EXPLORING THE IMPACT OF DIGITAL TECHNOLOGY IN FARMING PRACTICES ON FOOD SECURITY IN KENYA

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Contents

Table of Tables

Chapter 01 Summary of ERP

1.0 Summary of Extended Research Proposal

Having access to enough safe, nourishing food for an active and healthy life is known as food security, and it is a global concern (FAO, 2009). Despite advancements, 690 million people, primarily in sub-Saharan Africa, went to Hungary in 2019. A revolutionary solution to the problems with global food security in agriculture is the use of digital technology. GIS, remote sensing, and mobile technology are examples of digital agriculture techniques that can enhance food security, supply chain management, and agricultural productivity (Bronson and Knezevic, 2016, Klerkx et al., 2019). In Kenya, where over 40% of the workforce is employed in agriculture and which generates 33% of the country's GDP, digital technology is crucial. Food security in Kenya is threatened by pests, unpredictability in the weather, and restricted market access in the agricultural sector (Ngigi and Muange, 2022). These issues might be resolved by digital technology, commonly referred to as "digital agriculture" or "precise farming." This entails disseminating meteorological data and keeping an eye on crop health via mobile apps, GIS, and remote sensing (Okello Candiya Bongomin et al., 2018, Ngigi and Muange, 2022). Digital technology may help agriculture, but Kenya is still in the early stages of its integration process and faces several obstacles. These problems include high technological prices, inadequate infrastructure, and a lack of digital literacy among farmers (Ngigi and Muange, 2022). Despite the possible advantages of digital agriculture, the COVID-19 pandemic has made hunger and food insecurity in Kenya worse (Merchant et al., 2022). It is essential to comprehend how much digital technology is integrated into Kenyan agriculture and how this affects food security.

Research gaps already in place highlight the necessity for a full analysis of the consequences for digital technology integration and food security in Kenyan farming practices. Aiko and Mugwimi (2015) and Kamilaris et al. (2017) note that most current research isolates individual technologies, ignoring their synergies and combined advantages in agriculture. Research on farmers' digital literacy and technology disparities is scarce (Mugwimi, 2015). Additionally, not much is known about how policy influences the use of digital technology in agriculture (Kimega et al., 2022). Positive results are frequently emphasised, whereas unfavourable results are hardly discussed (Ontiri and Amuhaya, 2022). To fill these gaps, this project will examine critically how digital technology is used in Kenyan farming methods and how it affects food security. The goals are to look at technology integration, assess how it affects food security and agricultural productivity, identify integration barriers, and offer solutions to improve the use of digital technology in farming.

Conceptual Framework

The adoption of digital technology by Kenyan farmers is investigated in this study using the Technology Acceptance Model (TAM). Perceived utility (PU) and perceived ease of use (PEOU), according to Davis (1989)'s TAM, are what motivate people to adopt new technologies. Farmers' beliefs that digital technology will enhance agriculture, productivity, and food security are referred to as PU in this study. Farmers' perceptions of how simple it is to use digital technologies in farming are displayed by PEOU. Price Value (PV) is another component of the framework that emphasises farmers' cost-benefit analyses of adopting new technologies (Dai and Cheng, 2022). In order to investigate farmers' views of technology integration's utility and ease of use (Q1 and H1), agricultural productivity and food security (Q2 and H1), and integration hurdles (Q3 and H1), the study aligns TAM with the research questions and hypotheses. PV and barrier-overcoming strategies are now included in TAM (Q4 and H1). This TAM technique is used to analyse the intricate adoption of digital technology in Kenyan agriculture.

Research Question

Question 1: To what extent has digital technology been integrated into farming practices in Kenya?

Question 2: What is the impact of digital technology on agricultural productivity in Kenya?

Question 3: What is the impact of digital technology on food security in Kenya?

Question4: What are the barriers to the integration of digital technology in farming practices in Kenya?

Question 5: The implementation of strategies to overcome the identified barriers will significantly enhance the integration of digital technology in farming practices in Kenya?

Chapter 02 Methodology

2.1 Research Philosophy

The research philosophy of the study is positivism. The positivist research paradigm, according to Cohen et al. (2017), maintains that methods analogous to those employed in the natural sciences are optimal for knowledge generation. The method is now the subject of a scientific investigation into its effects on food security in Kenya and the practical use of digital technology in farming. There are a number of reasons why the positivist approach is the best fit for this study. At the outset, it permits the collection of objective data through recognised methods of systematic procedure, such as surveys. If you want statistical analysis to find patterns and trends, Ali and Birley (1999) say that you need to use quantitative measures for your variables. According to positivists, causal forces are the ultimate arbiters of what happens in the future (Alan and Emma, 2003). Our study's objectives—to assess how digital agriculture technologies have affected food security in Kenya—are well-aligned with this. Simply put, positivism makes it easier to generalise research results. There are major implications for Kenya's agricultural sector from the study's use of quantitative data (Creswell and Creswell, 2017). The positivist focus on the quantifiable impacts of digital technologies on food security makes it an appropriate philosophical framework for our study, despite positivism's purported disregard for subjective human experiences and social contexts (Bryman, 2016). Still, the author acknowledges the study's limitations and urges additional interpretive or phenomenological research into how digital technology affects farmers' day-to-day experiences.

2.2 Research Approach

According to Alan and Emma (2003), this study uses a deductive research strategy, which entails formulating hypotheses based on a thorough review of the relevant literature and then testing those hypotheses through empirical investigation. Since the positivist research paradigm also starts with building a theoretical framework and then uses it to assess its validity in specific circumstances, the aforementioned approach is consistent with it. A common argument in favour of the deductive approach is the high degree of accuracy it provides. The researcher will be able to zero in on a specific component of a previously established theory or hypothesis in order to conduct an analysis of it (Blackstone, 2018). The continuing investigation has successfully laid the groundwork for a well-defined theoretical framework regarding the function of digital technology in the field of food security and agriculture. This investigation can't get off the ground without first establishing a firm base. Its ability to replicate is an additional benefit. Replication is made easier, according to Saunders et al. (2009), when deductive research uses precise and standardised methods. The reliability of the results is guaranteed by the method of repeated testing. However, there are limits to the deductive method. The complex nature of human behaviour can be overlooked if the social environment is oversimplified, according to Bryman (2016). Nevertheless, the deductive method is seen as better suited to this study because it can yield quantifiable and confirmed results and is compatible with positivist epistemology.

2.3 Research Design

This study will make use of a survey design as its methodology. The use of this particular methodology is supported by its capacity to efficiently collect crucial data from a large sample, which allows for a thorough understanding of the research issue (Babbie, 2020). According to Sue and Ritter (2012), surveys are a good way to analyse established variables and see how connected they are. Methods used in survey research can be either quantitative (e.g., using numerical evaluations of items in the questionnaire) or qualitative (e.g., using open-ended questions) or a hybrid of the two (Singleton Jr et al., 1988).

The factors that are being considered in this study are the effects of digital technology on food security as they pertain to the agricultural sector. Using survey methods has proven to be beneficial in similar research projects. The impact of mobile device usage on the productivity of small-scale farmers in Kenya was investigated in a survey-based study by Naimasia (2021). Researchers were able to successfully interact with a large number of farmers and collect data that met statistical significance thanks to the strategy they employed. We have created a questionnaire to achieve this goal. The demographics of the participants and the level of digital technology integration into farming practices in Kenya are both covered in the survey. A variety of technological applications are investigated in the study, along with their perceived impacts on agricultural productivity and food safety. Limitations in digital skills and funding are some of the issues that the survey highlights as being in the way of technology integration. The study's aims are supported by the methodological focus, which provides important insights into the complex dynamics of digital technology implementation in Kenya's agricultural sector. Please see the survey questionnaire in Appendix A for further details.

