%) had practiced subsistence, or semi-commercial small-scale farming on less than 2.5 acres of land, followed by commercial smallholders farming at 24% (2.5 to 5 acres), medium-scale farmers at 11%. Large-scale farmers with over 12 acres of land constituted only 2%. Figure 5 shows the distribution of the different types of farming practices.



*Figure 5: Distribution of farming practices*

#### d. Sources of income

Table 3 shows the reliance on agriculture as a source of income. Sixty-two percent (62%) of respondents partially (10-50% level) relied on income from agricultural activities compared to 36% who relied entirely upon (50-100% level) agriculture as the source of income. Only 2% were not reliant (less than 10% category) on income from agricultural activities.

*Table 4: Reliance on agriculture as the primary source of income per county*

The extent of reliance on income from agricultural activities	County											
	Busia		Homa bay		Kilifi		Kisumu		Nakuru		Overall	
	n	%	N	%	n	%	n	%	n	%	n	%
Fully (50-100%)	18	32.7	29	36.3	25	32.1	46	63.0	48	28.2	166	36.4
Partially (10-50%)	36	65.5	51	63.8	51	65.4	26	35.6	119	70.0	283	62.1
Not reliant (less 10%)	1	1.8	0	0.0	2	2.6	1	1.4	3	1.8	7	1.5
Overall	55	100	80	100.0	78	100	73	100	170	100	456	100

The results show that residents in the five counties predominantly depend on agriculture as a source of income.

### e. Agricultural enterprises per county

Agricultural value chain activities mostly practiced across the five counties were production (97%). The other value chain activities that are not widely practiced include logistics and supply chain, agro-processing and value addition, aggregation, marketing and aggregation services, and provision of specialized services.

*Table 5: Agricultural Enterprises per county*

	County											
	Busia		Homa bay		Kilifi		Kisumu		Nakuru		Overall	
	n	%	N	%	n	%	n	%	n	%	n	%
Production	54	98.2	72	90.0	77	100	70	95.9	166	98.2	439	96.7
Logistics and supply chain	0	0.0	8	10.0	0	0.0	3	4.1	1	0.6	12	2.6
Agri-processing and value addition	1	1.8	3	3.8	0	0.0	6	8.2	4	2.4	14	3.1
Aggregation, Marketing, and brokerage services	2	3.6	8	10.0	0	0.0	0	0.0	7	4.1	17	3.7
Provision of specialized services	0	0.0	12	15.0	0	0.0	4	5.5	5	3.0	21	4.6
Overall	55	100	80	100	77	100	73	100	169	100	454	100

### f. Smartphones Ownership

Figure 6 shows the representation of smartphone ownership by age. Of the 456 respondents interviewed, 368 (81%) owned smartphones. The results show that 87% of the respondents aged between 18 and 35 and 83% aged 36-50 owned smartphones. In the older age bracket, 66% of those aged between 51 to 65 owned smartphones, while 55% of those aged above 65 years old owned smartphones. Smartphone

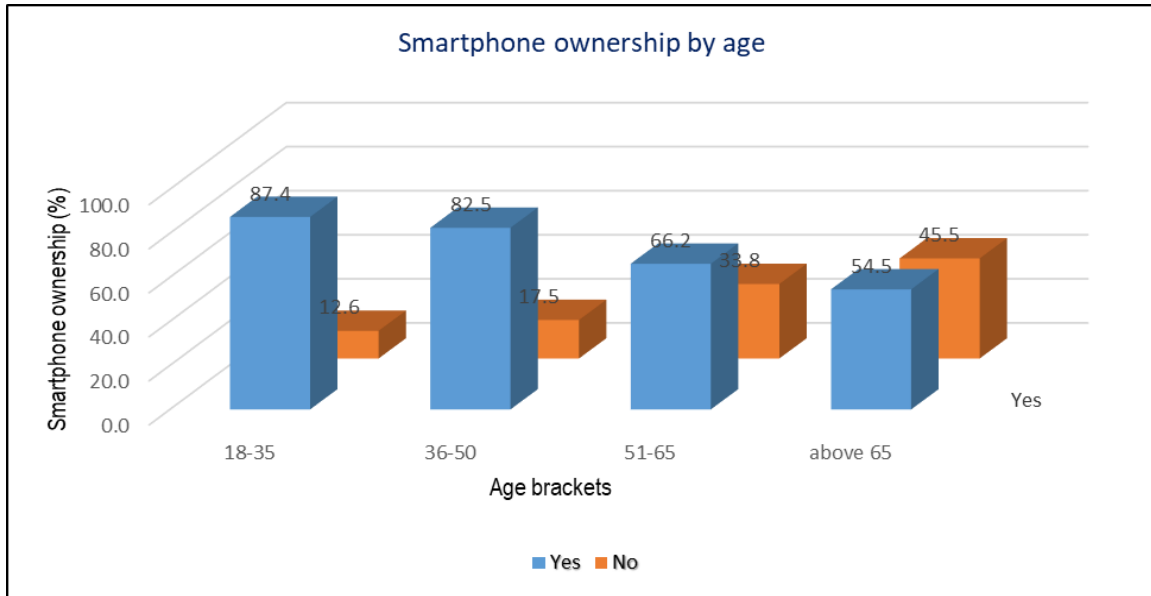


Figure 6: Smartphone ownership by age

Across the five counties, the number of respondents who owned smartphones were more than those who did not. Nakuru County had the highest number of those who owned smartphones at 147, followed by Homa Bay, Kilifi, Kisumu, and Busia, respectively. Figure 7 shows the distribution by county.

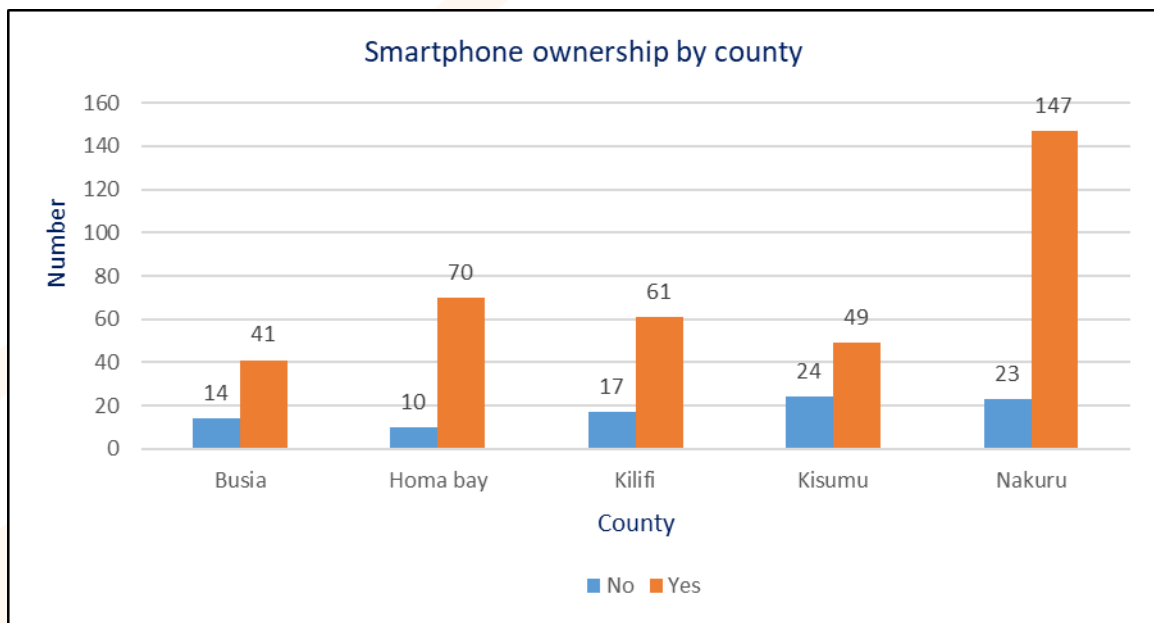


Figure 7: Smartphone ownership by county

## 4.2 User needs identification

The results show that the communities in the five counties have diverse digital needs to make decisions and use digital agricultural content effectively. The needs include:

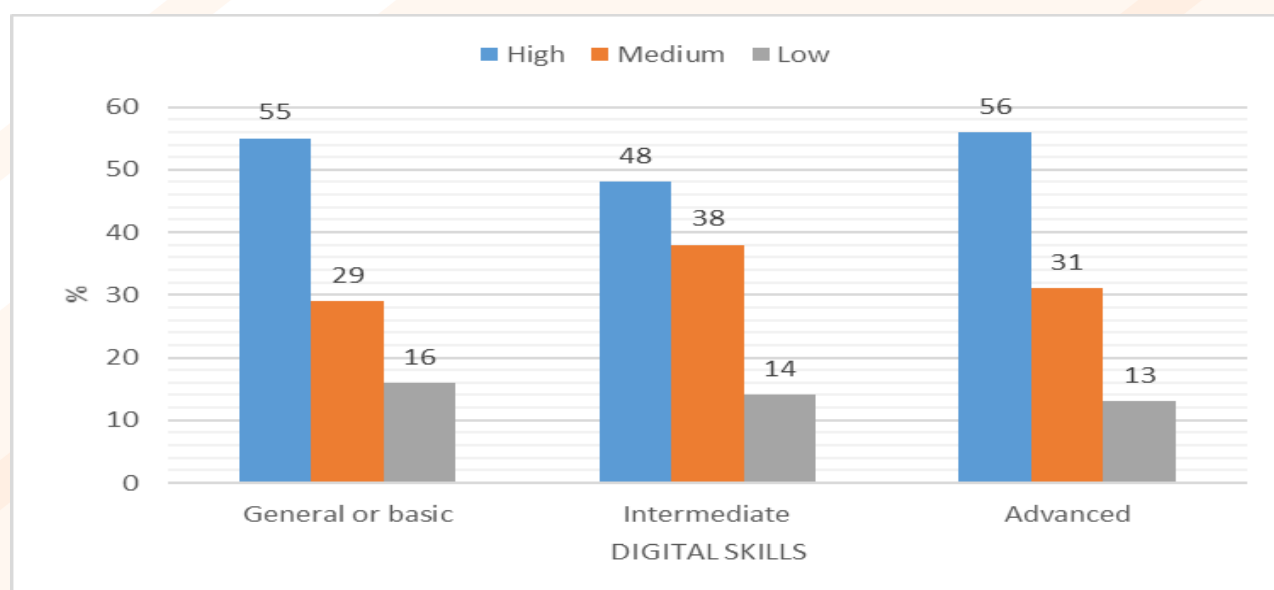
### 4.2.1. Digital Skills

More than half of the respondents expressed a *high* need for digital skilling related to general or basic digital literacy (55%), *neither low nor high* (29%) and *low* (16%). The requirement for intermediate digital skills was *high* (48%), *neither low nor high* (38%), and *low* (14%), while advanced digital skills requirement was *high* (56%), *neither low nor high* (31%) and *low* (13%).

*Table 6: The extent to which digital skilling is required*

		The extent of digital skills required		
		High	Low	Medium
Digital Skills	General or basic digital literacy skills	55%	16%	29%
	Intermediate digital skills	48%	14%	38%
	Advanced digital skills	56%	13%	31%

Generally, a high proportion of males expressed the need for digital skills compared to females at 55% and 45%, respectively. Figure 8 provides a summary of the skill requirements.



*Figure 8: A summary of digital skills requirements in the three levels*

Regarding gender distribution, more females required a "high" level of digital skilling in all three basic, intermediate, and advanced tiers at 59.7%, 51%, and 61%, respectively. The proportion of males that required "intermediate" and "low" skilling levels was more than that of females, as shown in Table 7.

*Table 7: Gender distribution of digital skills requirements at the three different levels*

LEVELS OF DIGITAL SKILLS REQUIRED	Female		Male		Total	
	n	%	n	%	n	%
<b>Basic digital literacy skills.</b>						
Low	24	11.7%	49	19.6%	73	16.0%
Medium	59	28.6%	73	29.2%	132	28.9%
High	123	59.7%	128	51.2%	251	55.0%
<b>Intermediate digital skills.</b>						
Low	22	10.7%	41	16.4%	63	13.8%
Medium	79	38.3%	95	38.0%	174	38.2%
High	105	51.0%	114	45.6%	219	48.0%
<b>Advanced digital skills.</b>						
Low	29	14.1%	29	11.6%	58	12.7%
Medium	50	24.3%	93	37.2%	143	31.4%
High	127	61.7%	128	51.2%	255	55.9%

Although there is a high need for digital skills to be able to use online agricultural content, most of the people interviewed own smartphones.

The need for capacity building on digital literacy to complement extension services was mentioned as a significant need in the five counties, and a means to achieve satisfactory levels of digitization in the agriculture sector. In addition, capacity building for the county technical staff, awareness creation about available digital solutions in agriculture, and provision of tablets and smartphones are some of the main areas required for the project to improve access to digital content in the counties. A respondent from Kilifi county said, *"with the penetration of smartphones increasing in the county, there is a need to train not only farmers but critical stakeholders, especially technical staff at the county, in digital solutions available in the sector."*

Another respondent from Kisumu county said, "digital literacy has become part of basic education. In other contexts, they have diversified digital literacy, and the training is in local languages. It is time as a county we move to these levels.". Similar concerns also came from respondents from Homa Bay county. One of the technical officers said, "it is sad to mention, but even most of the technical staff are as illiterate as the farmers when it comes to an understanding of how to access online information and navigate the modern digital devices effectively."

## 4.2.2. Improve access to digital agricultural content

There is a need to improve access to digital agricultural platforms. About 56% of respondents reported that they could get information effectively. In comparison, 44% indicated they do not access digital agricultural content. On the frequency of access to digital agricultural content, 42% showed they access it regularly, 35% rarely did, and 23% were neither regular nor rare users. Regarding gender, 23% of the females and 33% of males could access agricultural content, while 22% of the females and 21% of the males could not, respectively.

### Preferred Modes of accessing agricultural content

The most preferred digital channels for accessing agricultural content are SMS, Mobile applications, and websites at 74%, 35%, and 9%, respectively. Call center/IVRs, and USSD were the minor preferred channels at 1% and 2%, respectively. However, 38% prefer phone calls, while 33% prefer face-to-face as channels. Radio and local television stations were 22% and 17%, respectively.

Table 8: Showing Preferred modes of information dissemination channels

Preferred modes of information dissemination channels	Female		Male		Total	
	n	%	n	%	n	%
Short Messaging Service (SMS)	153	74.3%	182	72.8%	335	73.5%
USSD or quick codes	4	1.9%	4	1.6%	8	1.8%
Web-based sites	19	9.2%	22	8.8%	41	9.0%
Mobile applications (apps)	68	33.0%	92	36.8%	160	35.1%
Phone Calls	83	40.3%	90	36.0%	173	37.9%
IVRS/call Centre	1	0.5%	4	1.6%	5	1.1%
Face-to-face	74	35.9%	80	32.0%	154	33.8%
Radio Stations	47	22.8%	53	21.2%	100	21.9%
Television Stations	37	18.0%	42	16.8%	79	17.3%
Other	3	1.5%	13	5.2%	16	3.5%

### Access to digital agricultural platforms

Most youths (18-35 years) and middle-aged adults (36-50 years) had access to digital agricultural platforms at 60% and 60%, respectively. Only 36% of adults above 65 years had access to such platforms. Overall, 56% of the respondents had access to digital agricultural platforms compared to 44% who did not have access to the platforms. The number of respondents who had access to digital agricultural platforms per county is also shown in Figure 9.

