

# Digital Divide in Agricultural Extension: Exploring ICT Accessibility and Its Influence on Rural Farming Communities

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## **Abstract**

*This study explores the digital divide in agricultural extension by examining ICT accessibility and its impact on rural farming communities. Given the increasing role of technology in agriculture, understanding how ICT accessibility influences agricultural productivity, the effectiveness of extension services, and digital inclusion strategies is crucial. Using a combination of descriptive and correlation analyses, the research investigates the current state of ICT infrastructure in rural areas and its implications for farming practices. The findings reveal significant disparities in ICT accessibility among rural communities, with improved access correlating strongly with enhanced agricultural productivity ( $r = 0.65, p < 0.01$ ) and more effective agricultural extension services ( $r = 0.72, p < 0.01$ ). Furthermore, the study highlights the critical role of digital inclusion strategies in bridging the digital divide, with a strong correlation observed between effective strategies and higher ICT access ( $r = 0.78, p < 0.01$ ). These results underscore the need for targeted investments in ICT infrastructure, the integration of technology into extension services, and the implementation of comprehensive digital inclusion strategies. Addressing these areas can significantly enhance the effectiveness of agricultural support services, improve productivity, and foster overall development in rural farming communities.*

**Keywords:** Digital Divide, ICT Accessibility, Agricultural Extension, Rural Communities, Digital Inclusion Strategies.

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## **1. Introduction**

The digital divide, the gap between those who have access to modern information and communication technologies (ICTs) and those who do not, remains a significant barrier in various sectors, including agricultural extension services. Agricultural extension, which involves the dissemination of agricultural knowledge and innovations to farmers, is critical for enhancing productivity and sustainability in farming communities. However, the effectiveness of these services can be severely impacted by disparities in ICT accessibility.

In rural areas, where agricultural extension services are most needed, the digital divide often manifests as a lack of access to reliable internet, modern communication devices, and digital literacy skills (Bongiovanni & Lowenberg-Deboer, 2020). This divide is particularly pronounced in developing countries, where infrastructural challenges and economic constraints further

exacerbate the problem (Dey et al., 2019). Research indicates that farmers in these regions may miss out on vital information about crop management, pest control, and market prices due to inadequate ICT infrastructure.

The role of ICT in agricultural extension has gained prominence as digital tools and platforms offer new avenues for knowledge dissemination and interaction. Technologies such as mobile phones, internet-based applications, and satellite imagery provide opportunities to bridge the gap between extension services and farmers (Fisher et al., 2021). However, the disparity in access to these technologies can lead to unequal benefits among farmers, with those in less connected areas potentially receiving less support (Kuruja et al., 2018).

A growing body of research emphasizes the need to address the digital divide in agricultural extension to ensure equitable access to information and resources. For instance, initiatives aimed at improving digital infrastructure and literacy in rural areas are essential for maximizing the impact of agricultural extension services (Pardey et al., 2020). By examining the influence of ICT accessibility on rural farming communities, this study aims to provide insights into how the digital divide affects agricultural productivity and the effectiveness of extension services.

### **Statement of the Problem**

Agricultural extension services should ideally leverage on modern information and communication technologies (ICTs) to deliver timely, accurate, and relevant information to all farmers, regardless of their geographic location. ICT tools, including mobile phones, internet platforms, and digital databases, would be universally accessible, facilitating efficient communication between extension services and rural farming communities. Such accessibility would enable farmers to gain insights into best practices, market conditions, pest management, and crop optimization, thereby significantly enhancing agricultural productivity, sustainability, and overall rural development.

Currently, a significant digital divide exists in agricultural extension services, particularly in rural areas of developing countries. Many farmers lack access to essential ICT tools and reliable internet connections, which impedes their ability to benefit from modern agricultural practices and information. This digital divide is exacerbated by infrastructural limitations, economic constraints, and low levels of digital literacy among rural populations. Consequently, these farmers face difficulties in accessing up-to-date agricultural knowledge, which negatively impacts their productivity and economic well-being. The disparity in ICT accessibility not only hinders the effectiveness of extension services but also perpetuates inequalities in agricultural development.

If the issues surrounding ICT accessibility in agricultural extension are not addressed, the gap between technologically advanced and disadvantaged farming communities will likely widen. Farmers without access to ICT tools will continue to miss out on critical information that could improve their farming practices, leading to lower productivity, reduced income, and increased vulnerability to agricultural risks such as pest infestations and market fluctuations. The persistence of this digital divide may exacerbate rural poverty and hinder overall agricultural development, perpetuating economic disparities and limiting opportunities for sustainable growth in these communities. Furthermore, without targeted interventions to bridge this gap, efforts to modernize agricultural practices and enhance food security will be undermined, reducing the effectiveness of agricultural policies and programs aimed at fostering rural development and resilience.