2.4 Data Collection

The data for this study was gathered through an online survey that was administered through Qualtrics, a platform that had its robust data security procedures approved by the university's research committee. We chose Qualtrics because of its powerful survey creation and distribution features that prioritise security and user-friendliness. In addition, Qualtrics places a premium on data security and privacy (Molnar, 2019). When investigating intricate phenomena, like the effect of digital technology integration in agriculture on food security, Qualtrics's sophisticated data analysis features come in handy. According to Wright (2005), online surveys provide a convenient and user-friendly way for researchers and respondents alike. Researchers obtain high-quality data, and respondents are free to answer questions in their own way. Researchers can avoid the difficulties of reaching a geographically dispersed audience when they use Qualtrics instead of more conventional survey methods (Dillman et al., 2014). The use of Qualtrics is also consistent with the survey research strategy used in this study; this strategy is typical in contexts like this one. Thanks to its intuitive design, dependable functionality, and wealth of data analysis options, Qualtrics has proven to be an invaluable tool in previous studies by Niles et al. (2021) and Haynes-Maslow et al. (2020). In their study on online education, Oakley et al. (2019) lauded Qualtrics for its data analytics features. Accordingly, using Qualtrics as the research instrument is a sound decision that is in line with the methodology of current scholarly studies.

2.4.1 Sampling Technique

The research utilises a purposive sample methodology, specifically adopting a purposive sampling technique to ensure the selection of participants is both biased and representative of the targeted population. Purposive sampling is a highly regarded and rigorous technique in study design that reduces the likelihood of selection errors and improves the dependability of findings for the specific population being studied (Etikan et al., 2016). This study seeks to attain a more precise and impartial representation of the various viewpoints within the specific age group in Kenyan farming techniques by implementing randomization. The use of purposive sampling has been recommended due to its capacity to minimise sampling errors and enhance the external validity of study findings (Tongco, 2007). This approach is in line with the goal of acquiring a representative sample that significantly helps in the investigation of the integration of digital technology in Kenyan agriculture.

2.4.2 Sample size

The study includes a cohort of 127 participants, consisting of individuals of both genders aged between 21 and 50 years. Dattalo (2008) stated that the determination of the sample size is determined by the need to strike a compromise between the accuracy of study results and the practicality of collecting data. Increasing the sample size can improve the accuracy of the study; nevertheless, it is vital to recognise that this increase may also lead to higher costs and a longer data collection period. Etikan et al. (2016) have stressed that a smaller sample size would accurately represent the diverse agricultural community in Kenya.

2.4.3 Selection criteria

The eligibility requirements for participants in this study consist of individuals engaged in agricultural activities in Kenya, aged between 21 and 40 years. Both male and female farmers meet the criteria for being included in the sample. The selection of this age group aims to get insights from a demographic segment that is highly involved in agricultural operations and may be affected by the incorporation of digital technology. Participants must possess a substantial level of expertise and active involvement in agriculture in order to offer perceptive comments according to the study inquiries.

On the other hand, the exclusion criteria pertain to persons who fall outside the stipulated age range (below 21 or beyond 50 years) and those who are not actively involved in farming activities. By excluding participants who fall outside the specified age range, the study can concentrate on the target demographic that is most pertinent to its aims. In addition, the exclusion of persons who are not actively engaged in farming helps ensure the pertinence and dependability of the collected data, as the study seeks to obtain insights exclusively from individuals with direct involvement in agricultural operations. The study's findings are enhanced in terms of accuracy and significance by focusing on a particular age group that is actively engaged in farming in Kenya.

2.5 Data analysis

The research relied on quantitative data analysis techniques, with surveys collecting the bulk of the information. Statistical Package for the Social Sciences (SPSS) will be utilised to perform both descriptive and inferential statistical analyses after the data cleaning and coding procedure is complete. Because of its exhaustive nature, structured questionnaire data has found extensive application in comparative research (Field, 2013). The impact of digital technology adoption on Kenyan small-scale farming was examined in a study by Njura Joseph (2020) using the statistical tool SPSS. Descriptive statistics, including percentages, means, and standard deviations, will be used to summarise the data. In order to test the research hypotheses and learn more about the relationships between the variables, inferential statistics like chi square test will be used (Field, 2013). Data and study objectives are the two most important factors in inferential statistical procedures.

2.6 Ethical Considerations

The significance of ethical considerations in research, especially when human subjects are involved, cannot be overemphasised. This study exemplifies a rigorous respect to established ethical standards throughout all stages, as emphasised by Israel and Hay (2006). The main ethical aspects that are discussed are obtaining informed consent, ensuring confidentiality, and safeguarding privacy. To ensure informed consent, prospective participants will receive a detailed information sheet that clearly outlines the objectives of the study and their rights. Participants will be allotted an enough amount of time to make their decision and will be obligated to fill out a consent form if they wish to participate in the study. Preserving confidentiality is a crucial ethical concern that seeks to protect participants' data from unauthorised disclosure. To address privacy concerns, it is crucial to include anonymization, encryption, and secure storage protocols to minimise the possibility of unauthorised access. This aligns with the recommendations proposed by (Bryman, 2016). All potential discomfort encountered by participants during the data collection process was recognised and effectively dealt with. Requisite modifications will be implemented to guarantee the welfare and satisfaction of the participants. Hence, the current study is committed to upholding these ethical standards to maintain moral rectitude and guarantee the research's validity.

Chapter 03 Data Analysis

3.1 Introduction

This chapter meticulously analyses data obtained from 127 participants' responses. The statistical techniques used involve the Chi-Square test, a reliable approach for evaluating the lack of association between categorical variables. The Chi-Square test was employed to establish statistically significant correlations between respondents' attitudes and different factors related to integrating digital technology, obstacles, and strategies in farming practices. The reliability assessment of the study was based on the utilization of Cronbach's alpha, a widely recognised statistical measure. This method was utildsed to assess the internal consistency reliability of scale variables about integrating digital technology, its impact on agricultural productivity, food security, barriers, and strategies. The Cronbach's alpha values obtained served as an indicator of the data's reliability. The analysis relied on the software tools SPSS version 23 and the Microsoft Excel Package. These platforms enabled the performance of both descriptive and inferential statistical analyses. Descriptive statistics facilitated the visual representation of data using tables, bar charts, and pie charts. Using inferential statistics, specifically the Chi-Square test, was pivotal in establishing the associations between variables in the research. Incorporating these software tools ensured a thorough investigation of the influence of digital technology on agricultural methods, supported by rigorous statistical analyses and concise visual depictions. In addition, this chapter conducts a comprehensive evaluation of the study's results and highlights the application of the research in determining the impact of digital technology on farming practices.

3.2 Response Rate

Participants were selected for their farming and agricultural experience and sent 150 questionnaires. Even though 23 questionnaires were not returned, received, and recorded, only 127 responses were, giving the study an 85% response rate (see table 3.2.1). A response rate of over 70% is exceptional in research surveys, and over 50% is a representative sample marker (Saleh and Bista, 2017).

Table 3.2.1: Questionnaire Response Rate

Returned	**127**	**84.7%**
Unreturned	**23**	**15.3%**
Total	**150**	**100%**

3.3 Reliability Test

Cronbach's alpha is a standard measure of scale or variable internal consistency. This reliability coefficient measures how well scale items measure the same thing by calculating how closely related a group of variables is (Kirongo and Odoyo, 2020). An internal consistency value near 1 is good. It suggests the items measure the same construct, while a value close to 0 indicates low internal consistency and different structures (Taber, 2018). A Cronbach's alpha of 0.70 or above is reliable, 0.70 is acceptable, 0.80 is good, and 0.90 is good. Greater internal consistency is typical. The study's main scale variables' Cronbach's alpha values (see Table 3.3) indicate their reliability and validity for results and conclusions.