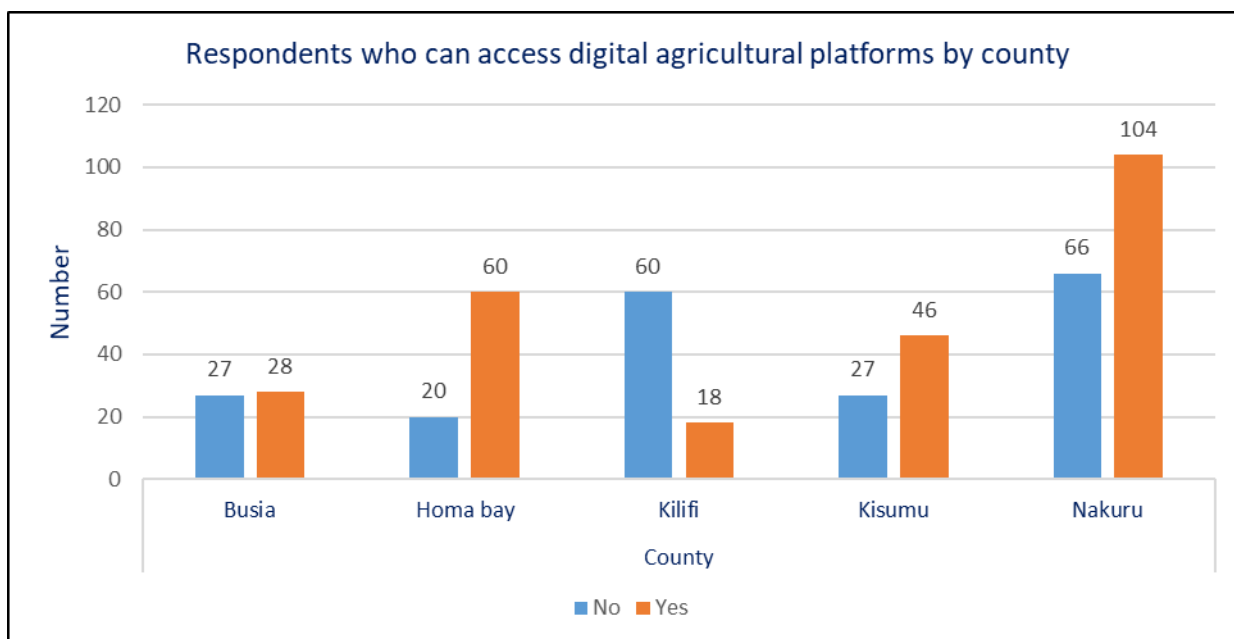


Figure 9: Access to digital agricultural Platforms by county

## Types of information access through the digital platforms

Most of the agricultural information accessed from the platforms is on general farming (74%), livestock farming (55%), and crop farming (40%). The respondents who owned smartphones indicated that they were accessing digital agricultural information, and 91% were able to use these platforms to access digital agricultural/farming information. The information accessed includes general farming information, fertilizer applications, availability of seeds, Use of pesticides, markets, and weather, among others. Figure 10 below shows the percentage distribution of digital agricultural information access.

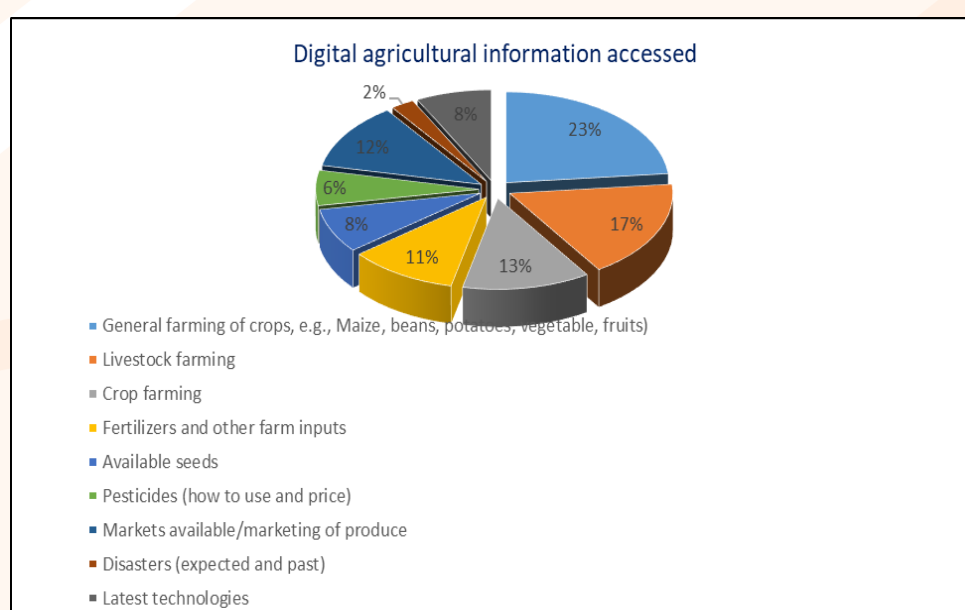


Figure 10: Digital agricultural information accessed

Table 9 shows the agricultural information accessed in the five counties in terms of county distribution. Nakuru county has the highest number of farmers accessing digital agricultural content, followed by Kisumu, Homa Bay, Busia, and Kilifi, respectively.

*Table 9: Types of Digital Agricultural information access rate by county*

Digital agricultural information accessed	County					Overall	
	Busia	Homa bay	Kilifi	Kisumu	Nakuru		
	n	n	n	n	n	n	%
General farming of crops	25	53	14	37	43	172	73.8
Livestock farming	11	13	0	30	74	128	54.9
Crop farming	13	9	6	9	56	93	39.9
Fertilizers and other farm inputs	8	21	9	3	38	79	33.9
Available seeds	6	16	7	1	28	58	24.9
Pesticides (how to use and price)	7	4	8	1	26	46	19.7
Markets available/marketing of produce	5	16	4	19	43	87	37.3
Disasters (expected and past)	2	0	1	0	14	17	7.3
Latest technologies	6	4	0	16	29	55	23.6

## Types of devices used

Concerning the types of devices used, Smartphone users are 79.8%, while feature and first-generation mobile constitute 19.5%. Desktop and laptop users were 0.2% each.

## Demand for digital agricultural information

The need for digital agricultural content and platforms is high at 59% and 47%, respectively. Consequently, the ability to apply the content obtained from these platforms is high at 57%. Those with moderate ability to effectively use the digital agricultural content is 32%, while low ability is 11%. Table 10 shows the distribution ranging from high to medium and low.

Table 10: Extent of need for digital resources

	Need for digital agricultural information			Need for digital agricultural platforms			Ability to apply the information obtained from the available online sources		
	High	Low	Medium	High	Low	Medium	High	Low	Medium
n	268	40	148	213	60	183	259	50	147
%	58.8	8.8	32.5	46.7	13.2	40.1	56.8	11.0	32.2

The qualitative results show that there is a need for the provision of more digital agricultural content. Although there are organizations that are actively providing digital content to agricultural stakeholders, the scale is not sufficient.

The Kenya Agricultural and Livestock Organization (KALRO) was the primary generator of agricultural content targeting stakeholders in different agricultural value chains. Other notable organizations participating in the digital agricultural content in the sector in the counties included Safaricom -Digi Farm, Egerton University, the County Department of ICT, Agriculture, Livestock and Fisheries, Department of Co-operatives, and Department of Youth and Social Services, among others. These organizations mainly provided digital solutions, digital content and platforms, technical services, and advisories. The results also show that World Bank projects have contributed significantly to agricultural content generation, especially the Kenya Climate Smart Agricultural Project (KCSAP) and the National Agricultural and Rural Inclusive Growth Project (NARIGP).

An officer from Nakuru county said, "Department of Agriculture, Livestock, and Fisheries through the NARIGP has actively provided digital extension services to empower farmers through innovative digital technologies. However, there is a need for additional digital content to reach more farmers".

Qualitative interviews show a need to improve access to digital agricultural content. Facilitating access to digital content was identified as a critical factor. Some of the barriers include language. Most of the users of agricultural content are framers who lack primary education and therefore cannot use the content provided in English. A respondent from Kilifi county said, *"lack of content in local language discourages farmers from accessing the content as most of them may not comprehend the information posted on the platforms." In my ward, most farmers don't understand English, and they use phones with no access to internet connections due to a lack of requisite skills. I suggest you consider other call center approaches to enable such farmers to access the content".*

Therefore, the results confirmed access to digital agricultural content is average, and there is a need to improve it. The extent of requirement for online agricultural content/platforms and the ability to apply the information from the available online sources were reported as high at 59%, 47% moderate, and 57% low, respectively.

### 4.2.3. Value proposition (Relevance) of Digital Agricultural content

The relevance of the digital content was assessed by asking respondents whether they agreed with five statements. About 57% of the respondents disagreed with the statements that they cannot do without online agricultural information or that their activities and practices significantly depend on the online agricultural information. However, 54% agreed that they were willing to pay for the online agricultural content, and 47% agreed that they could pay for it. Most respondents were neutral (47%) on whether the charges for accessing online agricultural information are not affordable.

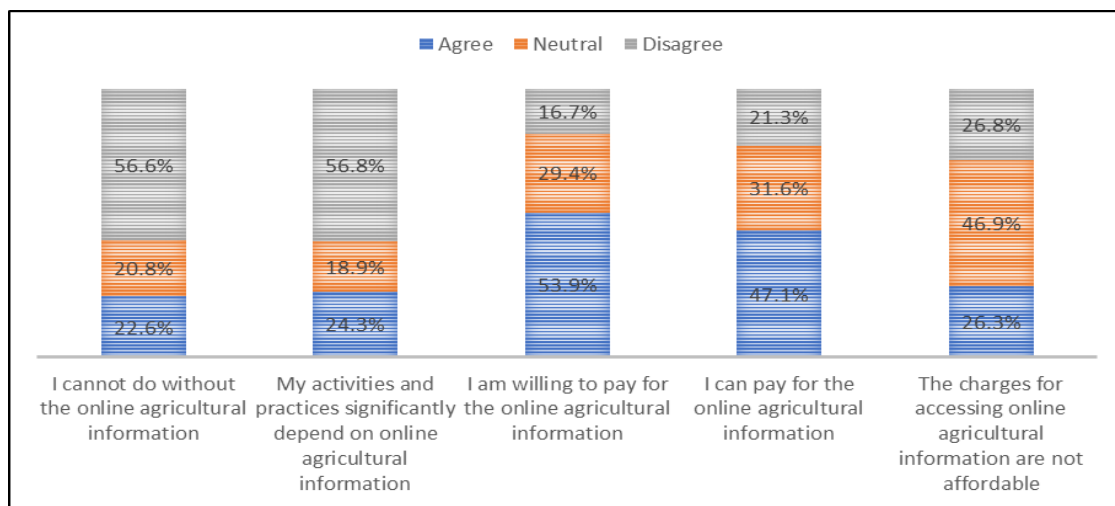


Figure 11: Relevance of Digital Agricultural content

Information on general agriculture was considered the most relevant content at 80%, followed by livestock and crop farming at 61% and 52%, respectively. Information on expected disasters is the least pertinent content accessed by farmers. Figure 12 shows the percentage distribution for different types of content.

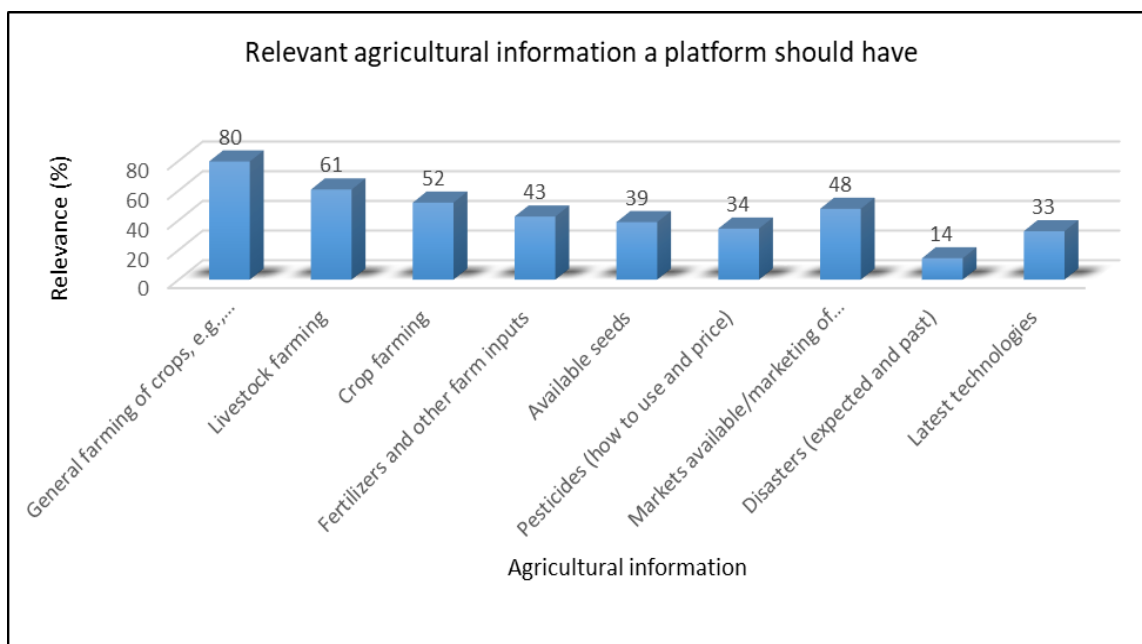


Figure 12: Relevant agricultural information a platform should have

#### 4.2.4 Extent of need for various types of digital content

The extent of the need for various digital agricultural content is high at 66%, while 23% said medium and 11% low, respectively. On the other hand, 47.4% prefer the content to be highly tailored to their requirements, while 32% and 21% indicated a medium and low need for customization of the content. In addition, 42% highly desired the content to be translated into local languages, and 23% and 35% indicated medium and low desires, respectively. Figure 13 shows the distribution scores for relevance from high to medium, then low.