### **Objectives of the Study**

The main objective of the study is to evaluate digital divide in agricultural extension: exploring ICT accessibility and its influence on rural farming communities. The specific objectives of the study are:

- i. To assess the current level of ICT accessibility among rural farming communities.
- ii. To examine the impact of ICT accessibility on the effectiveness of agricultural extension services.
- iii. To identify strategies for bridging the digital divide in agricultural extension.

### **Research Questions**

The study provided answers to the research question

- i. What is the current level of ICT accessibility among rural farming communities?
- ii. How does the level of ICT accessibility affect the effectiveness of agricultural extension services in rural areas?
- iii. What strategies can be implemented to bridge the digital divide and improve ICT access for agricultural extension in rural communities?

### **Statement of Hypotheses**

The following hypotheses in null form will guide the study:

- i. There is no significant difference in the level of ICT accessibility between rural farming communities.
- ii. ICT accessibility does not have a significant impact on the effectiveness of agricultural extension services in rural areas.
- iii. There are no effective strategies for bridging the digital divide that significantly improve ICT access for agricultural extension in rural communities.

### **Significance of the Study**

This study on the digital divide in agricultural extension and ICT accessibility holds substantial significance for various individuals and institutions:

- i. **Farmers and Rural Communities:** The primary beneficiaries are the farmers and rural communities who stand to gain from improved access to ICT tools and information. By addressing the digital divide, the study aims to enhance their access to crucial agricultural knowledge, which can lead to increased productivity, better crop management, and improved economic outcomes.
- ii. **Agricultural Extension Services:** Institutions involved in agricultural extension can benefit from insights into how ICT accessibility influences their effectiveness. The findings can help these organizations tailor their strategies to better meet the needs of farmers, optimize their outreach methods, and enhance the overall impact of their services.
- iii. **Policy Makers and Government Agencies:** The study provides valuable data for policymakers and government bodies tasked with developing strategies to improve rural infrastructure and digital literacy. Understanding the barriers and opportunities related to ICT access can guide the formulation of targeted policies and initiatives aimed at bridging the digital divide and fostering rural development.

- iv. **Non-Governmental Organizations (NGOs) and Development Agencies:** NGOs and development agencies working in the agricultural sector can utilize the study's findings to design and implement more effective programs and interventions. These organizations can leverage the insights to address ICT access issues and support rural farmers more effectively.
- v. **Researchers and Academics:** The study contributes to the body of knowledge on ICT in agricultural extension, offering a basis for further research. Academics can build on these findings to explore additional aspects of the digital divide and its impact on agricultural development.
- vi. **Technology Providers and Industry Stakeholders:** Companies and stakeholders involved in providing ICT solutions and services may gain insights into the specific needs and challenges faced by rural communities. This understanding can drive the development of targeted products and services that address the gaps identified in the study.

## 2. Conceptual Review

### Concept of Digital Divide

The concept of the digital divide refers to the disparity between individuals or communities who have access to and can effectively use information and communication technologies (ICTs) and those who do not. This divide encompasses several dimensions, including physical access to technology, the quality of internet connectivity, and the skills necessary to use digital tools effectively (van Dijk, 2017).

In the realm of agricultural extension, the digital divide highlights significant challenges faced by rural farming communities compared to their urban counterparts. Rural areas often experience limited access to ICT infrastructure, such as reliable internet connections and modern communication devices, which can hinder their ability to benefit from digital tools designed to support agricultural practices (Pardo & Villareal, 2016). Furthermore, low levels of digital literacy among farmers exacerbate these challenges, preventing them from fully utilizing digital resources such as mobile applications for weather updates, pest control, and market information (Bertot et al., 2016).

Addressing the digital divide involves more than just improving physical access to technology. It also requires enhancing digital skills and providing relevant training to ensure that individuals can effectively use the technologies available to them (Hargittai & Walejko, 2020). In agricultural extension, bridging this divide is crucial for ensuring that farmers can access timely and accurate information that can lead to improved productivity and sustainable agricultural practices (Zhang et al., 2021).

Efforts to close the digital divide in agricultural contexts include initiatives aimed at expanding ICT infrastructure in rural areas, developing affordable technology solutions, and offering training programs to enhance digital literacy among farmers (Duncombe & Heeks, 2018). These measures are essential for ensuring that the benefits of digital technologies are equitably distributed and can contribute to the advancement of agricultural practices and rural development.

### Current ICT Infrastructure and Access in Rural Areas

The current state of ICT infrastructure and access in rural areas reflects a significant challenge for agricultural development and rural livelihoods. Despite advancements in technology, rural regions

often lag behind urban areas in terms of ICT infrastructure, which includes internet connectivity, availability of modern communication devices, and the overall quality of digital services (Morris et al., 2018).