Table 3.3: Cronbach Output

Scale Variable	**Cronbach's Alpha**	**Number of sub-variables**	**Level of Reliability**
Digital Technology Integration in farming practices	0.889	6	Good and Acceptable
Impact of Digital technology on Agricultural productivity	0.891	6	Good and Acceptable
Impact of Digital technology on Agricultural Food Security	0.922	6	Highly Reliable
Barriers to the Integration of Digital Technology in farming practices	0.905	6	Highly Reliable
Strategies to overcome the barriers to the Integration of Digital Technology in farming practices	0.920	6	Highly Reliable

3.4 Demographic Analysis

The demographic analysis of study participants showed that 53.5% were male and 46.5% female (Figure 3.4.1).

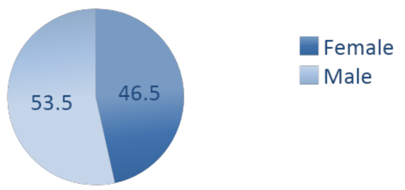


Figure 3.4.1: Gender

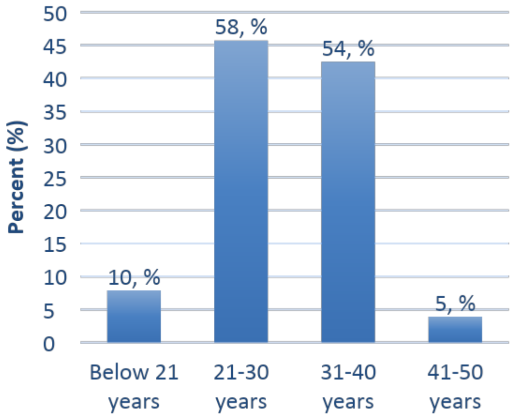


Figure 3.4.2: Age Range

Age distribution (Figure 3.4.2) showed that 45.7% of respondents were 21–30. In the next significant age group, 42.7% were 31 to 40, and 7.9% were under 21.

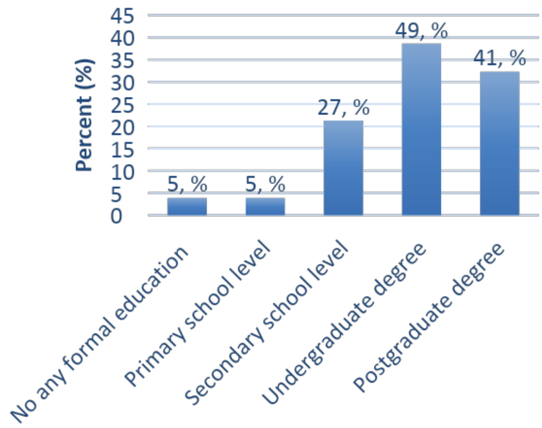


Figure 3.4.3: Highest Education Level Attained

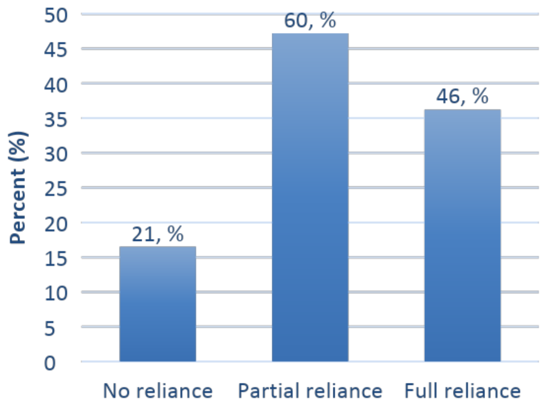
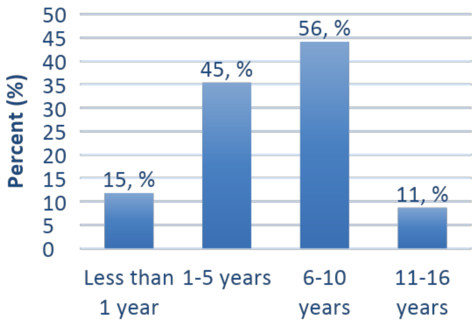


Figure 3.4.4: Income Reliance on Farming

The least represented age group was 41-50, 3.9%. 3.9% of respondents had no formal education, 3.9% completed primary school, 21.3% were in secondary school, 38.6% had undergraduate degrees, and 32.3% had postgraduate degrees (Figure 3.4.3). Income reliance on farming was also examined (Figure 3.4.4), showing that 16.5% of participants had no reliance, 47.2% partially, and 36.2% fully.



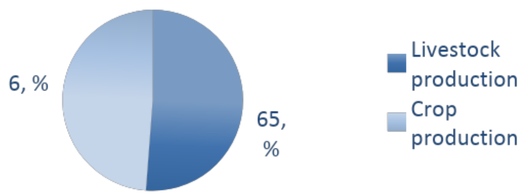


Figure 3.4.5: Years of Farming Experience

Figure 3.4.6: Involvement in Farming Activities

The majority (44.1%) had 6-10 years of farming experience (Figure 3.4.5), followed by 35.4% with 1-5 years, 11.8% with less than 1 year, and 8.7% with 11-16 years. Finally, 48.8% of respondents farmed crops and 51.2% farmed livestock (Figure 3.4.6). These demographic insights provide a comprehensive overview of study participants' diverse characteristics, enabling a more nuanced interpretation of subsequent research findings.

3.5 Inferential Analysis

3.5.1 Digital Technology Integration in Farming Practices Scale

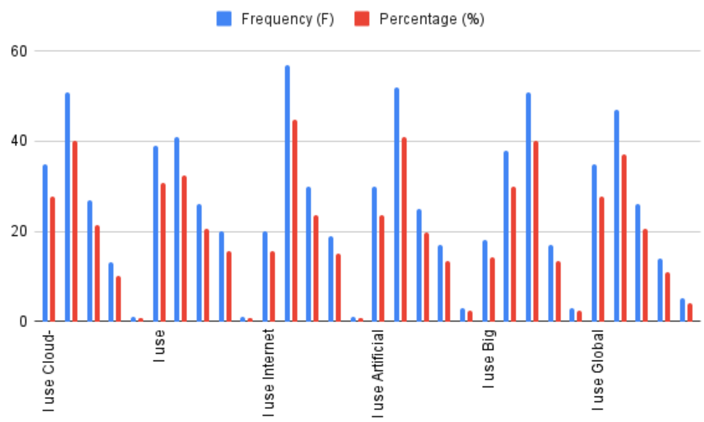


Figure 3.5.1: Digital Technology Integration in Farming Practices Scale

According to Figure 3.5.1, respondents generally support using digital technologies in farming (See Table 3.5.0 in Appendix B). Cloud-based platforms were supported by 67.8% of respondents. Cloud technology improves farming, so this suggests widespread acceptance. Support for block chain and financial technology solutions was more diverse, as shown by the 20.5% neutral percentage. Most (60.6%) were positive about using IoT and sensors in farming. In general, 64.5% agreed or strongly agreed with AI. With 40.2% neutral and 44.1% agreeing or strongly agreeing, Big Data Analytics (BDA) showed a more even distribution of opinions. Drones and GPS were liked by 64.6% of respondents. These findings show a widespread enthusiasm for integrating digital technologies. However, the mixture of support and neutrality suggests the importance of contextual factors and individual perspectives in promoting their widespread adoption in agriculture.