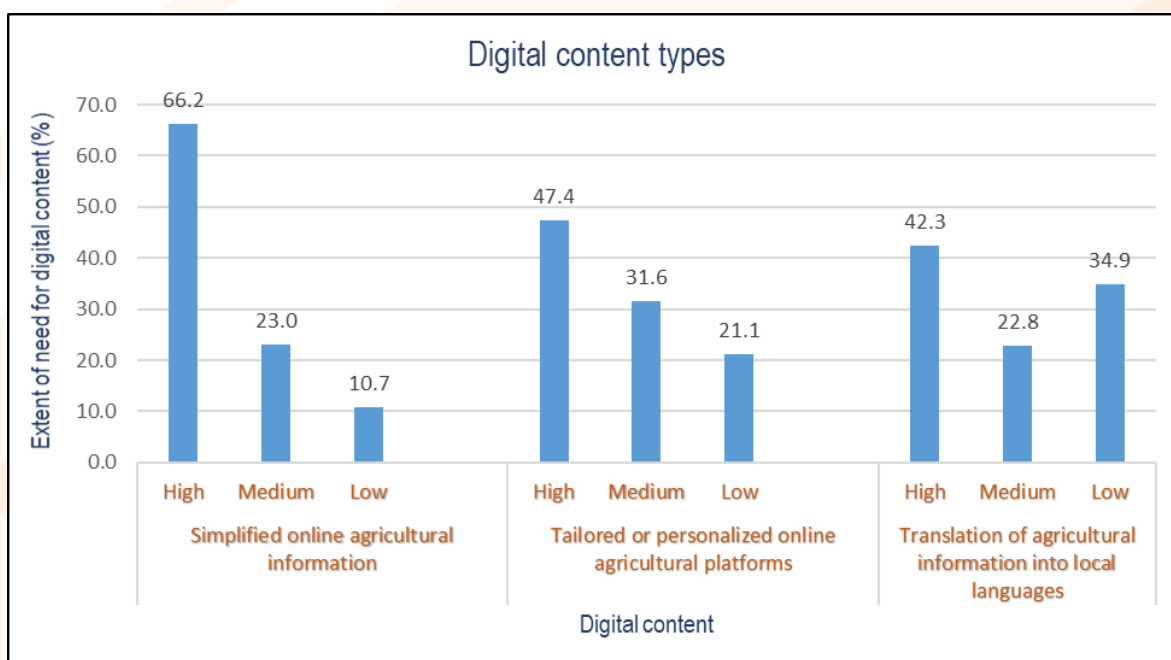


Figure 13: Extent of need for various types of digital content

### 4.2.5 Benefits of the available digital agricultural information

About 64% of the digital agricultural information available on the digital platform is considered a high benefit to farmers, and 32% is moderately helpful to farmers. In comparison, 4% indicated having a low use. Figure 14 shows how much digital agricultural information benefits farmers based on the age group.

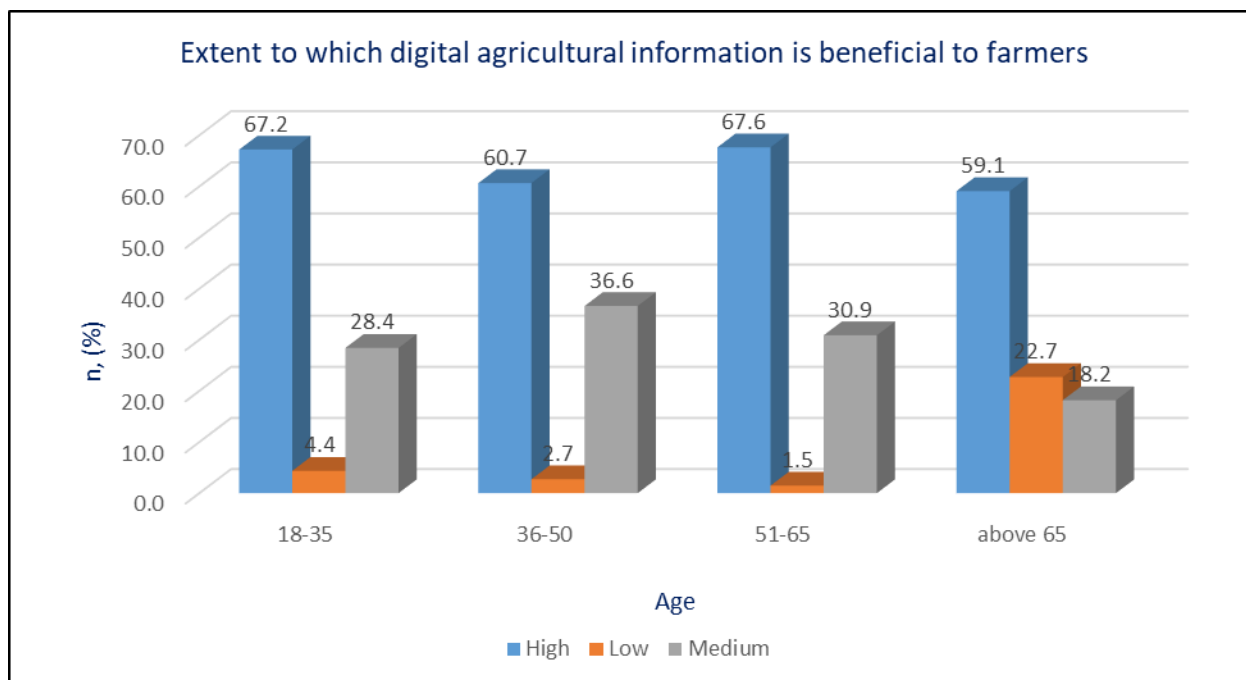


Figure 14: The extent of benefits of the available digital agricultural content

Qualitative results consistently showed that most of the digital content was relevant. However, some significant hindrances are farmers' inability to interpret the information and the lack of interaction mechanisms with the farmers. An officer from Homa Bay county said, *"Most agricultural information is scientific and general, and interpretation is required. Given what I said, you can conclude that this situation makes the information irrelevant."*

Consistent with previous studies (Visser, 2014; Ochieng et al., 2017; Molotsi & Makombe, 2019), this assessment found a critical need across the five counties to improve the relevance of digital agricultural content. However, efforts to meet these needs by diverse organizations remain limited. In turn, these gaps have influenced the extent of information flow among agricultural value chain actors in these counties. Therefore, the results confirmed that relevance is one factor that affects the access and use of digital content, especially in rural areas where farming activities occur.

#### 4.2.6 Access to the Internet

Most of the respondents (84%) reported having access to the internet, while 16% did not have access to the internet. Challenges for those who did not have internet access varied from affordability to connectivity. More men had access to the internet at 88% compared to females at 79%.

*Table 11: Access to the internet distributed by gender*

Access to Internet	Female		Male		Total	
	n	%	n	%	n	%
No	43	20.9%	31	12.4%	74	16.2%
Yes	163	79.1%	219	87.6%	382	83.8%

Of those without access to the internet, 93% could not afford smartphones, while 3% lacked electricity and 4% had poor network connection challenges. Busia county had the highest number of those with network connectivity challenges at 19%. Table 12 shows the different needs to can facilitate internet access.

*Table 12: The different needs to can facilitate access to the internet*

	County						
	Busia	Homa bay	Kilifi	Kisumu	Nakuru	Overall	
	%	%	%	%	%	n	%
Unable to afford a smartphone	75.0	100.0	100.0	100.0	93.3	69	93.2
No electricity	6.3	0.0	0.0	0.0	6.7	2	2.7
Poor network connection	18.8	0.0	0.0	0.0	0.0	3	4.1

#### 4.2.7 Access to Technology

On the access to technology, farmers interviewed were asked whether they agreed with various statements related to access to technology. Among those polled, 42% agreed they regularly accessed online agricultural information, and 34% disagreed. On devices, 66% agreed that they could access agricultural information using their own devices. Regarding digital skills, about 60% of the respondents agreed that they had the requisite skills to access online agricultural information and adequate network connectivity to access online information. In comparison, 58% agreed they regularly charged the devices they used to access online information.

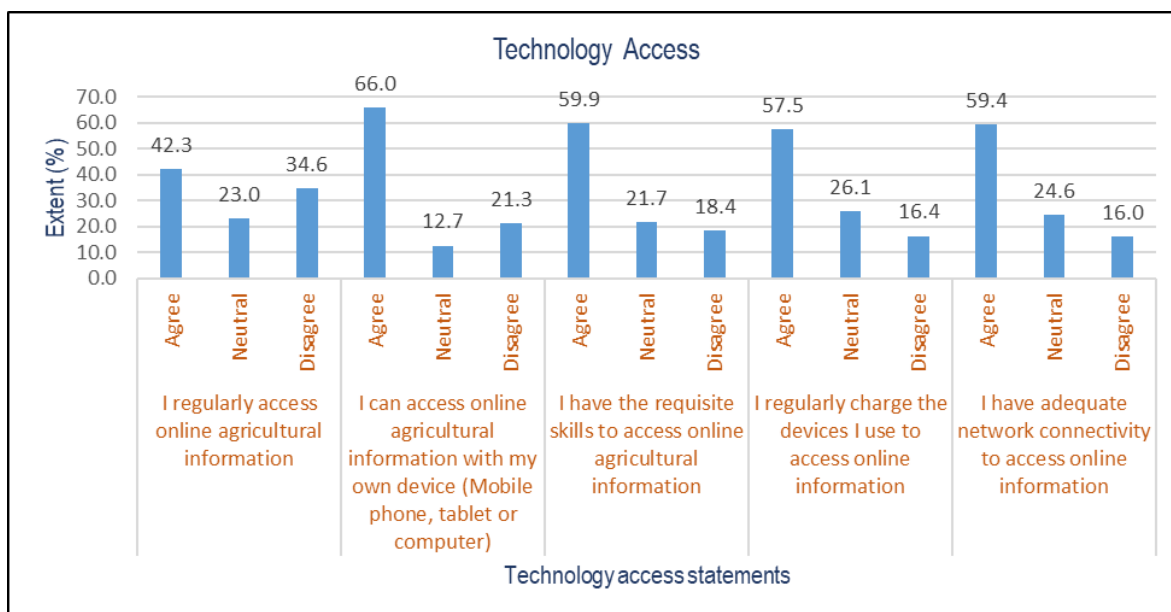


Figure 15: Access to technology

The qualitative results showed that internet connectivity and connection to telecommunication or cellular towers were pretty good across the five counties. This factor was considered the *"digital infrastructure need,"* leading to low access to the internet, data, and digital content. Although internet connectivity and mobile network seem adequate, there are areas without last-mile connectivity. The county offices have inadequate computing resources such as data centers, servers, and end-user devices. One of the county officers stated, *"there are various internet service providers including Safaricom, Airtel, Telkom, and Faiba telecoms, but there are areas where connectivity to electricity and internet is limited or non-existent at all."*

An officer from the county said this on the digital infrastructure status, "digital infrastructure is not a focus of the county management; therefore, urgent attention is needed. This situation has contributed to low access to digital agricultural content since most staff use their data bundles to access information". Concerning the existence of reliable digital infrastructure in terms of well-established Data centers and servers, an officer from a sub-county in Homa bay county said, "if the county doesn't have a proper data center, you can imagine the situation at the sub-county and ward". Another officer from Nakuru county affirmed the dire situation and said, "investment is required to expand internet connectivity in the remote areas where most agricultural activities are practiced. Although the voice infrastructure is available, many areas have intermittent connectivity."

Another critical factor in the infrastructure is the high cost of internet and data bundles. An officer from Busia county stated, *"apart from intermittent and irregular internet connectivity where sometimes you have to move to a location with better*

connectivity or a cyber café, and the internet is expensive. Also, whenever I use my smartphone to access the internet, the cost of data bundles is unsustainable."

It also emerged that some areas in Kenya have no internet connectivity or mobile network entirely. An officer from Homa Bay County said, "Some places have not been accessible with connectivity, especially in the islands. Only government offices have the infrastructure. The cellular network sometimes fluctuates due to the border's effect. Sometimes you can connect to Uganda mobile provider such as MTN."

The need to establish internet infrastructure was confirmed in most of the five counties. For instance, an officer from Kilifi county said, "there are not enough internet boosters in most areas, especially rural ones. There are few places where one can access the internet in many rural areas."

#### 4.2.8 Perceived Ease of Use on Digital Content

Different modes of information dissemination channels are preferred. Short Messaging Service (SMS) (74%), Phone Calls (38%), Mobile applications (apps) (35%), and Face-to-face (34%) were most preferred. Unstructured Supplementary Service Data (USSD) or quick codes and Interactive Voice Response Systems (IVRS) /call Centre were least preferred at 2% and 1%, respectively. Figure 16 shows the different channels preferred by framers to access information.

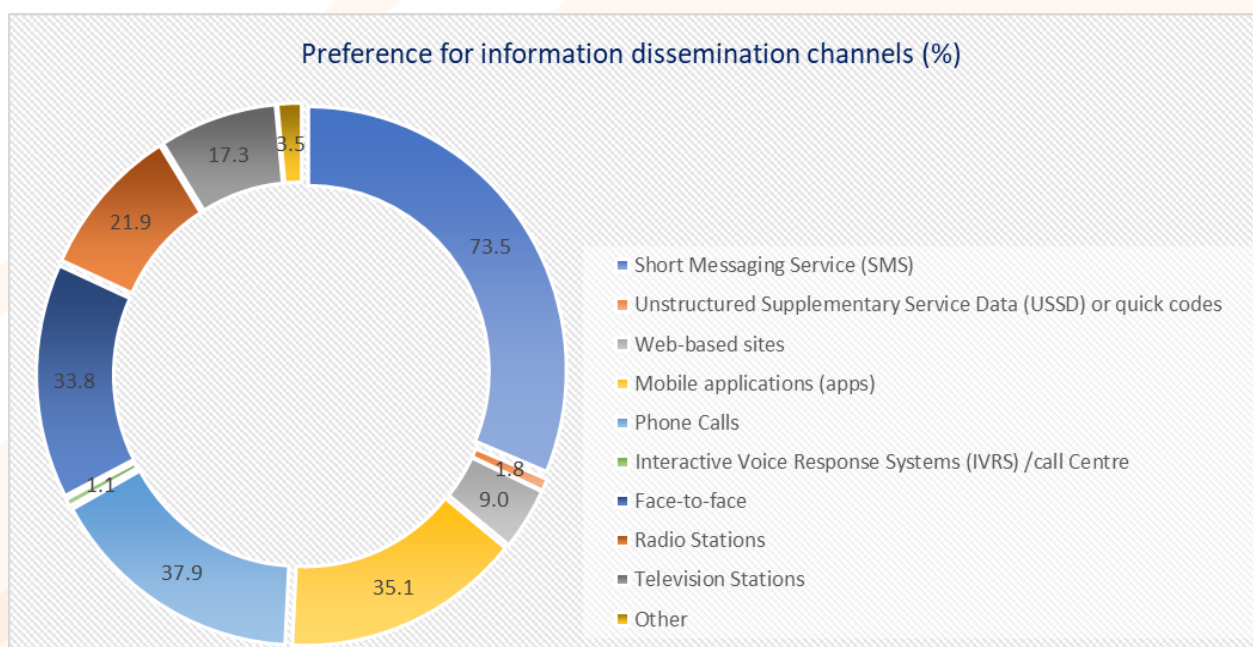


Figure 16: Preference for information dissemination channels

The other dissemination channels preferred included field days and exhibitions & open days (50%), seminars, posters, and stakeholder platforms at 6.3% for each of the three categories.