Table 3.5.1: Respondents' view on Digital Technology Integration in farming practices

	Degrees of freedom	**Chi square test X^2**	**P value**
Digital Technology Integration in Farming Practices Scale	20	42.29	0.02

The Chi-Square test determines categorical variable independence. This time, we tested the independence of technology type and response distribution. The Chi-square test was used to determine if respondents' attitudes toward digital technology integration and other survey variables are statistically significant. Overall, the dataset's Chi-square test statistic (X^2) is 42.29, with a p-value of 0.02. With a p-value below 0.05, the results are statistically significant at 5%. This means the observed association between respondents' digital technology attitudes and other variables is less than 5% random chance.

3.5.2 Impact of Digital technology on Agricultural Productivity Scale

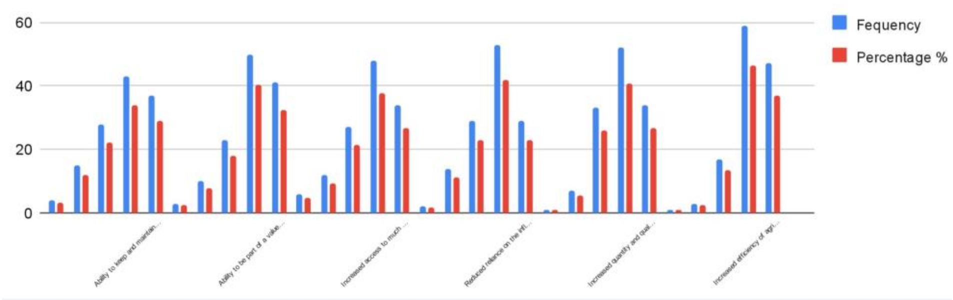


Figure 3.5.2: Impact of Digital technology on Agricultural Productivity Scale

In Figure 3.5.2, respondents' views on digital technology's impact on agricultural productivity reveal technological integration's perceived effects (See Table 3.5.0 in Appendix B). Most (83.5%) agreed (46.5%) or strongly agreed (37.0%) that the technology increased agricultural production resource efficiency. A large portion (67.7%) agreed (40.9%) or strongly agreed (26.8%) that technology has improved crop/animal production. Many respondents (64.5%) agreed that the technology could reduce human-related challenges in agricultural practices. Technology is thought to improve access to capital and agricultural production resources, as 64.5% of respondents agreed (37.8%) or strongly agreed (26.7%). The ability to be part of a value chain and keep good farming records was also favored by 71.3% and 62.9%. These findings indicate a positive outlook on how digital technology will affect agricultural productivity among surveyed participants.

Table 3.5.2: Respondents' view on Impact of Digital technology on Agricultural productivity

	Degrees of freedom	**Chi square test X²**	**P-value**
Impact of Digital technology on Agricultural Productivity	20	40.76	0.05

In this case, we tested the independence between digital technology's impact on agricultural productivity and response distribution. The Chi-square test was used to determine if respondents' attitudes toward digital technology and agricultural productivity variables were statistically significant. Overall, the dataset's Chi-square test statistic (X^2) is 40.76, with a p-value of 0.05. According to the conventional significance level of 0.05, the results are statistically significant at 5%. This implies a 5% chance that the observed association between respondents' attitudes towards digital technology and agricultural productivity variables is random.

3.5.3 Impact of Digital technology on Agricultural Food Security Scale

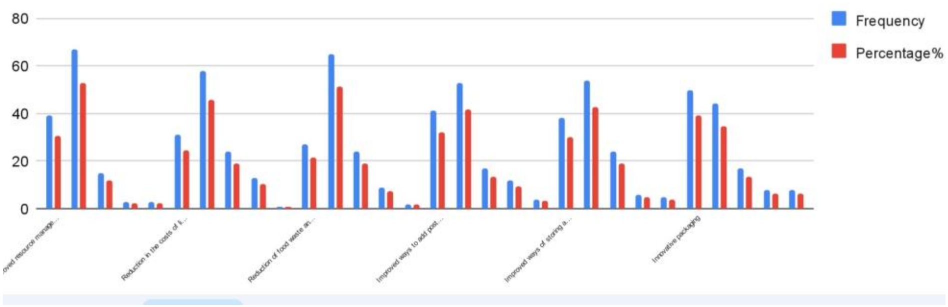


Figure 3.5.3: Impact of Digital technology on Agricultural Food Security Scale

In Figure 3.5.3, respondents' views on the impact of digital technology on agricultural food security are analysed (For details, see Table 3.5.0 in Appendix B). Due to extensive relevant data, 83.5% of respondents agreed (52.8%) or strongly agreed (30.7%) that resource management decisions improved. Digital technology is believed to improve decision-making through data-driven insights. A significant 70.1% agreed (45.7%) or strongly agreed (24.4%) that technology reduces the cost of linking farmers to agricultural produce buyers, demonstrating positive perceptions of technology's role. Reducing food waste and enabling circularity was supported by 72.5% of respondents, highlighting technology's role in sustainable agriculture. 73.9% of respondents agreed (41.7%) or strongly agreed (32.3%) that agricultural produce could be improved post-production. 72.4 percent of respondents supported improved agricultural produce storage and preservation, demonstrating the perceived benefits of technology in food preservation. Most respondents (73.0%) supported innovative packaging as a food security measure, indicating that technology can change packaging practices. These results indicate a positive and comprehensive view of how digital technology affects agricultural food security among surveyed participants.

Table 3.5.3: Respondents' view on the impact of Digital technology on Agricultural Food Security

	Degrees of freedom	**Chi square test X²**	**P value**
Impact of Digital technology on Agricultural Food Security	20	35.62	0.01

To test the independence between digital technology's impact on agricultural food security and response distribution. The Chi-square test was used to determine if respondents' attitudes toward digital technology and agricultural food security variables were statistically significant. Overall, the dataset's Chi-square test statistic (X^2) is 35.62, with a p-value of 0.01. With a p-value below 0.05, the results are statistically significant at 5%. This implies that there is less than a 5% chance that the observed association between respondents' attitudes towards digital technology and agricultural food security variables is random.

3.5.4 Barriers to the Integration of Digital Technology in farming practices Scale

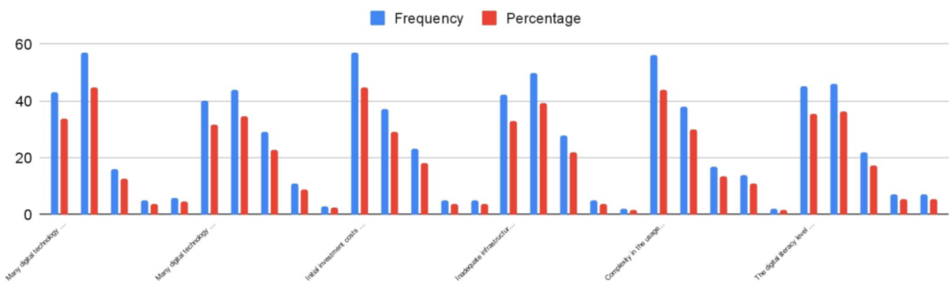


Figure 3.5.4: Barriers to the Integration of Digital Technology in farming practices Scale

As shown in Figure 3.5.4, respondents identified several significant barriers to digital technology in farming (For details, see Appendix B Table 3.5.0). 78.8% of respondents either agreed (44.9%) or strongly agreed (33.9%) that many digital technology solutions do not work or share data smoothly. This suggests that farming technology compatibility and seamless collaboration is a significant concern. The convincing value proposition of digital technology solutions is another barrier, with 66.1% agreeing (34.6%) or strongly agreeing (31.5%) that many solutions lack value. This suggests that farmers need more transparent communication and demonstration of these technologies' tangible benefits. 74.0% of respondents (44.9%) strongly agree (29.1%) that initial investment costs are usually high, which is a primary concern. Farmers see a significant financial barrier to the adoption of digital technology. On infrastructure support, 72.5% agreed (39.4%) or strongly agreed (33.1%) that inadequate infrastructure hinders digital technology integration, emphasising the importance of a supportive technological environment. User-friendly interfaces and training programs are needed because 74.0% of respondents find digital technology solutions complicated. Finally, 71.6% agree (35.4%) or strongly agree (36.2%) that farmers' digital literacy is challenging. These findings demonstrate the complexity of farmers' digital technology integration challenges, requiring comprehensive solutions.

Table 3.5.4: Respondents' view on barriers to the Integration of Digital Technology in farming practices

	Degree of freedom	**Chi square test X^2**	**P value**
Barriers to the Integration of Digital Technology in farming practices	20	34.32	0.03

This time, examined the independence between barriers to digital technology integration in farming and response distribution. The Chi-square test was performed to determine if respondents' attitudes toward barriers to digital technology integration in farming practices were statistically significant. The dataset's Chi-square test statistic (X^2) is 34.32, with a p-value of 0.03. With a p-value below 0.05, the results are statistically significant at 5%. This implies that the observed association between respondents' attitudes towards barriers to digital technology integration in farming practices and other variables is less than 5% random chance.

3.5.5 Strategies to overcome the barriers to the Integration of Digital Technology in farming practices Scale

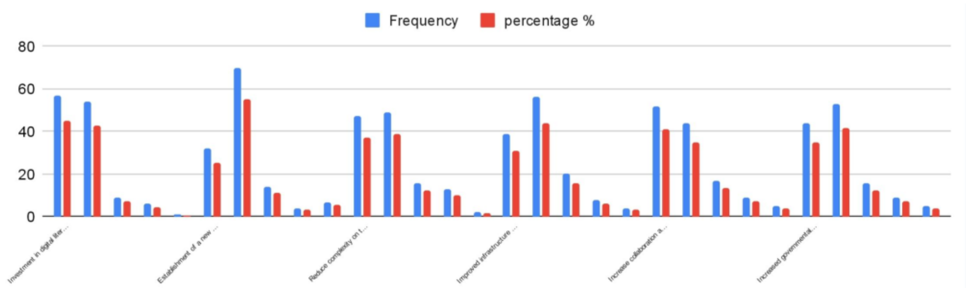


Figure 3.5.5: Strategies to overcome the barriers to the Integration of Digital Technology in farming practices Scale

Figure 3.5.5 shows respondents' ideas for overcoming digital technology resistance in farming (For details, see Appendix B, Table 3.5.0). The results show how different approaches are viewed. 87.4% strongly agreed (44.9%) or agreed (42.5%) that investing in farmers' digital literacy, especially rural farmers, would be effective. Establishing new agricultural extension services received 80.3% agreement (55.1%) or strong agreement (25.2%). Reducing digital technology complexity was essential to 75.6% of respondents, who agreed (38.6%) or strongly agreed (37.0%). Infrastructure and set up to support digital technology in farming were strongly agreed upon by 74.8% (30.7%) or agreed upon (44.1%). Increasing digital technology solution collaboration and interoperability was effective for 75.9% of respondents, indicating the importance of seamless integration. Finally, 76.3% expressed strong agreement (34.6%) or agreement (41.7%) with increasing government support, especially for agricultural research and development. According to these findings, educational, infrastructural, and collaborative strategies and strong government support are needed to integrate digital technology into farming practices.

Table 3.5.5: Respondents' view on Strategies to overcome the barriers to the Integration of Digital Technology in farming practices

	Degree of freedom	**Chi square test X^2**	**P value**
Investment in digital literacy of farmers, especially those in rural areas	20	32.13	0.04

To test the independence of Strategies to overcome barriers to digital technology integration in farming practices and our response distribution. The Chi-square test was used to determine if respondents' attitudes toward Strategies to overcome barriers to introducing digital technology in farming practices were statistically significant. The dataset has a Chi-square test statistic (X^2) of 32.13, with a p-value of 0.04. A p-value below 0.05 indicates statistical significance at 5%. This implies that there is less than a 5% chance that respondents' attitudes towards Strategies to overcome barriers to integrating Digital Technology in farming practices and other variables are due to random chance.

Chapter 04 Discussion

4.1 Introduction

This discussion section conducts a meticulous analysis of the research findings to offer a comprehensive understanding of the intricate relationship between the integration of digital technology and farming practices in Kenya. The study's research questions and corresponding hypotheses guide the investigation. Through a thorough analysis of respondents' perspectives on the implementation of digital technology, its impact on agricultural productivity and food security, barriers that hinder progress, and potential solutions, valuable insights can be gained regarding the present status of technological adoption in the agricultural industry. In addition, statistical analyses, such as Chi-square tests, are used to interpret significant correlations and associations, which enhance the basis for making inferences and recommendations.

4.2 Strategies to overcome the barriers to the Integration of Digital Technology in farming practices

The investigation aimed to determine the level of digital technology integration in farming practices in Kenya by addressing the research question: "To what extent has digital technology been integrated into farming practices in Kenya?" Based on the null hypothesis (H_0), there is no statistically significant correlation between Kenyan farming practices and the level of integration of digital technology. The alternative hypothesis (H1) posits a substantial correlation between these two variables. Table 3.5.1 displays the respondents' perspectives regarding integrating digital technology. The Chi-square test assessed the association between the distribution of responses and the type of technology employed. The test, which had 20 degrees of freedom, yielded a test statistic (χ^2) of 42.29 and a p-value of 0.02. The computed p-value demonstrates statistical significance at a significance level of 5% and is lower than the conventional threshold of 0.05. This challenges the idea that there is no connection by demonstrating a significant and robust correlation between farmers' perspectives on implementing digital technology and other elements of their agricultural methods. The results indicate a substantial correlation between Kenyan farmers' perceptions and utilization of digital technology and their desired level of integration in their agricultural activities. The findings of this variable's analysis have corroborated previous research indicating that integrating digital technology into agricultural practices can enhance productivity, efficiency, and sustainability within the sector (Marinchenko, 2021).

Moreover, the study participants expressed that the utilisation of digital technology tools and techniques, such as sensors, drones, and Internet of Things systems, is consistent with the conclusions drawn by Pauschinger and Klauser (2022). Moreover, identified a notable correlation between the enhancement of farming methods and the adoption and assimilation of digital technology in agriculture. Furthermore, the study participants have expressed a level of knowledge and use of AI and big data analytics due to their increasing implementation in various economic sectors. These findings align with the research conducted by Padhy et al. (2022), which asserts that data analytics and artificial intelligence (AI) play a crucial role in facilitating digital transformation within the agriculture sector, particularly in implementing predictive and preventive farming methods.

4.3 Impact of Digital technology on Agricultural Productivity

The null hypothesis (H_0) for the second research question, about the impact of digital technology on agricultural productivity in Kenya, posited that there is no statistically significant correlation between the utilisation of digital technology and agricultural productivity. Conversely, the alternative hypothesis (H1) indicated a notable correlation. The participants' viewpoints on the influence of digital technology on agricultural productivity are displayed in Table 3.5.2. The Chi-square test yielded a test statistic (χ^2) value of 40.76, with 20 degrees of freedom and a p-value of 0.05. The null hypothesis can be rejected as the calculated p-value is below the conventional significance level of 0.05. There is a strong and positive correlation between Kenyan agricultural productivity and the utilisation of digital technology. The results demonstrate a robust correlation between farmers' utilisation of digital technology and their perception and firsthand encounter of alterations in agricultural productivity. This supports the theory that connects digital technology to Kenya's food security and agricultural productivity. This aligns with Brown (2015), which examined the advantages of employing mobile phone-based digital monitoring and remote control to enhance agricultural productivity among Australian farmers. The analysis highlighted the significant correlation between supply chain management and the integration of digital technology in farming practices. The research findings support those of Ekekwe (2017), who discovered that using digital technology enhances the accessibility and efficiency of supply chain networks in agricultural operations. Furthermore Walter et al. (2017) has demonstrated that digital technology enhances the process of documenting farming activities and predicting crop yields. This, in turn, fosters greater resilience and effectiveness in agriculture.