#### 4.2.9 Use of Digital content

The respondents were also asked whether they agreed with five statements about agricultural information use. Less than half of the respondents (48%) agreed that they know where online agricultural information is stored. About 34% agreed they regularly use online agricultural information for their farming practices. The online agricultural information was considered user-friendly by 52% of the respondents, and 68% agreed it was valuable and essential. Less than a third of the respondents agreed that most of the online agricultural information is stored in a single place where they can easily find them (a one-stop-shop). The various statements were responded to as seen in Figure 17:

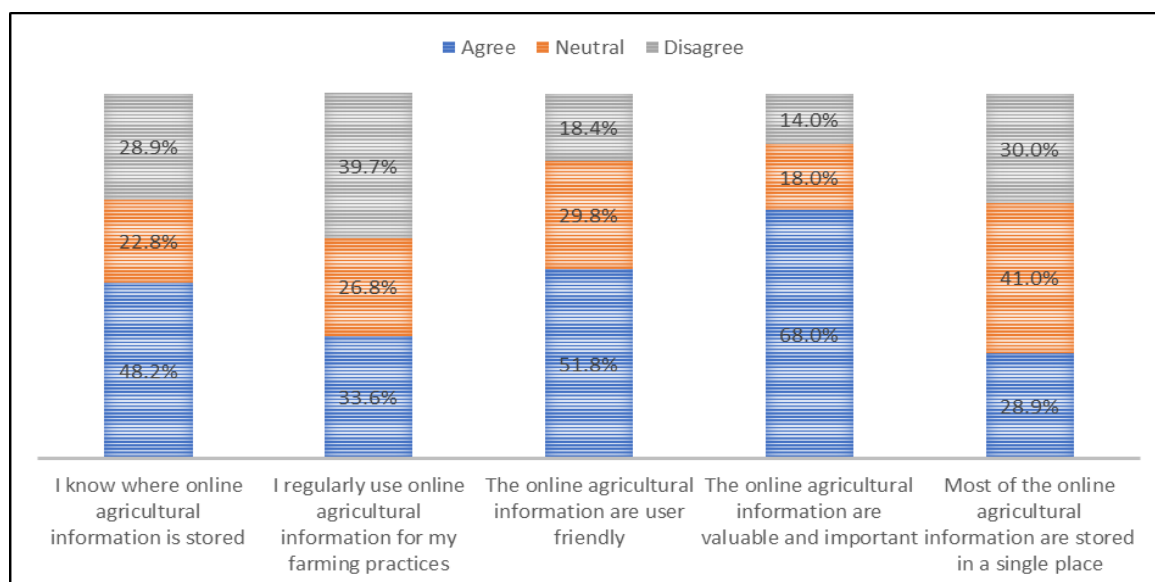


Figure 17: Use of digital agricultural content

It emerged that while most of the digital agricultural content is relevant. Simplification and downscaling the terms and language used are essential. A respondent from Nakuru said, *"Creating an easily accessible and simplified agriculture app is what farmers want. Also, they want a comprehensive digital platform where information from farm inputs to weather forecast advisories can be found. It is critical to realize that farmers lack technical skills to navigate the deeper aspects of technology to search for information"*.

Qualitative results confirmed that the digital content provided to farmers must be relevant by ensuring they are simple and easy to understand. As a result of lack of relevance, farmers have ignored digital content leading to low uptake and Use of such content. Prior studies have shown that agricultural digital content uptake is

inadequate for several reasons, including relevance and skills levels (Boniface & Jose, 2020). Drawing from extant literature, organizations that develop content should consider the relevance factor. This relevance factor is often missed. The respondents indicated that ensuring the digital agricultural content is simplified and presented in forms and languages compatible with the users' education and skill levels is critical. Therefore, the development and presentation of digital agricultural content should be relevant. Organizations responsible for providing content must comply with these conditions to achieve the goals. *A respondent describes the situation: "over the years, farmers have relied on non-digital content, which is difficult to update in real-time, but they don't have a choice since they limited capacity to comprehend highly scientific content from research institutions. This situation has impacted the extent of Use of available digital content in my county".*

#### 4.2.10 Internet connection and usage frequency

Most respondents (79%) confirmed that they frequently connected to the internet. Among those who indicated that they frequently connect and use the internet, 39% said they access it in the evening and 29% at night. Morning and afternoon recorded 16% and 15%, respectively, while 1% indicated they spent the whole day online. However, about 15% of respondents never connected to the internet, while 6% were uncertain about when they got connected. Of the respondents who connected to the internet, 79.8% mainly used smartphones, while 14.7% used tablets. The other 5.5% used multiple devices.

Regarding the frequency of internet connection, 71% of respondents reported using the internet daily. The remaining 29% used the internet intermittently. Out of the 456 respondents interviewed, 41.7% indicated they connected to the internet daily to search agricultural-related information, while 29.6% connected several times a day to search general information, including agricultural content. Those who joined once a week constituted 9.6% of the respondents. Those who were uncertain or connected once a month or less were very few.

*Table 13: The frequency of internet use*

Frequency of internet use	County						
	Busia	Homa bay	Kilifi	Kisumu	Nakuru	Overall	
	n	n	n	n	n	n	%
Daily	32	19	27	19	93	190	41.7
Don't know	2	1	1	4	4	12	2.6
Less than a month	0	1	1	1	1	4	0.9
Monthly	1	1	1	0	0	3	0.7
Never	12	8	15	18	15	68	14.9

Several times a day	4	43	19	30	39	135	29.6
Weekly	4	7	14	1	18	44	9.6
Overall	55	80	78	73	170	456	100.0

Figure 18 shows the different types of connections in a graphical representation of the frequency of internet use.

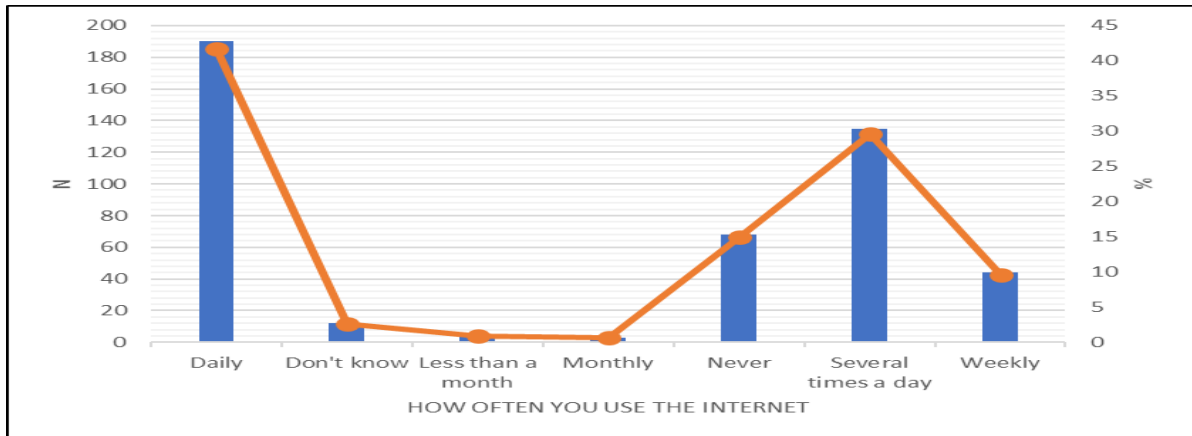


Figure 18: The frequency of internet use

Additionally, 30.3% went online to look for information on agriculture, while 10.7%, 29.8%, and 10.3% rarely, sometimes, and very often, respectively, went online to look for information on agriculture. Figure 18 shows the number of respondents and the frequency of internet connection to look for agriculture information per county.

Table 14: Frequency of going online to look for information on agriculture

Frequency of going online to look for information on agriculture	County						
	Busia	Homa bay	Kilifi	Kisumu	Nakuru	Overall	
	n	n	n	n	n	n	%
Don't know	0	0	0	5	1	6	1.3
Never	17	15	23	6	19	80	17.5
Often	23	43	16	7	49	138	30.3
Rarely	7	1	9	11	21	49	10.7
Sometimes	3	11	26	32	64	136	29.8
Very often	5	10	4	12	16	47	10.3
Overall	55	80	78	73	170	456	100.0

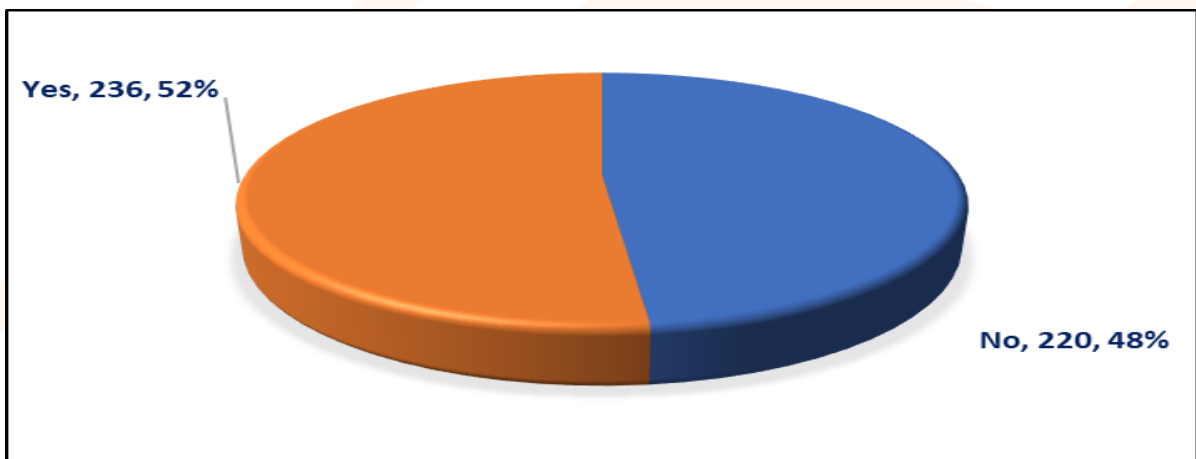
The Figure 19 shows a graphical representation of the number of respondents and the frequency of internet connection to look for agriculture.



*Figure 19: The number of respondents and the frequency of internet connection to look for agriculture*

#### 4.2.11 The extent of awareness of digital agricultural platforms

The level of awareness of the existence of digital agricultural platforms is average. About 52% of the respondents indicated they were aware, while 48% were unaware of the digital agricultural platforms



*Figure 20: The extent of awareness of the digital agricultural platforms*

Kisumu County registered the highest number of respondents who were aware of the digital agricultural platform(s) (65.8%), followed by Homa bay County (63.8%), Nakuru County (54.7%), Busia County (52.7%), and Kilifi County (19.2%).

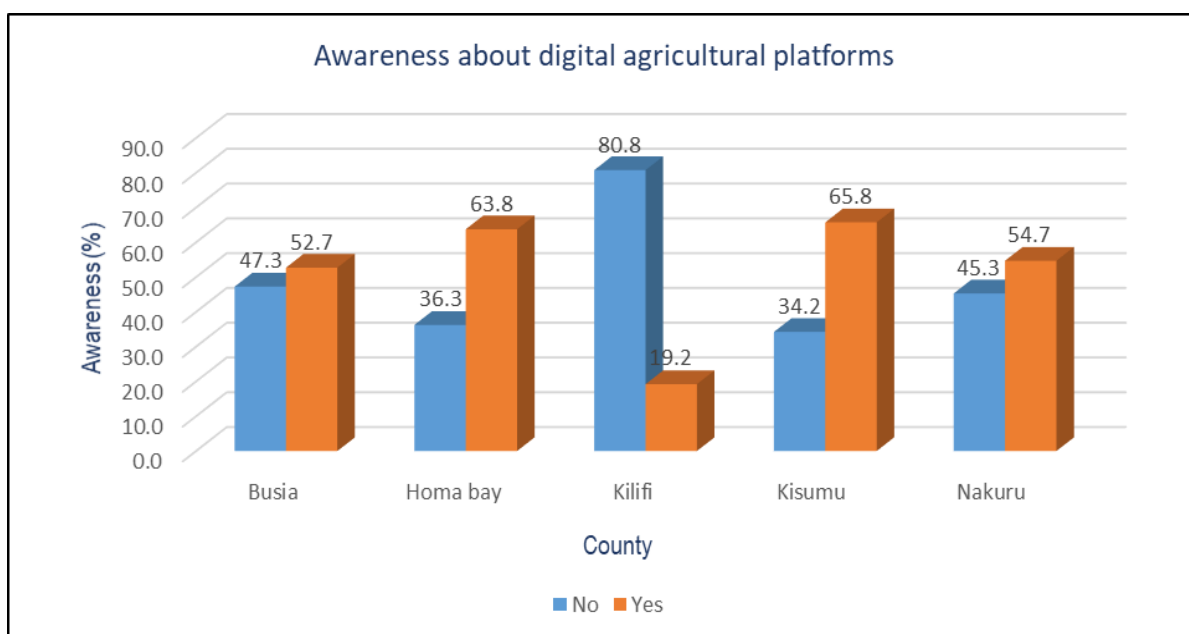


Figure 21: Awareness of digital agricultural platforms by county

The digital agricultural platforms that the respondents were aware of and had used in the last 12 months include KALRO Mobile Apps (54.7%), Acre Africa (29.2%), KALRO Selector (14.1%), and Digital Green Audio platform (10.4%), and Bundled services (11.5%). Plantix (5.2%) and Laikipia GAPs (2.1%) are other mentioned platforms. Other applications are shown in Table 15.

Table 15 :The Agricultural platform(s) used by farmers in the last 12 months

Agricultural platform(s) used by farmers in the last 12 months	County						
	Busia	Homa bay	Kilifi	Kisumu	Nakuru	Overall	
	n	n	n	n	n	n	%
KALRO Mobile Apps	5	14	4	24	58	105	54.7
Bundled Services	0	5	0	13	4	22	11.5
LAOP (Laikipia Agri-Observatory Platform)	1	0	1	1	0	3	1.6
Laikipia GAPs	0	0	1	3	0	4	2.1
Plantix	0	1	5	3	1	10	5.2
CABI Plant-Wise	0	0	0	0	0	0	0.0
KALRO Selector Service	0	27	0	0	0	27	14.1
Acre Africa agronomic information	3	1	0	37	15	56	29.2
Digital Green Platforms	5	4	1	2	8	20	10.4
Overall	14	37	8	59	74	192	100.0

#### 4.2.12 Availability of digital agricultural information

When they accessed or used the digital agricultural platforms, 59% of the respondents indicated that they found the information on agriculture they were looking for compared to 41% who did not find the information.

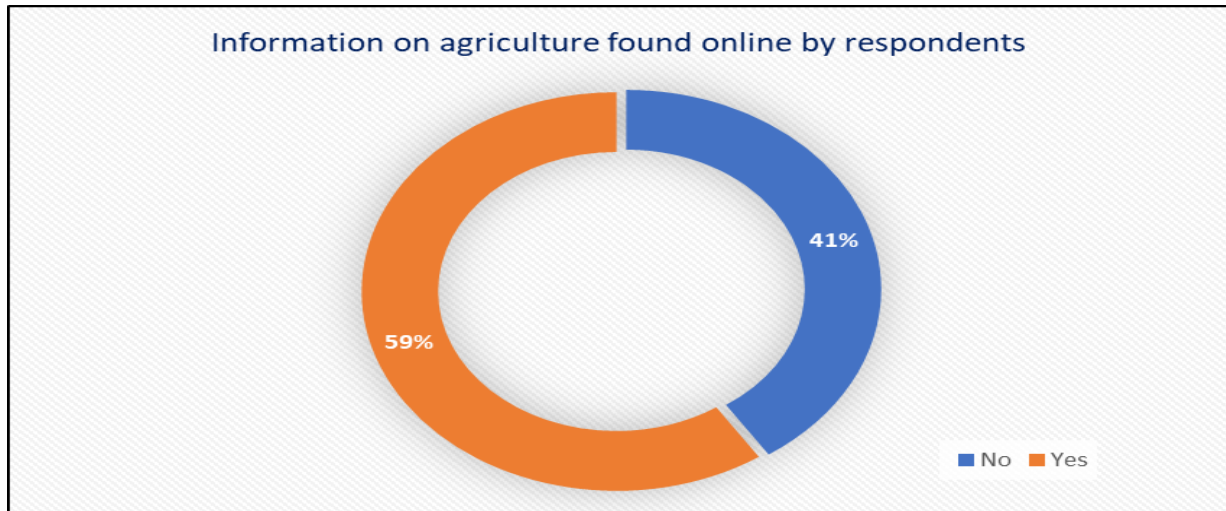


Figure 22: The number of respondents who found information on agriculture online

The respondents also indicated that 71.9% had found online information that helped them improve their farming productivity. Figure 23 shows the critical types of information. Homa bay County recorded the highest number of respondents who had found online information that helped them improve their farming productivity at 78.8%, while Kilifi County recorded the least at 60.3%.