4.4 Impact of Digital technology on Agricultural Food Security

The third research question aimed to evaluate the impact of digital technology on Kenya's food security. The alternative hypothesis (H1) posited a substantial correlation between the utilisation of digital technology and food security, while the null hypothesis (H_0) posited the absence of a significant correlation. The respondents' opinions regarding the impact of digital technology on agricultural food security are presented in Table 3.5.3. The Chi-square test yielded a p-value of 0.01 and a test statistic (χ^2) of 35.62, with 20 degrees of freedom. If the p-value is lower than the conventional significance level of 0.05, it indicates that the null hypothesis should be rejected. This implies a robust and statistically significant correlation between Kenyan food security and the use of digital technology. The results indicate a robust correlation between farmers' adoption of digital technology and their perceptions and emotions regarding changes in food security. This supports the hypothesis that utilizing digital technology in Kenya has contributed to enhancing agricultural food security. The findings align with the research conducted by Banhazi et al. (2012), which demonstrated that enhancing storage and preservation methods for agricultural produce is an effective strategy for enhancing agricultural security.

4.5 Barriers to the Integration of Digital Technology in farming practices

The fourth research question aimed to identify obstacles hindering the integration of digital technology in Kenya's agricultural practices. Based on the null hypothesis (H_0), there is no significant correlation between farmers' perceptions of barriers and the actual barriers they face. On the other hand, the alternative hypothesis (H1) suggests a correlation. The respondents' perspectives on the difficulties of incorporating digital technology into farming practices are presented in Table 3.5.4. The Chi-square test yielded a test statistic (χ^2) of 34.32, with 20 degrees of freedom and a p-value of 0.03. Given that the p-value is below the conventional significance threshold of 0.05, we can conclude that the null hypothesis is rejected. This indicates a robust and meaningful correlation between farmers' perceptions regarding obstacles and the tangible obstacles they encounter while incorporating digital technology into their agricultural practices in Kenya. The findings suggest that farmers' perceptions and the challenges they encounter when adopting digital technology are similar, underscoring the need to address these perceived obstacles for successful integration (Lutz Goedde, 2022). Furthermore, the table demonstrates that a significant majority of participants believed that the requirement for additional digital technology solutions that offer adequately compelling value is another significant obstacle to implementing digital technology in agricultural practices. The study participants perceive that the initial expenses associated with incorporating digital technology solutions are typically substantial, thus impeding the acceptance of digital technology in agricultural practices. What is this strongly reminiscent of? A study by Pauschinger and Klauser (2022) revealed that African farmers have embraced digital technology infrastructure and devices. Moreover, most participants believe the complexity of utilising digital technology is a significant obstacle to its implementation in agricultural practices. Abdulai et al. (2023) presented strong evidence indicating that an individual's capacity to embrace and utilise digital technology is significantly impacted by their level of digital literacy.

4.6 Strategies to overcome the barriers to the Integration of Digital Technology in farming practices

The fifth research question aimed to assess the efficacy of implementing strategies to overcome identified barriers to significantly enhance the integration of digital technology in farming practices in Kenya. Based on the null hypothesis (H_0), implementing strategies to eliminate identified barriers has no noticeable impact on integration. However, the alternative hypothesis (H1) posits that it has a substantial impact. The participants' perspectives on strategies to address obstacles to integrating digital technology in agricultural practices are presented in Table 3.5.5. The Chi-square test yielded a test statistic (χ^2) of 32.13, with 20 degrees of freedom and a p-value of 0.04. Since the p-value is smaller than the conventional significance level of 0.05, we can conclude that the null hypothesis is rejected. This demonstrates a significant and robust correlation between implementing barrier-breaking strategies and improving digital technology integration in farming practices in Kenya. The results indicate that the effective incorporation of digital technology in agricultural methods can be significantly facilitated by adopting targeted approaches, such as providing farmers with training in digital literacy. Fabregas et al. (2019) examined the difficulties associated with incorporating digital technology into agricultural practices and proposed practical remedies, thus corroborating the findings. The analysis of the research findings also provided recommendations for enhancing infrastructure and setup to facilitate the incorporation of digital technologies into farming practices and for optimising the usability of these solutions by making them more user-friendly. Moreover, the data indicates that most participants believe that enhancing collaboration and harmonisation among digital technology solutions is crucial for eliminating obstacles to integrating digital technology in agricultural practices. Additionally, they highlight the potential advantages of increased government funding, particularly for agricultural research and development, as an effective strategy for overcoming these challenges (Bellon Maurel et al., 2022).

This comprehensive study examines the many effects of digital technology on Kenyan farming. The study examined 127 participants' responses using the Chi-Square test and Cronbach's alpha reliability assessment to understand farmers' digital technology attitudes and challenges. Moreover, found a strong correlation between farmers' perspectives and digital tool integration, confirming sensors, drones, and IoT systems' transformative potential. The study contributes theoretically and practically by explaining farmers' perspectives and identifying barriers and effective adoption strategies. According to the research, digital integration increases crop yields and reduces environmental impact. This study emphasises the importance of digital technology in resilient, efficient, and sustainable agriculture by monitoring climate change in real time and building farmer communities.

Chapter 05 Conclusion

5.1 Conclusion

To summarise, this chapter thoroughly compiles the investigation's main discoveries, presenting valuable perspectives on the revolutionary effects of incorporating digital technology into agricultural methods in Kenya. The evidence strongly supports the claim that integrating digital technology improves agricultural productivity. Various studies, including the present research, emphasise the beneficial impact of precision agriculture methods involving sensors, GPS, and other digital technologies. These techniques have resulted in a significant rise in crop production (Abiri et al., 2023). In addition to increasing productivity, incorporating digital technology is crucial in promoting more efficient and environmentally friendly farming methods. Digital technology helps mitigate the environmental impact of agricultural practices by decreasing dependence on chemical inputs, such as pesticides and fertilizers, and promoting eco-friendly methods.

Moreover, the projected path suggests that as digital technologies progress and become more readily available to farmers, their adoption is expected to rise, offering the potential for a more substantial influence on agricultural productivity. Precision agriculture, equipped with various tools such as sensors, drones, and satellite imagery, emerges as a crucial facilitator, granting farmers the ability to make well-informed choices regarding irrigation, fertilization, and pest control. Digital platforms grant farmers access to essential market data, weather forecasts, and professional advice and provide opportunities for cost reduction, waste minimization, and enhanced profitability. To address the challenges posed by climate change, the resilience of farming practices can be enhanced by intelligently incorporating digital technologies, such as real-time monitoring, to measure soil moisture levels and optimise water usage. The acquisition of knowledge and skills by farmers through the adoption of digital technologies enables the integration of new farming techniques. It promotes a sense of community and collaborative learning, thereby improving the overall resilience of farming practices. Based on these discoveries, the chapter ends by urging additional investigation to build upon these understandings, providing theoretical and practical recommendations for enhancing the incorporation of digital technology into agriculture and tackling the obstacles faced in this revolutionary procedure.