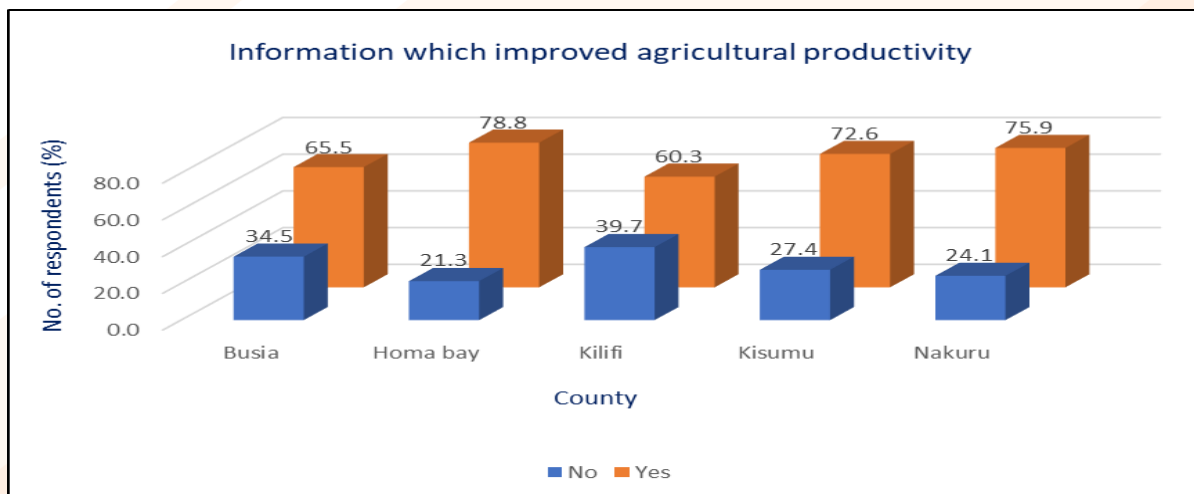


Figure 23: Information that improved agricultural productivity

#### 4.2.13 Barriers to accessing agricultural content from the internet

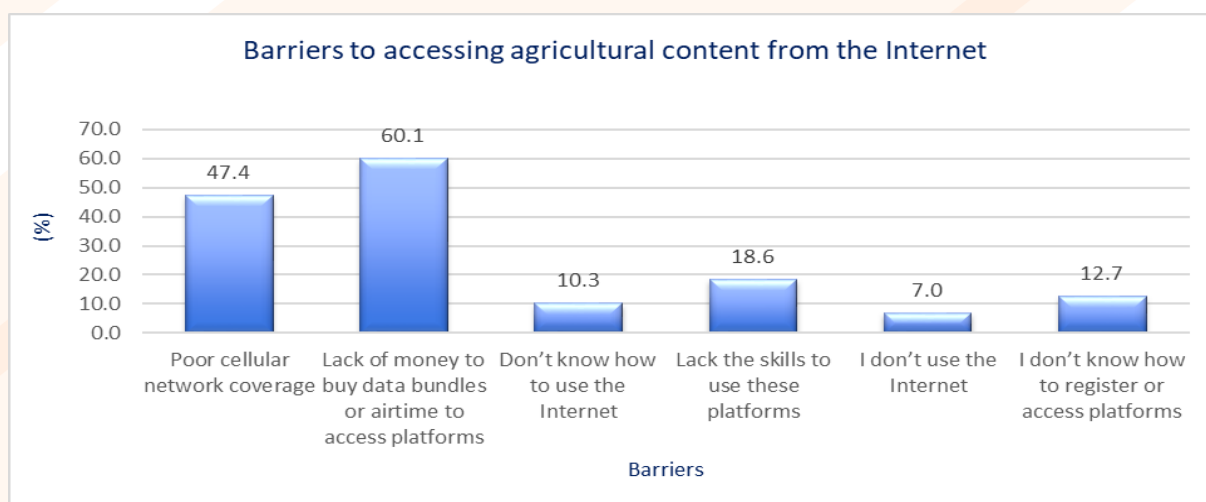
On challenges faced in accessing agricultural information from the internet, most respondents cited lack of money to buy data bundles or airtime to access platforms

(60.1%) as their biggest challenges. Other notable challenges included poor cellular network coverage (47.4%) and a lack of skills to use the platforms (18.6%).

*Table 16: Distribution of barriers to access online agricultural information by county.*

Challenges in accessing digital agricultural information	County						
	Busia	Homa bay	Kilifi	Kisumu	Nakuru	Overall	
	n	n	n	n	n	n	%
Poor cellular network coverage	33	35	41	38	69	216	47.4
Lack of money to buy data bundles or airtime to access platforms	28	69	46	40	91	274	60.1
Don't know how to use the Internet	5	17	3	5	17	47	10.3
Lack the skills to use these platforms	6	5	19	6	49	85	18.6
I don't use the Internet at all	6	5	5	9	7	32	7.0
I don't know how to register or access platforms	9	1	20	2	26	58	12.7
Overall	55	80	78	73	170	456	100.0

A graphical representation of the barriers is presented in Figure 24. Inability to use the internet and register on digital platforms are the lowest barriers hindering access to digital agricultural information.



*Figure 24: Barriers to accessing agricultural content from the internet*

#### 4.2.14 Sources of agricultural information

Radio registered the highest number of respondents, 190 out of 456, as the current sources of agricultural information representing 42% of respondents. Others were Television (36%), Friends or family members (34%), and County government agricultural extension workers/officers (33%). Nakuru County registered the highest number of respondents whose current source of agricultural information was the internet (61%), followed by Busia County (25%), Kilifi County (17%), Kisumu County (12%), and Homa bay County (4%).

*Table 17: The different sources of information*

Current Sources of agricultural information	County						
	Busia	Homa bay	Kilifi	Kisumu	Nakuru	Overall	
	n	n	n	n	n	n	%
Radio	25	76	8	51	30	190	41.7
County government agricultural extension workers/officers	16	8	59	17	52	152	33.3
Television	13	29	6	29	90	167	36.6
Friends or family members	12	2	26	0	117	157	34.4
Community members	10	1	23	9	83	126	27.6
Mobile phone call/SMS	7	13	11	31	18	80	17.5
County government officials/agency	18	1	3	4	14	40	8.8
The Internet	14	3	13	9	104	143	31.4
Overall	55	80	78	73	170	456	100.0

Figure 25 shows the distribution of current sources of agricultural information by county. Homa Bay county leads in the number of those accessing agricultural information through radio, while Nakuru on access through the internet at 955 and 61% respectively. Also, Homa bay county has the highest number of those accessing the information through SMS, followed by Kisumu county.

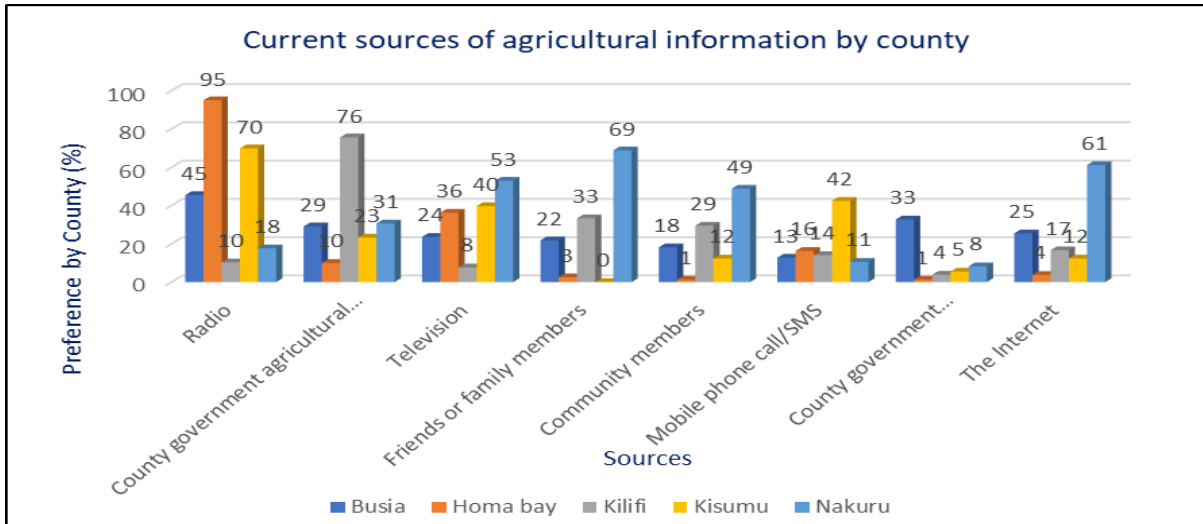


Figure 25: Sources of agricultural information

Figure 26 shows the current sources of agricultural information by age across the age groups. When disaggregated by age, farmers above 60 years prefer to access information through radio, followed by the 36-50 years bracket, while the youth aged between 18-35 like to use the internet. The preference for SMS was average across the different age groups.

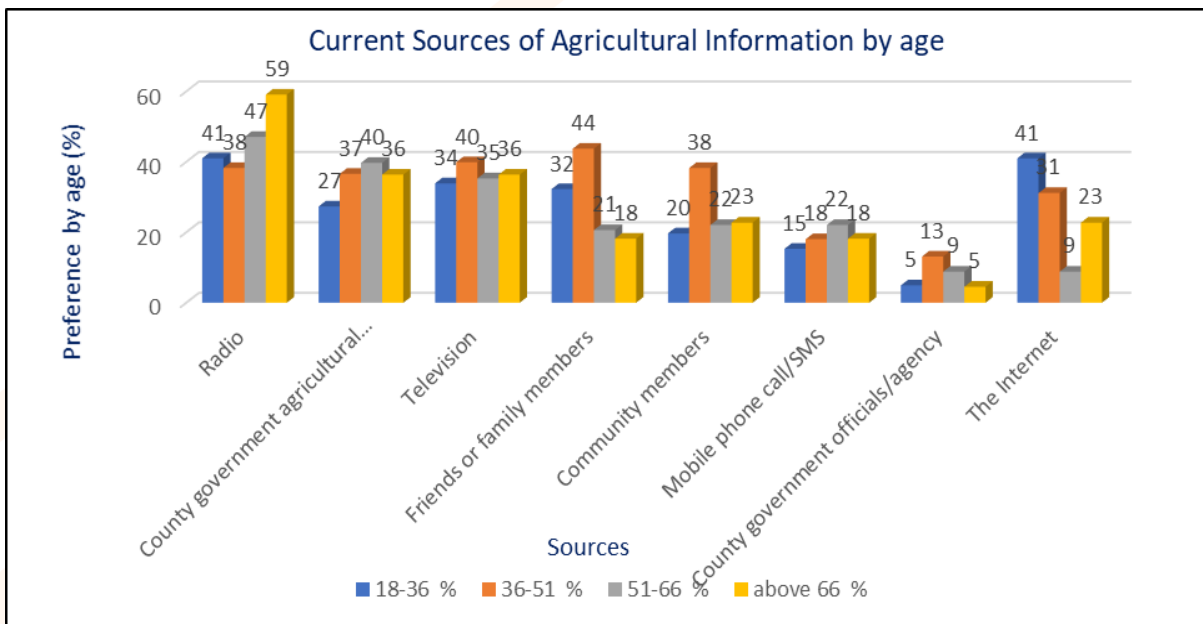


Figure 26: Current sources of agricultural information by age

#### 4.2.15 Use of Social Media sites for agricultural information

The study assessed social media as a source of agricultural information. The results show that social media is a significant source of agricultural information access. Most social media sites used by farmers to seek information are WhatsApp, Facebook, and Youtube at 90.0%, 78.9%, and 43.1%, respectively. Figure 27 shows the social networking sites used by most respondents per county.

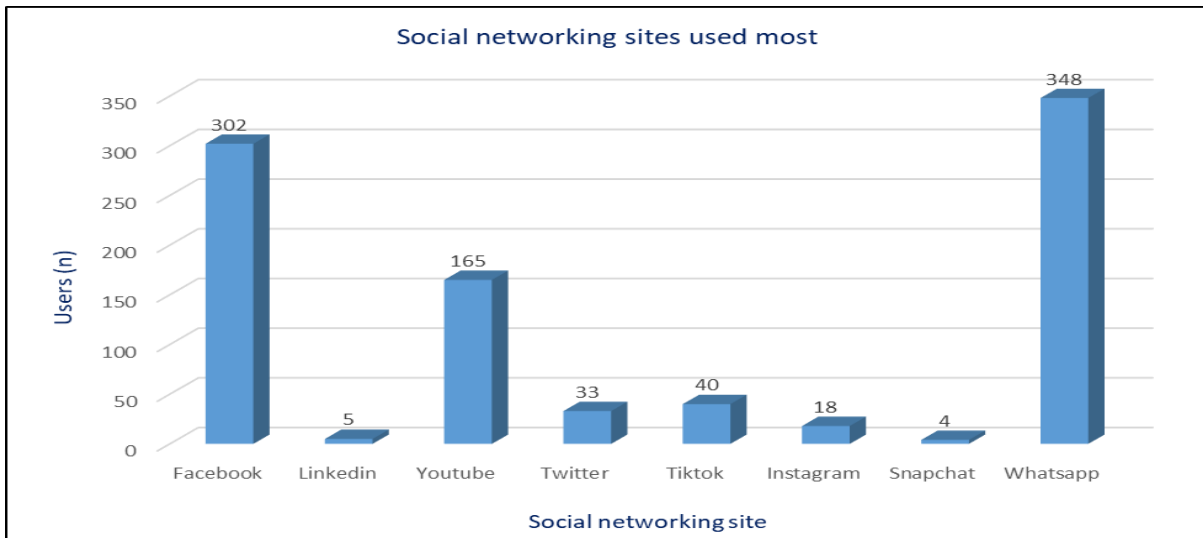


Figure 27: The social networking sites used

The results show that social media is a source of information about new technologies, content, and practices in the five counties. It facilitates networking and collaboration among farming communities, farmers, and extension agents. Figure 28 below shows comparative analysis of social networking sites by county.

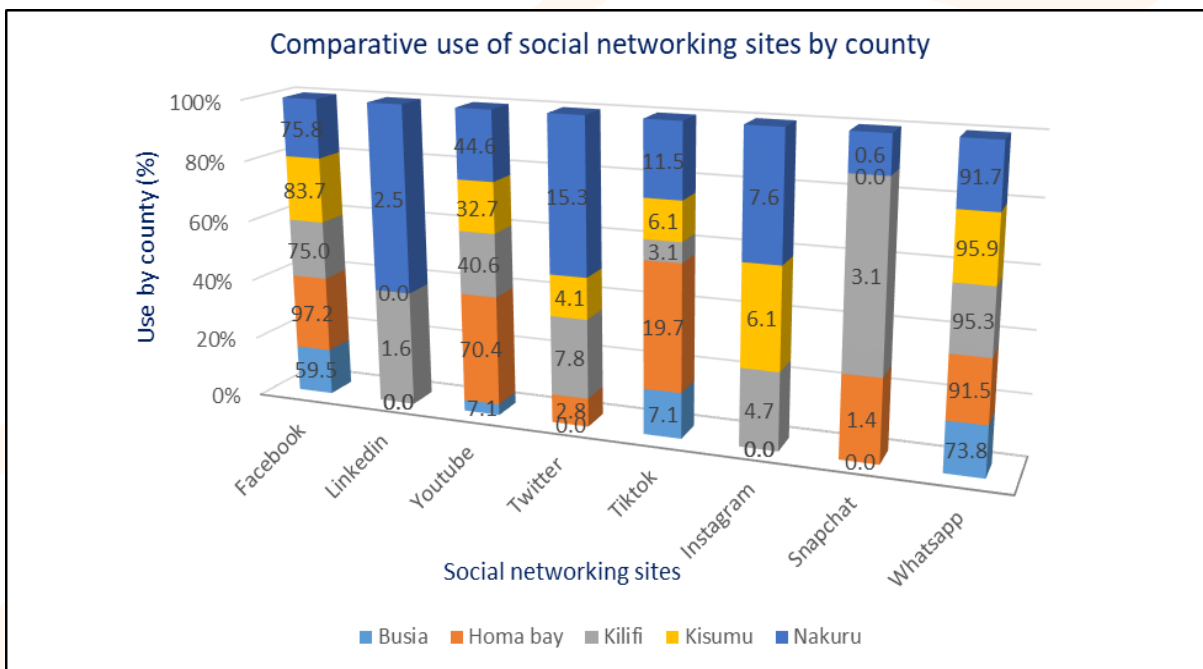


Figure 28: Comparative use of social networking sites by county

#### 4.2.16 Information Most read and shared by respondents on social networking sites

Agricultural information remains the most type of content shared on social media, followed by political views and breaking news. Table 18 shows the distribution of information sharing by the different categories and counties.

Table 18: Information read or shared on social networks by respondents

Information read or shared on social networks by respondents	County					
	Busia	Homa bay	Kilifi	Kisumu	Nakuru	Overall
	n	n	n	n	n	n
Academic information	4	29	19	3	22	77
Spiritual information	15	42	5	7	29	98
Relationship status	5	53	3	0	26	87
Agricultural information	36	29	20	39	101	225
Personal photos	2	8	4	3	42	59
Political views	11	36	18	16	85	166
Breaking news	6	13	25	2	91	137
All of the Above	0	0	5	13	1	19
None of the above	6	4	20	17	13	60
Don't know	0	1	2	4	1	8

Nakuru county has the highest number of farmers sharing agricultural information on social media, followed by Kisumu and Busia. Homa Bay county is leading in sharing academic information on social media, followed by Nakuru and Kilifi, respectively, while Kisumu and Busia recorded the lowest number. Figure 29 shows the distribution of the information mostly read or shared on social networks.

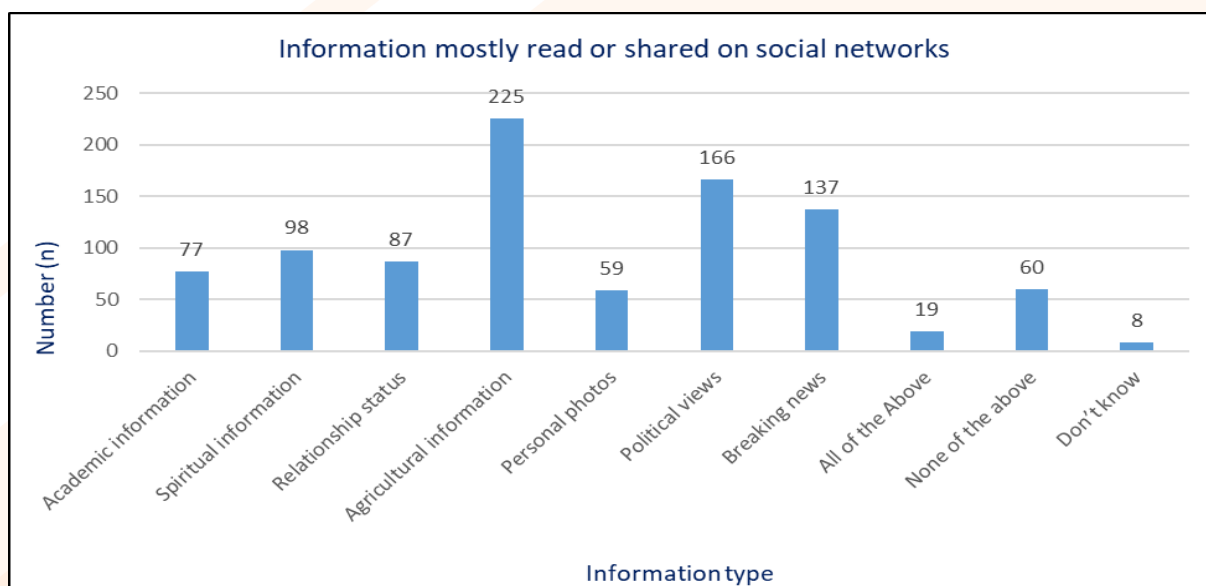


Figure 29: Information mostly read or shared on social networks

## 4.2.17 Project and Group Membership

The information on group membership is shown in Figure 30. Most respondents interviewed belonged to a farmers group (154), followed by table banking groups (131), women groups (119), and youth groups (93), respectively. Those who did not belong to any group were 76.

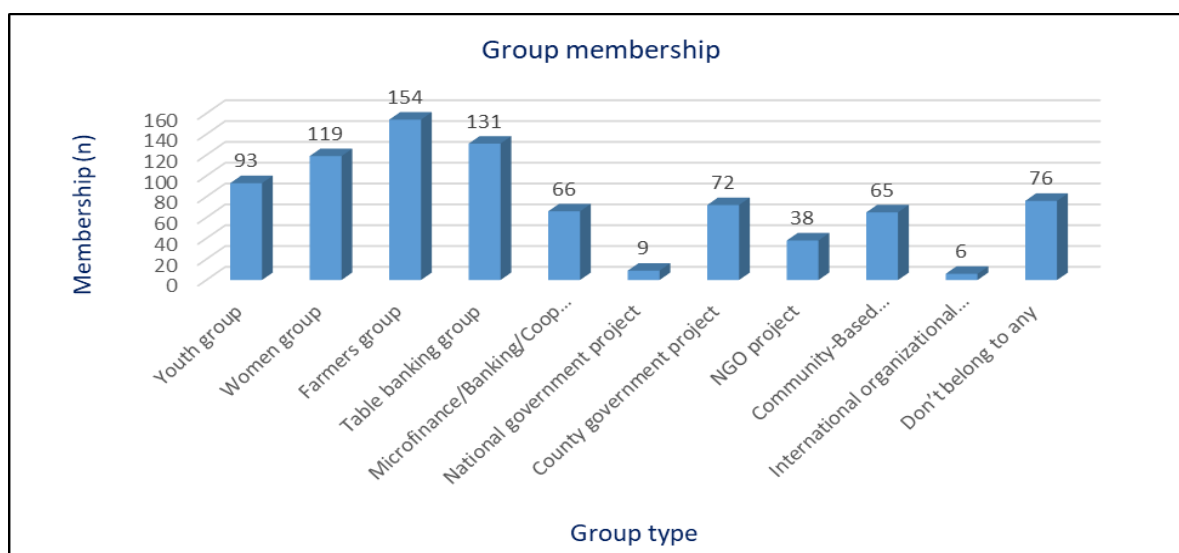


Figure 30: Project and group membership.

## 4.3 Gaps, Challenges, and Opportunities

The counties reported gaps, opportunities, and needs to enhance effectiveness and efficiency in accessing and using digital agricultural content for farmers and other relevant stakeholders. Digital capacity building was the most prevalent need, followed by financial support for digitizing the agricultural content. Digitization will support the effective acquisition, processing, and dissemination of content. Some of the challenges reported include limited digital capacity, limited understanding of digital content, limited extension staff to hand-hold farmers, inefficient ICT systems, and poor internet infrastructure in rural areas. In addition, limited funding was a critical challenge leading to low access and use. Notably is the argument that making agricultural content accessible and usable requires financial resources and support from the various institutions responsible for these activities. ***“Knowledge loss”*** is a phenomenon and a critical challenge in the five counties. A specific need is how to manage tacit knowledge. A respondent from one of the counties said, *“there is a need to enhance approaches including policies on capturing tacit knowledge and depositing information materials into the county repository to ensure continuous and sustainable inflow.”*

## CHAPTER 5: Conclusion and Recommendations

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Whereas digital capacity development and training are powerful accelerators of digital agricultural content access, strategies, and programs to ensure adequate capacity remain challenging in the five counties. The main challenges include; (i) limited relevant digital capacity for farmers, for instance, limited digital skills on digital tools and approaches. (ii) Poor internet infrastructure in rural areas (iii) customization of digital content, including translation into local languages. The results showed that 41% of the respondents did not find the information helpful. (iv) Furthermore, inadequate strategies and policies in the county to prioritize the digitization of agricultural content is a huge gap.

In addition, the lack of a framework for ensuring the staff are trained and well equipped with the relevant skills is also a challenge. A case in point is the lack of a framework to test, scale and sustain capacity development and training programs at the county level. A highly noticeable capacity gap is the lack of champions and County forums to promote learning and knowledge exchange among stakeholders. Subsequently, all five counties have limited capacity to design, manage and promote safe and responsible use of digital agricultural content and digital tools. Over and above, ICT infrastructure at the county offices remains a significant hindrance, leading to poor access to digital agricultural content. Besides, there is a lack of a model that can be scaled to accelerate the uptake of digital content. The need to strengthen digital capacity at the county level to train farmers remains critical.

### 5.1 Recommendations and Critical Priority Needs

Drawing from the rapid assessment findings, the following are crucial areas that need to be addressed to improve access and safe use of digital agricultural content in the five counties and generate empirical evidence for decision-making for the project and partners. In addition, there is a need for a dedicated budget line to be allocated for supporting the digital agricultural content agenda in counties in the short to long term. Furthermore, the funds must be committed and disbursed consistently on time to ensure that digital activities in the counties are not affected.

#### 5.1.1 Digitized Agricultural Content Gap

Several agricultural extension officers in counties, sub-counties, and wards cannot currently digitize and develop innovation to achieve sustainable and climate-smart agricultural performance. There are no programs or plans for digitization due to the lack of resource allocation since the devolution of the county governments. As a first step, the project, in collaboration with counties, needs to identify the critical

Use Cases and critical content that would regularly address the farmers' pain points, related demand, and impact.

### 5.1.2 Establish a Partnership and collaboration Framework

Building a robust ecosystem for digital actors in agriculture in the five counties can improve partnerships and collaboration among the key players from the public, private sector, and farmers are critical to the success of the project in these counties. However, there is no structure to facilitate collaboration and working together among crucial actors. Therefore, there is an urgent need to create and establish a framework that will stimulate effective working relationships between the content generators, infomediaries (content curators and publishers), and farmers for each of the five counties. In line with the study findings, this assessment recommends that the successful implementation of the project will require an intentional approach to bring the stakeholders together and ensure the project resources work best as catalysts and initial support for stakeholders' engagement. After that, create a framework that engages the commercial, NGO, government-run institutions and extension, market linkage agents, and financial service actors to develop and disseminate the available and new digital content continuously.

### 5.1.3 Investment in Digital Innovation

In all the five counties, most agricultural extension staff are aging, and there is no succession plan, and replacement is curtailed. The number of extension officers is deficient at the county, sub-county, and ward levels. Therefore, the issue of human resource capacity should be looked at urgently and strategically. While building sufficient human resource capacities for the counties will go a long way in addressing the human resource constraint, this approach is expensive and out of the project scope and focus. In addition, existing extension staff in the five expressed need for appropriate training in digital skills and sound processes and practices. A reasonable approach to address these gaps and challenges is to invest in digital innovations and digitize the critical information that can support the attainment of sustainable, climate-adapted, and digitally-enabled agriculture for enhanced food security in the five counties. Some of the suggested innovations include social, process, and product innovations. For instance, identify the farmers' critical needs using sustainable methods and the necessity for collaboration with key actors to achieve the required learning levels and change needed for revitalizing their productivity and resilience against climate change. In addition, invest in processes for improving the development of digital agricultural content in the form of products and services.

### 5.1.4 Investment in Digital infrastructure

There is insufficient ICT equipment, tools, and resources in all five counties, including servers, laptops, and digital devices. In addition, there is limited or no

internet in some cases, particularly at the county, sub-county, and ward offices. Therefore, there is urgent to identify and connect the county management to affordable internet service providers such as Mawingu and Community Networks. In addition, mid-wife the relationship between commercial internet service providers and the county to establish collaboration through existing mechanisms such as Corporate Social Responsibility (CSR) arrangements. These approaches can improve internet connectivity and availability at the county or community level.

### 5.1.5 Contextualize the agricultural content

A sufficient understanding of the environment where the digital agricultural content is to be used is critical in ensuring that the information is relevant and usable in the county's context. It is crucial to provide all the digitized content are context-specific to meet the target user's needs and not copied from other environments with different needs.

### 5.1.6 Proactive Planning

The project implementation should leverage the user needs assessment as a guide to ensure the users' actual needs are met and addressed for impact. In addition, it builds the users' digital capacity as a process of sensitization or as part of initial training. Further, the project should document the processes involved in the implementation as a framework that can guide scalability and model testing. Content development can be best achieved through participatory approaches to steer collaboration and enrich the content. There is also a need to include intentional communication of the processes among the key stakeholders. This approach will facilitate effective project implementation and sustainability.

## 5.2 Conclusions

While farmers and stakeholders in the five counties have recognized the contribution of digitizing agricultural content to achieving sustainable and climate-smart adaptable practices and food security in Kenya, access to relevant digital content remains insufficient. As this assessment has shown, the agricultural extension officers in counties, sub-counties, and wards cannot digitize and innovate agricultural content to achieve sustainable and climate-smart agricultural performance. About 52% of the respondents indicated they were aware, while 48% were unaware of the digital agricultural platforms. These values indicate moderate levels of awareness. With access to digital content, Radio remains the most preferred channel, and the cost of the internet is a critical barrier. These findings show that farmers and stakeholders are not benefiting as much as they could from the available agricultural information and knowledge generated by research institutions and private sector actors. Several factors contribute to the challenges, as articulated in the results sections of this report. Unfortunately, policy-makers and

relevant institutions at the national and county levels have not focused on specific aspects of access, use, and relevance of agricultural information. This report has paid adequate attention to these areas, summarized the findings, and provided recommendations. Therefore, this report has suggested interventions for reducing the digital divide and social exclusions to improve the availability, accessibility, and usability of the existing agricultural information.