5.2 Recommendations

The subsequent recommendations are derived from the study's conclusions and notable findings: Farmers should adopt farm management software integrated with digital instruments to monitor and control farm activities effectively. This is derived from the survey findings, which indicated that most respondents were ready to utilise diverse digital technologies, including IoT and sensors. Implementing this approach would enable farmers to adjust variables such as ventilation or feeding using remote monitoring technology, resulting in time and resource savings. In order to gather data regarding soil moisture levels, weather patterns, crop development, pest infestations, and other relevant factors, farmers should allocate resources towards acquiring sensors, drones, satellites, and other Internet of Things (IoT) devices. Advanced analytics techniques can be employed to analyse this data to glean crucial insights about the crops' health, potential yield, and efficient allocation of resources. This recommendation is based on the respondents' willingness to gather data on different farming aspects using digital technology (Smidt and Jokonya, 2022).

Moreover, the favorable disposition of participants towards utilizing digital technology to improve farming methods indicated the need for implementing techniques such as automated irrigation systems and GPS-guided equipment for precision agriculture. Agricultural practitioners can accurately sow seeds, administer fertilizers and insecticides, and gather crops using GPS-guided machinery. Automated irrigation systems can aid in water conservation by providing the precise amount of water crops require at the optimal time. Considering that 79.4% of participants recognised the importance of digital literacy, farmers should participate in training programs that will provide them with the necessary skills and knowledge to incorporate digital technology into their farming practices effectively. Agricultural institutions, governmental organizations, and business associations should allocate funds toward training programs to educate farmers on using digital tools and technologies. The courses should encompass topics such as data acquisition and analysis, advanced precision farming techniques, farm management software utilization, and implementation of cybersecurity protocols (Erdei-Gally and Vágány, 2022).

Given that digital technology relies on consistent internet access and infrastructure, it is recommended that existing infrastructural concerns be resolved. Hence, governments and telecommunications providers must cooperate to enhance broadband connectivity in rural regions characterised by a higher prevalence of agricultural activities. Additional endeavors should be undertaken to develop hardware products that align with the specific requirements of farmers and are cost-effective (Gawande et al., 2023). Farmers should use predictive analytics and artificial intelligence (AI) to enhance decision-making and generate precise forecasts. Predictive analytics models integrate historical data with current information to forecast agricultural yields, disease outbreaks, and market patterns. AI-powered algorithms can also recommend optimal planting schedules, provide pest management strategies, and offer resource allocation guidance. Finally, it is essential to encourage data sharing and cooperation among farmers, academics, and industry stakeholders to fully leverage digital technology's benefits in agricultural practices. The agricultural community can benefit from identifying patterns, trends, and best practices through the exchange of anonymised data. Collaborative platforms and networks in digital agriculture facilitate the exchange of information, resolution of problems, and generation of innovative ideas.

5.3 Implications

This investigation underscores the transformative implications of integrating digital technology into agricultural practices in Kenya. The evidence points to a significant boost in agricultural productivity through precision agriculture methods, emphasizing the potential for economic growth. Beyond productivity, integrating digital tools emerges as a critical strategy for fostering environmentally sustainable farming practices, mitigating the environmental impact of traditional methods. The economic benefits are evident in enhanced efficiency, cost reduction, and increased profitability for farmers. Moreover, the study highlights the role of digital technologies in building climate resilience by enabling proactive adaptation to changing conditions. The empowerment of farmers through knowledge and skill acquisition further contributes to a sense of community and collaborative learning. Overall, these findings suggest a promising trajectory for the global agricultural sector, emphasizing the need for continued research and development to unlock the full potential of digital technology in agriculture.

5.4 Limitations of the Study

First, acknowledge this study's limitations before calling for more research. One drawback is data collection. Surveys take time to collect and analyse data and risk incomplete questionnaires. A cross-sectional approach evaluated the data within a specific timeframe, minimizing the risk of anomalous data patterns over time. While closed-ended structured questionnaires ensured uniform and comprehensive responses, they may have limited nuanced opinions. Due to academic obligations and extracurricular, the researcher needed a Gantt chart to organise the study schedule. Though sufficient for the study, 150 Kenyan respondents may introduce variability in the results. Due to limited subscription-based journal and book access, the researcher used the university's electronic library and offline sources. A computerised poll addressed study issues in Kenya, but these constraints caution against generalizing the findings.

5.5 Suggestions for Further Studies

Future research should address areas that emerged as potential further exploration during this study. First, given the current study's limitations, more extensive research with a larger and more diverse sample size is needed to improve generalizability. The long-term effects of digital technology integration into agriculture may reveal sustainability and productivity trends. A comparative analysis across regions or countries may reveal differences in agricultural digital technology adoption and effectiveness. Digital tools like precision agriculture could be studied to understand their effects on crop management and resource optimization. Further research into farmers' adoption of digital technology and social and economic factors may help identify barriers and facilitators in different contexts. Lastly, longitudinal studies on agricultural digital technology adoption would shed light on industry trends.

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Appendix

Appendix A Questionnaire

DEMOGRAPHIC FEATURES OF RESPONDENTS

Please pick the most appropriate from the options provided below;

1. Gender: Male [ ] Female [ ] I prefer not to say [ ]

2. Age Range: Below 21 years [ ] 21 – 30 years [ ] 31 – 40 years [ ]
41 – 50 years [ ] 51 years and above [ ] I prefer not to say [ ]

3. Highest education level attained: No any formal education [ ] Primary school level [ ]
Secondary school level [ ] Undergraduate degree [ ] Postgraduate degree [ ]

3. Income Reliance on Farming: Full Reliance [ ] Partial Reliance [ ] No Reliance [ ]

4. Years of Farming Experience: Less than 1 year [ ] 1 – 5 years [ ] 6 – 10 years [ ]
11 – 16 years [ ] 16 years and above [ ]

5. Involvement in Farming activities: Crop production [ ] Livestock Production [ ]

Instruction: Please select the appropriate option from each of the following;
Key: SA= Strongly Agree; **A=** Agree; **N**=Neither agree nor disagree; **D=**Disagree; **SD=**Strongly disagree

S/N	STATEMENT	SA	A	N	D	SD
Digital Technology Integration in farming practices						
1.	I use Cloud-based platforms in my farming practices					
2.	I use blockchain and/or other financial technology solutions in my farming practices					
3.	I use Internet of Things (IoT) and sensors in my farming practices					
4.	I use Artificial Intelligence (AI) in my farming practices					
5.	I use Big Data Analytics (BDA) in my farming activities					
6.	I use Global Positioning Technology (GPS) and Drones in my farming activities					

Source: Connolly (2022)

Impact of Digital technology on Agricultural productivity		SA	A	N	D	SD
1.	Increased efficiency of agricultural production resources used					
2.	Increased quantity and quality of crop/animal production					
3.	Reduced reliance on the influence of human factors					
4.	Increased access to much needed capital and agricultural production resources					
5.	Ability to be part of a value chain of large supply networks					
6.	Ability to keep and maintain an adequate record of farming and farm management activities					

Source: Kolmykova, Obukhova, Klykova, Mashegov, Zaitsev and Popova (2021); Amana (2021).