The needs assessment methodological process and report provide a detailed account of counties' digital ecosystem challenges and the unintended consequences by highlighting diverse factors and dynamics responsible for the slow rate of digitization of the agricultural sector. This approach of analyzing the ecosystem in the context where the project plans to scale has ensured that suggested interventions and recommendations, including technology tools and strategies, will be relevant and sustainable. This level of analysis has expanded the concept of Principles for digital Development and will ensure that project doesn't duplicate existing efforts. Additionally, this study has provided sufficient and more profound articulation of factors responsible for low access and digital agricultural content use from practice and context perspectives. It further shows how cultural, gender norms, political environment, socio-economics, and technological infrastructure affect farmers' and relevant stakeholders' ability to access and use digital agricultural content or unaware of their benefits. Consequently, this study's findings can guide the implementation of similar projects in other counties.

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# ANNEX A: Sustainable, climate-adapted, and digitally enabled agriculture for enhanced food security project in Kenya: County Screening, selection Criteria Checklist

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## 1.0 Introduction

Digitization of Agriculture is a game-changer to achieving agricultural transformation in developing countries such as Kenya. Consequently, an inclusive, digitally-enabled agricultural transformation could help achieve meaningful livelihood improvements for smallholder farmers and pastoralists[1]. It can boost productivity, profitability, and resilience to climate change. It could also drive greater engagement in agriculture for women and youth and stimulate employment opportunities along the value chain [2]. However, despite the potential, the advancement towards Digital for Agriculture (D4Ag) has been somewhat slow to serve the smallholders that produce 80% of Africa's agricultural output.

### 1.1 Mobile Use Centricity

While mobile money and mobile penetration rate are solid and high, only 40% of Kenya's population is actively using the Internet as of 2021[3]. Despite the unsatisfactory level of internet users, mobile penetration grew to 11% between 2020 and 2021, a penetration rate of more than 100%. Although most Kenyans have mobile connections, only approximately 21.75 million are Internet users as of January 2021, which translates into 40% usage [3]. As of January 2021, Kenya had a population of 54.38 million, with 28.2% in urban centers and 71.8% in rural areas. Also, about 11 million are using social media, 20% of the population[3].

Device ownership is a critical metric to access internet use and connectivity. Among the Internet users aged 16 to 64, 99.7% own a smartphone; 14.4% feature phones, 60% have laptop or desktop computers, and 20% have a tablet. On the other hand, 14% of those Internet users have a smartwatch, while 4% have a smart home device[4].

### 1.2 Tracking Progress

In December 2020, ACWICT received funding support from the UK Government Digital Access Programme (Accountable Grant No.204963) to implement a six-month pilot project (Digital Agriculture for Accelerated and Inclusive Post COVID-19 Economic Recovery in Laikipia County). The project resulted from action

research conducted between December 2019 and October 2020. The study sought to assess the barriers to use and access digital content in agriculture. In addition, to establish the user needs, critical success factors, digital models, and opportunities available for increasing access to locally relevant, gender-sensitive, and development-oriented digital content for smallholder farmers. In particular, identifying the challenges women and youth farmers faced in Laikipia county was also assessed.

A critical look at the achievements demonstrates the need to expand and replicate the innovations and models from the pilot project to reach more farmers and broaden the effectiveness of the interventions. The Assessment Report and achievement from the project highlighted the potential impacts of increasing digital inclusion in the other counties to create digital ecosystems and opportunities that address specific development challenges in most counties in Kenya. In addition, studies show that the rising climate variabilities could lead to significant declines in agricultural productivity for many of the counties in Kenya [4]. These findings stimulated the need to assess the possibility of scaling the project to five additional counties in Kenya. The need to scale is critical because the project addresses practical challenges and provides opportunities for scaling up activities within Laikipia and other counties. Scaling the activities to different counties will enable the project to reach more than one million farmers among the most vulnerable communities in Kenya. However, a screening tool is required to guide the selection of the counties to scale the project and comprehensively synthesize evidence and map the available literature on the state of digitization.

## 2.0 Methodology

This scoping study seeks to provide in-depth evidence based on existing literature to guide the selection of possible counties for scaling the project. The process involved desk research to comprehensively review extant literature and systematically examine many reports, published papers, and other relevant documents. The method also involved studying the other variables such as internet network connectivity, agricultural productivity.

In addition, the application of principles for digital developments was critical. The principles enabled the scoping study to understand the digital roadmap and ecosystem across the 47 counties in Kenya. This approach is crucial because well-designed initiatives and digital tools consider the particular structures and needs in each country, region (county), and community. Consequently, dedicating time and resources to analyze the ecosystem or context where the project can be scaled helps ensure that selected technologies and tools will be relevant and sustainable and will not duplicate existing efforts. In this scoping study, the

assessment of the ecosystem considered governance, agricultural contribution to the county's economy, ICT technology infrastructure, and other factors that can affect farmers' ability to access and use digital content in agriculture or active participation in the project.

The ecosystem is fluid, multifaceted, and ever-changing, requiring that digital development practitioners regularly analyze the context to check their assumptions. This study recognizes that projects that do not assess the ecosystem challenges are less likely to achieve their objectives or scale successfully. Subsequently, it may also lead to unintended consequences. A scoping study involves the following steps:

The scoping review process

- Step 1 - Defining a precise review subject and objectives
- Step 2 - Developing a protocol for literature review and analysis
- Step 3 – Application of the Population/participants and Concept/Context (PCC) framework.
- Step 4 - Conducting systematic searches (including grey literature)
- Step 5 - Screening results for studies that meet the eligibility criteria.

Thus, this study developed a checklist for the capacity assessment to guide the proposal of potential counties to scale up the project activities. The Checklist is essential in verifying the extant literature information collected during the screening process.

## 2.1 Screening process to guide the selection of counties for Scaling the Project

A scoping study is adopted to help understand the digital ecosystem at the county level in Kenya and conduct the screening and ultimate selection. This process documents and provides analyses of the stakeholders, systems, and enabling environment at the county level that empowers communities to use digital technology to access services to pursue their economic livelihood. It also provides a snapshot of the assessment for guiding the selection of the counties by synthesizing the Gross Value Added (GVA) contributions to GDP by the agriculture sector, digital roadmap, and governance context for the different counties in Kenya. Complementary materials include references and annexes for the GVA, climate analysis, and a listing of potential projects for leveraging.

### 2.1.1 Counties Gross Value Added Contribution to GDP by the agriculture sector

The Gross Value Added (GVA) estimates for Agriculture, Forestry, and Fishing to GDP show the sector's contribution. The latest report shows that the top ten (10) Counties are: Nakuru, Nyanduraua, Kiambu, Elgeyo Marakwet, Meru, Narok, Bomet, Bungoma, Kakamega, and Nyeri. The lowest contributors are Taita Taveta,

West Pokot, Lamu, Tana River, Garissa, Marsabit, Kajiado, Mandera, and Isiolo. The other countries are medium contributors, while Nairobi and Mombasa counties are mainly not agricultural counties.

### 2.1.2 Status of ICT Infrastructure

In Kenya, the ICT infrastructure plays a substantial role in catalyzing economic growth and other development programmes and is a leading enabler of such growth in many counties. Specifically, the Internet and mobile telecommunication infrastructure are the key drivers (Pradhan et al., 2018), leading to a considerable increase in fiber optic and fixed broadband. In addition, connectivity and capacity have greatly improved, filling a substantial infrastructure gap and increasing competition further (Sutherland, 2014).

### Fibre Network Distribution in Kenya

Currently, the Fibre optic network covers the major towns and cities in Kenya. There are also small-scale companies that do not have their network infrastructure but rely on the leading players. Figure 1 shows the Fibre distribution network coverage in Kenya.

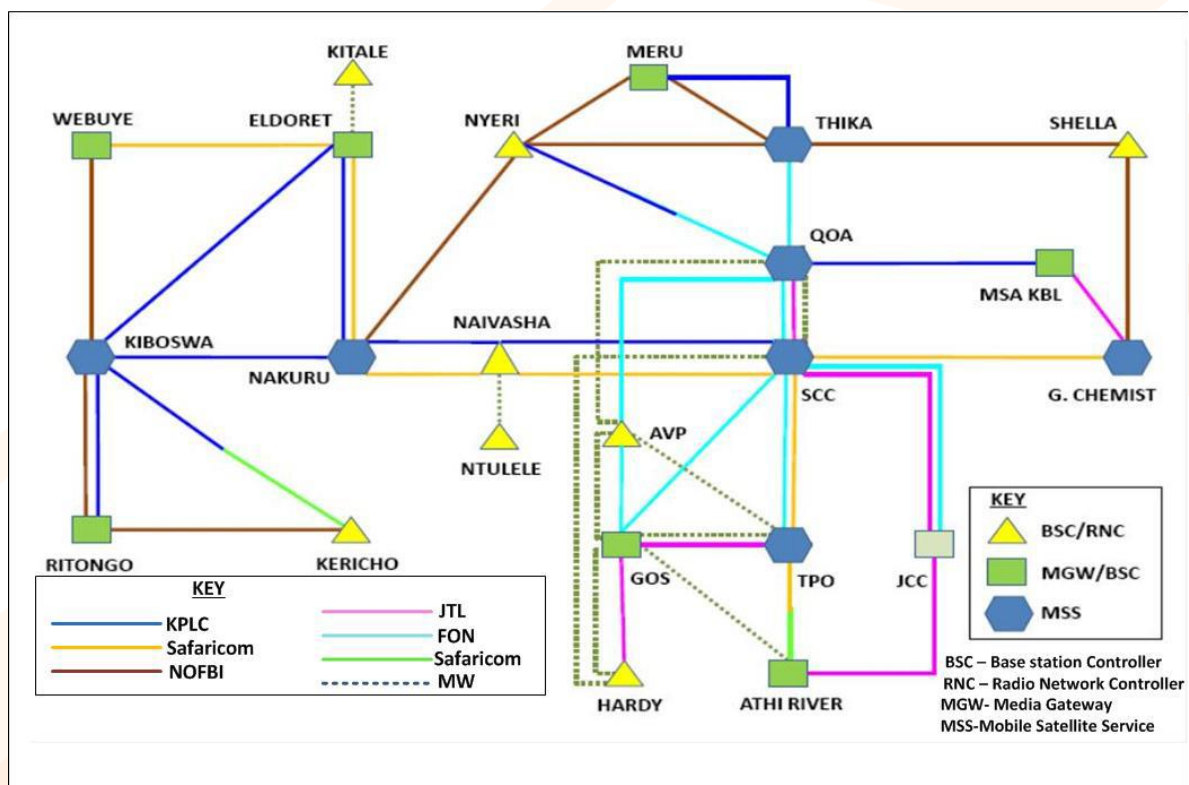


Figure 1: Extent of Fibre distribution network in Kenya  
(Source: Safaricom PLC, 2019)

Key: KPLC- Kenya Power and Lighting Company; NOFBI- National Optic Fibre Back-borne Initiative; JTL-Jamii Telecom Limited; FON-Frontier Network; MW-

Microwave; AVP –Avenue Park; SCC-, GOS-, TPO -, QOA -, KBL are confidential locations of points of presence (pop).

### Areas with potential for new internet connectivity

While each county in Kenya has at least one sub-location or ward with a 3G connection, about 50% of the wards have zero 3G coverage. Communication Authority of Kenya (CAK) ICT gaps assessment report shows the areas (sub-location or communities) with potential for internet connectivity in Kenya. Figure 2 shows these areas.

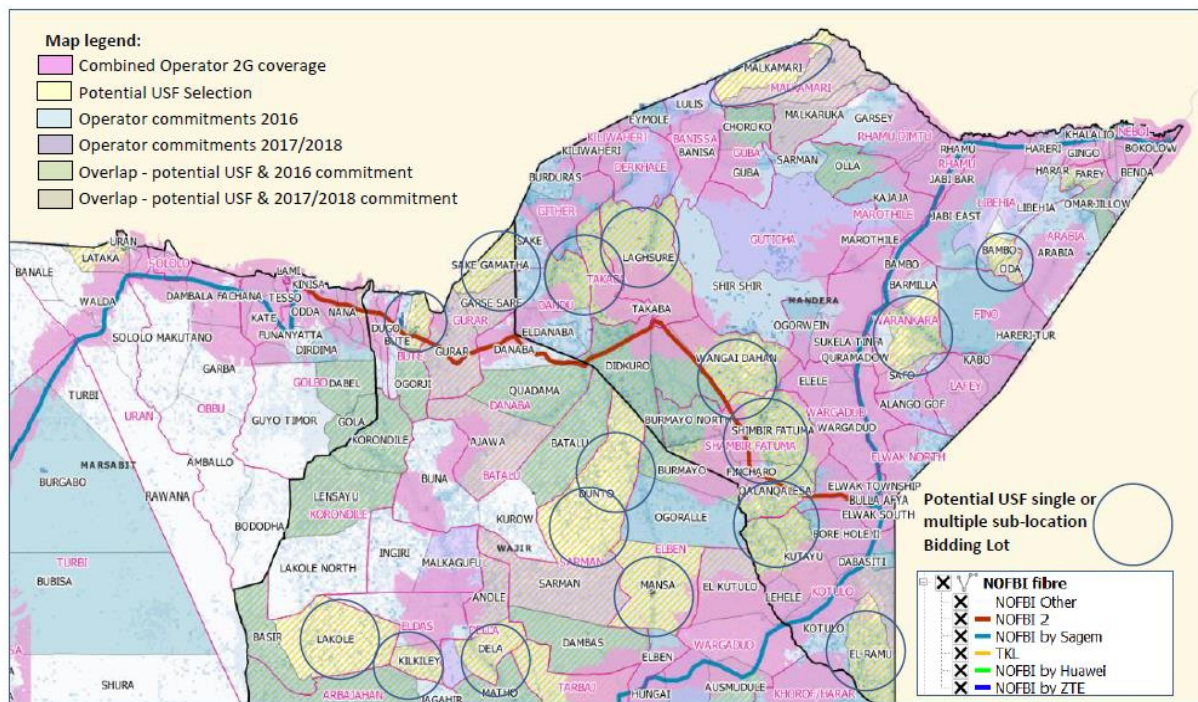


Figure 2: Areas marked circles show the potential for new connectivity (Source: CAK, ICT Gap study report, 2020)

### National Optic Fibre Backbone Infrastructure in Kenya

Kenya's National Optic Fibre Backbone (NOFBI) ensures connectivity in 47 counties. Currently, all the counties in Kenya have NOFBI connections but are not well distributed across all the areas in the counties. Figure 3 shows infrastructure across the country.

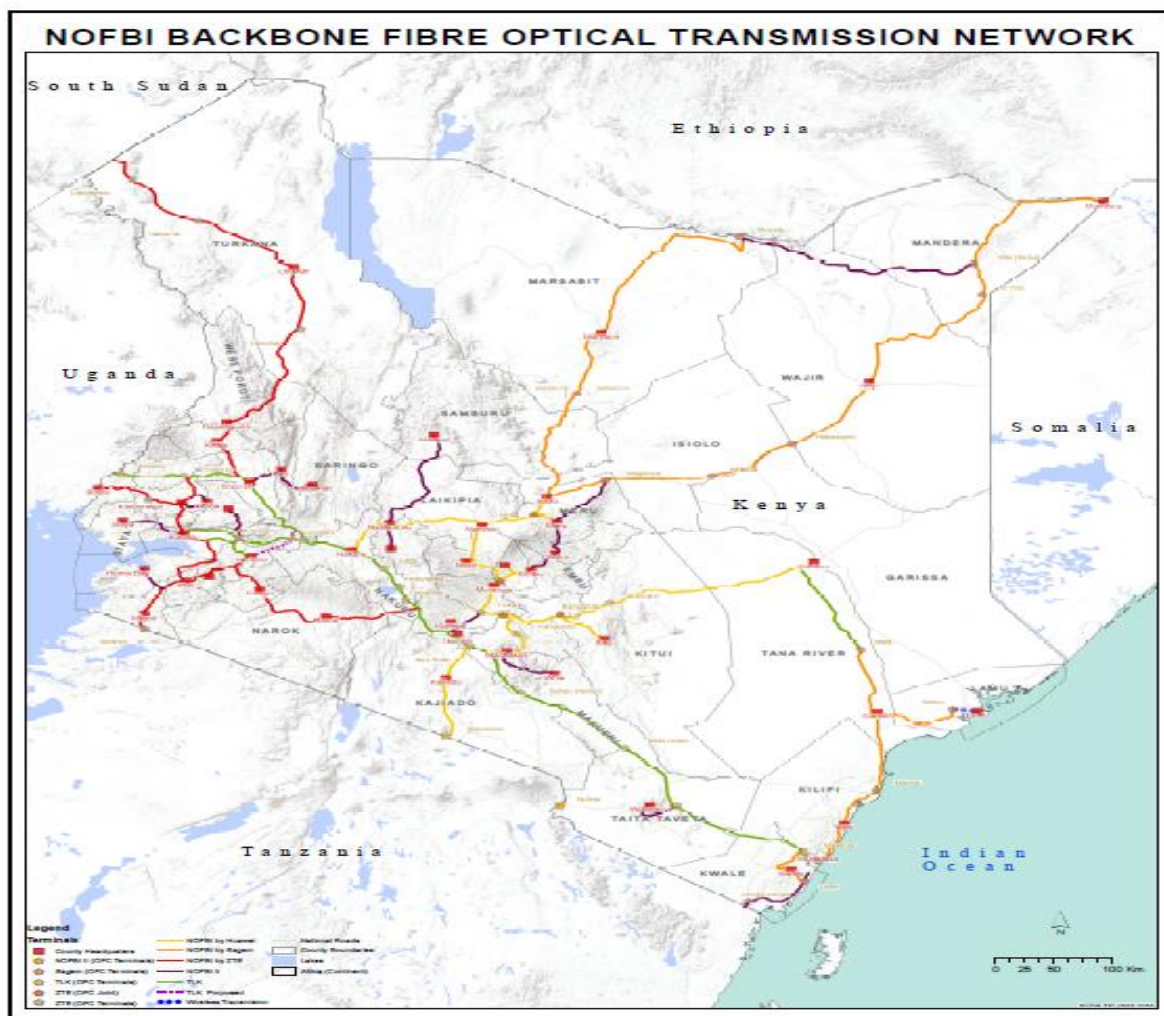


Figure 3: NOFBI Infrastructure coverage in Kenya (Source: CAK, 2021)

As of January 2022, the data from CAK shows that about eight counties excluding Nairobi and Mombasa have been 100% connected under NOFBI 2E up to sub-county levels. Approximately thirty counties are above 50%, and eight counties are at below 50% connection rate at sub-county levels. Table 1 shows the different stages of internet connectivity at sub-county levels.

No.	County	No. of Administrative Division	No. of Administrative Division connected to NOFBI 2E	% of Administrative Division connected to NOFBI 2E
	Bomet	5	5	100
	Embu	4	4	100
	Kirinyaga	4	4	100
	Kisumu	7	7	100
	Kwale	4	4	100
	Lamu	2	2	100

No.	County	No. of Administrative Division	No. of Administrative Division connected to NOFBI 2E	% of Administrative Division connected to NOFBI 2E
	Migori	8	8	100
	Tharaka-Nithi	4	4	100
	Busia	7	6	86
	Nyeri	7	6	86
	Bungoma	12	10	83
	Nyandarua	6	5	83
	Uasin Gishu	6	5	83
	Kisii	11	9	82
	Nyamira	5	4	80
	Makueni	9	7	78
	Kakamega	13	10	77
	Kiambu	13	10	77
	Elgeyo/Marakwet	4	3	75
	Homa Bay	8	6	75
	Taita/Taveta	4	3	75
	Wajir	8	6	75
	Machakos	11	8	73
	Murang'a	7	5	71
	Trans Nzoia	7	5	71
	Meru	10	7	70
	Isiolo	3	2	67
	Kericho	6	4	67
	Kilifi	9	6	67
	Nandi	6	4	67
	Samburu	6	4	67
	Vihiga	6	4	67
	Narok	8	5	63
	Siaya	8	5	63
	Laikipia	5	3	60
	Baringo	6	3	50
	Marsabit	4	2	50
	Nakuru	16	8	50
	Kitui	18	8	44
	Garissa	6	2	33
	Kajiado	6	2	33
	Mandera	9	3	33
	Tana River	7	2	29

No.	County	No. of Administrative Division	No. of Administrative Division connected to NOFBI 2E	% of Administrative Division connected to NOFBI 2E
	Turkana	17	2	12
	West Pokot	9	1	11

*Table 1: Percentage of sub-counties Connected Under NOFBI 2E*

### National 3/4G Network coverage in Kenya

As of January 2022, additional data from CAK indicates that the 3/4G network coverage of thirty-nine counties is above 50%, and only eight counties are below 50%. Table 2 shows the percentage network coverage of 3/4G in all the counties in Kenya. From the data available at CAK, which is shown in Table 2, it can be seen that there is adequate 3/4G network coverage in most of the counties in Kenya.

	County	Sum of Area Covered (sq. Km)	Sum of Geographical. Area (sq. Km)	% area covered
1	Nyamira	898999752	899284969	100.0
2	Kisii	1316761067	1317533347	99.9
3	Kakamega	2659103739	2661574471	99.9
4	Vihiga	918717061	920576897	99.8
5	Nairobi	693682495	695100332	99.8
6	Kisumu	2080106109	2085939674	99.7
7	Kericho	2147628140	2157901221	99.5
8	Machakos	6176574750	6208251802	99.5
9	Siaya	2516273703	2530395955	99.4
10	Uasin gishu	3314791152	3345228359	99.1
11	Busia	1676337409	1695038895	98.9
12	Migori	2560725088	2595942169	98.6
13	Nandi	2839057996	2884193582	98.4
14	Kiambu	2568097427	2614139463	98.2
15	Homa bay	3101036780	3183301512	97.4
16	Nakuru	7274146649	7495104697	97.1
17	Embu	2715890861	2818048286	96.4
18	Makueni	7680045330	8008763602	95.9
19	Mombasa	209574549	218859754	95.8
20	Elgeyo-marakwet	2859398588	3029794398	94.4
21	Bomet	2630581881	2792408100	94.2
22	Murang'a	2342579327	2488114586	94.2
23	Nyandarua	3026779265	3245259860	93.3

	County	Sum of Area Covered (sq. Km)	Sum of Geographical. Area (sq. Km)	% area covered
24	Kirinyaga	1369372917	1479093878	92.6
25	Trans nzoia	2297529214	2495542262	92.1
26	Tharaka-nithi	2357632983	2638843188	89.3
27	Meru	5862742028	6933049808	84.6
28	Nyeri	2742220539	3337107239	82.2
29	Bungoma	2456524748	3032169110	81.0
30	Laikipia	7441330478	9461972151	78.6
31	Baringo	7973096988	11015381309	72.4
32	Narok	12797245977	17933097239	71.4
33	Kwale	5117051837	8270136111	61.9
34	Kajiado	13347534421	21901006469	60.9
35	Kilifi	6608637077	12609742674	52.4
36	Lamu	3271712692	6273125176	52.2
37	Taita-taveta	8853053676	17084034749	51.8
38	West pokot	4728429218	9169518007	51.6
39	Kitui	15645031976	30496585547	51.3
40	Mandera	11352345160	25991761447	43.7
41	Garissa	16459689207	44175209677	37.3
42	Tana river	13772058734	38437009132	35.8
43	Wajir	18182049978	56686215395	32.1
44	Samburu	6120872443	21022424359	29.1
45	Isiolo	6864657133	25336244275	27.1
46	Turkana	13309055749	68680848776	19.4
47	Marsabit	11379551215	70961908999	16.0

*Table 2: Percentage of 3/4G network in Kenya*

### 3.0 Developing the Checklist

In developing the Checklist for selecting the counties, the principles for digital development and scoping study techniques guided the process:

- User and stakeholder engagement includes analyzing existing research to understand the people, internet connectivity networks, governance, politics, ICT infrastructure, and agricultural contribution to GDP, including previous and current projects.
- Understanding the digital ecosystem ensured that the project aligns with the county level's existing technological, governance, and regulatory policies.

- Collaboration and consultation with strategic organizations, national and county governments, and other projects under implementation. This approach provided crucial data and learning from the successful and unsuccessful projects. As a result, it was easy to assess ongoing efforts, avoid duplications, and potential to leverage and integrate with existing projects more efficiently.
- Involving in telephone discussions with the community members, other donors, county and national governments officials, and other organizations implementing different projects in the counties.
- Assess the digital roadmap at the counties to identify potential changes during the project lifecycle.
- Application of Population/participants and Concept/Context (PCC) framework guided the identification of the main concepts for analysis and deferential pointers.

### 3.1.1. The process

#### 1. Analysis and Planning

This process provided a thorough context analysis, including desk research, preliminary in-person interviews, and other relevant research methods. Subsequently, it enabled the identification and context analysis of the 47 counties using different factors, as shown in Table 1. The context analysis included a social and inclusive technological assessment that can lead to social change and the project's impact. The screening considered among other factors:

- Target users' levels of education to determine the digital tools they can use.
- Existing ICT infrastructure, including affordability
- Governance or political environment at the county level.

The analysis and planning enabled understanding of the ecosystem and gathering data to develop knowledge about the people targeted, including women, children, people with disabilities, the community, and socio-economic context. The data collection process was mainly through consulting published research or engaging with those who previously worked in the counties. In addition, the ICT infrastructure, environment, including the political landscape, policies, and regulations. Further, active donors, implementing organization and digital development programmes.

#### 2. Designing and Development of the Checklist

Designing the Checklist involved reflecting on the context to determine which factors would meet the project target of reaching one million farmers and their needs. To evaluate the critical ecosystem considerations such as connectivity, mobile network penetration, and emerging technologies, among others, was helpful during the formative research phase. The analysis and planning revealed what technology and capacity already exist. This information informed the design of the Checklist. Table 3 shows the Checklist and factors considered in selecting the counties.

**Table 3: CHECKLIST FOR SELECTING COUNTIES**

	Infrastructure and connectivity			Agricultural contribution to GDP	Internet affordability	Other factors			Emerging Technologies	
County	Internet connection (Fiber/Cable)	Mobile data Network coverage (3G/4G)	Internet penetration rate		Poverty Index (KNBS data)	ICT literacy	Gross added value	One Million DAT platform	Community Network	TV White Space
Kisumu	X	X	High	High	High	High	Average		X	
Nakuru	X	X	High	High	High	High	High	X	X	
Kiambu	X	X	High	High	High	High	High	X		
Uasin gishu	X	X	Medium	Medium	Medium	Medium	Average	X		
Kakamega	X	X	Medium	Medium	Medium	Medium	High			
Kisii	X	X	Medium	Medium	Medium	Medium	Average	X		
Meru	X	X	Medium	Medium	Medium	Medium	High			
Tharaka-nithi	X	X	Medium	Medium	Medium	Medium	Medium	X		
Embu	X	X	Medium	Medium	Medium	Medium	Medium			
Kwale	X	X	Medium	Medium	Medium	Medium	Medium			
Kilifi	X	X	Medium	Medium	Medium	Medium	Medium		X	
Nyeri	X	X	Medium	Medium	Medium	Medium	High	X		
Kirinyaga	X	X	Medium	Medium	Medium	Medium	Medium	X		
Murang'a	X	X	Medium	Medium	Medium	Medium	Average	X		
Machakos	X	X	Medium	Medium	Medium	Medium	Average			
Laikipia	X	X	Medium	Medium	Medium	Medium	Medium			X
Homa bay	X	X	Medium	Medium	Medium	Medium	Average		X	
Siaya	X	X	Medium	Medium	Medium	Medium	Average	X	X	
Tana river	X	X	Low	Low	Low	Low	Low			
Lamu	X	X	Low	Medium	Low	Low	Low			
Taita taveta	X	X	Low	Medium	Low	Low	Medium			

	Infrastructure and connectivity			Agricultural contribution to GDP	Internet affordability	Other factors			Emerging Technologies	
Trans-nzoia	X	X	Low	Low	Low	Low	Average	X		
Elgeyo-marakwet	X	X	Low	Low	Low	Low	High			
Nandi	X	X	Low	Low	Low	Low	Average	X		
Baringo	X	X	Low	Medium	Low	Low	Average			
Narok	X	X	Low	Medium	Low	Low	High	X		
Kajiado	X	X	Low	Medium	Low	Low	Low			
Kericho	X	X	Low	Medium	Low	Low	Average			
Bomet	X	X	Low	Medium	Low	Low	High			
Vihiga	X	X	Low	Medium	Low	Low	Medium			
Bungoma	X	X	Low	Medium	Low	Low	High			
Busia	X	X	Low	Medium	Low	Low	Average			
Migori	X	X	Low	Medium	Low	Low	Medium			
Nyamira	X	X	Low	Medium	Low	Low	Average	X		

*Table 3: CHECKLIST FOR SELECTING COUNTIES*

**KEY: X - exist**

### 3.0 Summary of the selection criteria

While all the 47 counties in Kenya have internet connectivity to support some level of access and use of digital agricultural content, counties increasingly demand high-quality internet service. This is because access and utilization of digital agricultural content activities in Kenya occur at the sub-county and ward levels where farming occurs. For the project to succeed, beneficiaries, including farmers, require specialized and timely information to increase agricultural outputs, raise productivity, and adapt to climate change. Table 3 lists several factors to provide insights into the capacities, constraints, and challenges regarding accessing and using digital agricultural content at the sub-county level where these activities occur.

Drawing from Checklist developed and shown in Table 3, the ACWICT proposes five (5) counties to undertake the capacity assessments for scale-up to enable the project to reach more than one million farmers among the most vulnerable communities in Kenya. The selection of the counties represents different levels of internet infrastructure and connectivity, agricultural contribution (GVA) to GDP, internet affordability, internet penetration rate, and presence of emerging technologies, among other factors.

The internet penetration rate and emerging technologies are critical factors used in the screening process to justify the selection of the five counties proposed for project scale-up. The scoping study identified several variations across the 47 counties in Kenya, as shown in Table 3. While the screening of the counties can only provide insights, the emerging common issues imply that the analysis and recommendations are helpful beyond the counties selected. Therefore, three types of selection criteria are applicable, namely:

- Internet penetration rate
- Presence of emerging technologies
- Inclusivity

Based on the three criteria stated above, Kisumu and Nakuru are proposed in the high internet penetration rate category, while Kilifi and Homabay are in the medium category and Busia under low since there is a possibility of Community Network extension to Busia county through Siaya county.

#### Summary of proposed counties

High Internet penetration rate + Presence of Emerging technologies in the county	Medium Internet penetration rate + Presence of Emerging technologies in the county	Low Internet penetration rate + Possible Emerging technologies connection in the county
Kisumu	Kilifi	Busia
Nakuru	Homabay	

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