Impact of Digital technology on Agricultural food Security		SA	A	N	D	SD
1.	Improved resource management decisions due to availability of large relevant data					

2.	Reduction in the costs of linking farmers to agricultural produce buyers					
3.	Reduction of food waste and enablement of circularity					
4.	Improved ways to add post-production value to agricultural produce					
5.	Improved ways of storing and preserving agricultural produce					
6.	Innovative packaging					

Source: The World Bank (2019); UNCTAD (2017)

Barriers to the Integration of Digital Technology in farming practices		SA	A	N	D	SD
1	Many digital technology solutions do not work or share data with each other					
2.	Many digital technology solutions do not provide value that are convincing enough					
3.	Initial investment costs of digital technology solutions are usually high					
4.	Inadequate infrastructure and setup to support integration of digital technologies					
5.	Complexity in the usage of digital technology solutions					
6.	The digital literacy level of farmers					

Source: Kieti, Waema, Baumüller, Ndemo and Omwansa (2022)

Strategies to overcome the barriers to the Integration of Digital Technology in farming practices		SA	A	N	D	SD
1	Investment in digital literacy of farmers, especially those in rural areas					
2.	Establishment of a new generation of agricultural extension services					
3.	Reduce complexity on the usage of digital technology solutions by making them user-friendly					
4.	Improved infrastructure and setup to support integration of digital technologies in farming practices					
5.	Increase collaboration and interoperability between digital technology solutions					
6.	Increased governmental support especially when it comes to agricultural research and development					

Source: Iversen, Cheng, Helgason and LaFleur (2021); Fox and Signe (2022).

Appendix B

Table 3.5.0

Digital Technology Integration in Farming Practices			
	Likert Scale	**Frequency (F)**	**Percentage (%)**
I use Cloud-based platforms in my farming practices	Strongly Agree	35	27.6
	Agree	51	40.2
	Neutral	27	21.3
	Disagree	13	10.2
	Strongly Disagree	1	0.8
I use blockchain and/or other financial technology solutions in my farming practices.	Strongly Agree	39	30.7
	Agree	41	32.3
	Neutral	26	20.5
	Disagree	20	15.7
	Strongly Disagree	1	0.8
I use the Internet of Things (IoT) and sensors in my farming practices.	Strongly Agree	20	15.7
	Agree	57	44.9
	Neutral	30	23.6
	Disagree	19	15.0
	Strongly Disagree	1	0.8
I use Artificial Intelligence (AI) in my farming practices.	Strongly Agree	30	23.6
	Agree	52	40.9
	Neutral	25	19.7
	Disagree	17	13.4
	Strongly Disagree	3	2.4
I use Big Data Analytics (BDA) in my farming activities.	Strongly Agree	18	14.2
	Agree	38	29.9
	Neutral	51	40.2
	Disagree	17	13.4
	Strongly Disagree	3	2.4
I use Global Positioning Technology (GPS) and Drones in my farming activities	Strongly Agree	35	27.6
	Agree	47	37.0
	Neutral	26	20.5
	Disagree	14	11.0
	Strongly Disagree	5	3.9

Impact of Digital technology on Agricultural productivity			
Increased efficiency of agricultural production resources used	Strongly Agree	47	37.0
	Agree	59	46.5
	Neutral	17	13.4
	Disagree	3	2.4
	Strongly Disagree	1	0.8
Increased quantity and quality of crop/animal production	Strongly Agree	34	26.8
	Agree	52	40.9
	Neutral	33	26.0
	Disagree	7	5.5
	Strongly Disagree	1	0.8
Reduced reliance on the influence of human factors	Strongly Agree	29	22.8
	Agree	53	41.7
	Neutral	29	22.8
	Disagree	14	11.0
	Strongly Disagree	2	1.6
Increased access to much needed capital and agricultural production resources	Strongly Agree	34	26.77
	Agree	48	37.8
	Neutral	27	21.3
	Disagree	12	9.4
	Strongly Disagree	6	4.7
Ability to be part of a value chain of large supply networks	Strongly Agree	41	32.28
	Agree	50	40.2
	Neutral	23	18.1
	Disagree	10	7.9
	Strongly Disagree	3	2.4
Ability to keep and maintain an adequate record of farming and farm management activities	Strongly Agree	37	29.1
	Agree	43	33.9
	Neutral	28	22.0
	Disagree	15	11.8
	Strongly Disagree	4	3.1
Impact of Digital technology on Agricultural Food Security			
Improved resource management decisions due to availability of large relevant data	Strongly Agree	39	30.7
	Agree	67	52.8
	Neutral	15	11.8

	Disagree	3	2.4
	Strongly Disagree	3	2.4
Reduction in the costs of linking farmers to agricultural produce buyers	Strongly Agree	31	24.4
	Agree	58	45.7
	Neutral	24	18.9
	Disagree	13	10.2
	Strongly Disagree	1	0.8
Reduction of food waste and enablement of circularity	Strongly Agree	27	21.3
	Agree	65	51.2
	Neutral	24	18.9
	Disagree	9	7.1
	Strongly Disagree	2	1.6
Improved ways to add post-production value to agricultural produce.	Strongly Agree	41	32.3
	Agree	53	41.7
	Neutral	17	13.4
	Disagree	12	9.4
	Strongly Disagree	4	3.1
Improved ways of storing and preserving agricultural produce	Strongly Agree	38	29.9
	Agree	54	42.5
	Neutral	24	18.9
	Disagree	6	4.7
	Strongly Disagree	5	3.9
Innovative packaging	Strongly Agree	50	39.4
	Agree	44	34.6
	Neutral	17	13.4
	Disagree	8	6.3
	Strongly Disagree	8	6.3
Barriers to the Integration of Digital Technology in farming practices			
Many digital technology solutions do not work or share data with each other.	Strongly Agree	43	33.9
	Agree	57	44.9
	Neutral	16	12.6
	Disagree	5	3.9
	Strongly Disagree	6	4.7
	Strongly Agree	40	31.5
	Agree	44	34.6

Many digital technology solutions do not provide values that are convincing enough.	Neutral	29	22.8
	Disagree	11	8.7
	Strongly Disagree	3	2.4
Initial investment costs of digital technology solutions are usually high.	Strongly Agree	57	44.9
	Agree	37	29.1
	Neutral	23	18.1
	Disagree	5	3.9
	Strongly Disagree	5	3.9
Inadequate infrastructure and setup to support integration of digital technologies.	Strongly Agree	42	33.1
	Agree	50	39.4
	Neutral	28	22.04
	Disagree	5	3.93
	Strongly Disagree	2	1.6
Complexity in the usage of digital technology solutions.	Strongly Agree	56	44.1
	Agree	38	29.9
	Neutral	17	13.4
	Disagree	14	11.0
	Strongly Disagree	2	1.6
The digital literacy level of farmers	Strongly Agree	45	35.4
	Agree	46	36.2
	Neutral	22	17.3
	Disagree	7	5.5
	Strongly Disagree	7	5.5
Strategies to overcome the barriers to the Integration of Digital Technology in farming practices			
Investment in digital literacy of farmers, especially those in rural areas	Strongly Agree	57	44.9
	Agree	54	42.5
	Neutral	9	7.1
	Disagree	6	4.7
	Strongly Disagree	1	0.8
Establishment of a new generation of agricultural extension services	Strongly Agree	32	25.2
	Agree	70	55.1
	Neutral	14	11.0
	Disagree	4	3.1

	Strongly Disagree	7	5.5
Reduce complexity on the usage of digital technology solutions by making them user-friendly	Strongly Agree	47	37.0
	Agree	49	38.6
	Neutral	16	12.6
	Disagree	13	10.2
	Strongly Disagree	2	1.6
Improved infrastructure and setup to support integration of digital technologies in farming practices	Strongly Agree	39	30.7
	Agree	56	44.1
	Neutral	20	15.7
	Disagree	8	6.3
	Strongly Disagree	4	3.1
Increase collaboration and interoperability between digital technology solutions	Strongly Agree	52	40.9
	Agree	44	34.6
	Neutral	17	13.4
	Disagree	9	7.1
	Strongly Disagree	5	3.9
Increased governmental support especially when it comes to agricultural research and development	Strongly Agree	44	34.6
	Agree	53	41.7
	Neutral	16	12.6
	Disagree	9	7.1
	Strongly Disagree	5	3.9