Rural areas frequently face limitations in broadband availability and network coverage. Studies have shown that rural regions are less likely to have access to high-speed internet compared to urban centers, which can impede the effective use of digital tools and services (Beine & Dymond, 2020). For instance, while urban areas may benefit from widespread 4G and 5G networks, many rural areas still struggle with slower and less reliable connections (Lee et al., 2019). This lack of infrastructure limits the ability of farmers to access online resources and participate in digital agricultural extension programs.

Beyond connectivity, the availability and affordability of digital devices also pose significant barriers. Rural communities often have fewer resources to invest in modern communication devices such as smartphones, tablets, and computers (Higgins & Moss, 2020). Additionally, the cost of maintaining and updating these devices can be prohibitive for many rural households, further widening the digital divide.

Even where ICT infrastructure exists, the quality of service can vary. Inadequate technical support and limited digital literacy can exacerbate problems, making it difficult for rural residents to effectively use the technologies that are available to them (Chen & Wellman, 2021). This includes challenges related to device maintenance, software updates, and troubleshooting, which can hinder the adoption and effective use of ICT in agricultural practices.

Efforts to improve ICT infrastructure and access in rural areas are critical for bridging the digital divide. These include initiatives aimed at expanding broadband coverage, reducing the cost of technology, and enhancing digital literacy programs to ensure that rural populations can fully utilize digital resources for agricultural development and other essential services (Perrin & Duggan, 2015).

### **Barriers to ICT Adoption and Usage among Rural Farmers**

The adoption and effective usage of information and communication technologies (ICTs) among rural farmers are hindered by various barriers that limit their ability to benefit from digital resources. Understanding these barriers is crucial for developing targeted interventions to bridge the digital divide in agricultural contexts.

1. **Infrastructure Limitations:** One of the primary barriers is the inadequate ICT infrastructure in rural areas. Many rural regions lack reliable internet connectivity and access to modern communication technologies. Studies show that limited broadband availability, frequent service interruptions, and low internet speeds are significant obstacles to ICT adoption among rural farmers (Hargittai & Walejko, 2020). The lack of proper infrastructure restricts farmers' ability to access online agricultural resources, weather forecasts, and market information.

2. **Economic Constraints:** Economic factors play a critical role in the digital divide. The cost of acquiring and maintaining digital devices, such as smartphones, tablets, and computers, can be prohibitive for many rural farmers. Additionally, the expenses associated with internet subscriptions and data plans further compound the issue. Research indicates that high costs and limited financial resources significantly deter rural farmers from investing in ICT (Duncombe & Heeks, 2018).

3. **Digital Literacy and Skills:** Even when infrastructure and economic barriers are addressed, low levels of digital literacy can impede ICT adoption. Many rural farmers lack the necessary skills to effectively use digital tools and navigate online platforms. This gap in digital literacy can prevent farmers from utilizing available technologies for agricultural purposes, such as accessing online training or using agricultural apps (Mossberger et al., 2019). Educational and training programs are often insufficient or inaccessible, further exacerbating this challenge.

4. **Social and Cultural Factors:** Social and cultural barriers also affect ICT adoption. In some rural communities, there may be resistance to adopting new technologies due to traditional practices or a lack of awareness of the benefits of ICT. Social norms and cultural attitudes can influence how technology is perceived and accepted within these communities (Higgins & Moss, 2020).

Addressing these barriers requires a multifaceted approach, including improving ICT infrastructure, reducing costs, enhancing digital literacy, and considering cultural contexts. By overcoming these obstacles, rural farmers can better access and utilize digital tools, leading to improved agricultural practices and outcomes (Chen & Wellman, 2021).

### **Policy and Programmatic Interventions for Digital Inclusion in Agriculture**

Policy and programmatic interventions play a crucial role in addressing the digital divide in agriculture by improving access to and utilization of information and communication technologies (ICTs) among rural farmers. These interventions are essential for fostering digital inclusion and ensuring that the benefits of modern technologies are equitably distributed.

1. **Infrastructure Development and Expansion:** Effective policies often focus on expanding ICT infrastructure in rural areas to ensure widespread access to high-speed internet and modern communication technologies. Government and private sector initiatives aimed at building and upgrading broadband networks are critical for bridging the connectivity gap (Reddick, 2017). Investments in infrastructure can help reduce the disparities in internet access between urban and rural regions, enabling farmers to benefit from digital agricultural services and resources.

2. **Financial Support and Subsidies:** To address the economic barriers associated with ICT adoption, policies that provide financial support and subsidies can be highly effective. This includes subsidizing the cost of digital devices and internet access for low-income farmers and rural communities. Programs that offer grants or low-interest loans for purchasing technology can make ICT tools more affordable and accessible (Miller et al., 2018). Such financial interventions can help reduce the economic burden on farmers and encourage greater adoption of digital technologies.

3. **Digital Literacy and Training Programs:** Enhancing digital literacy through targeted training programs is essential for ensuring that rural farmers can effectively use ICT tools. Government and non-governmental organizations often implement educational initiatives aimed at improving

digital skills among rural populations. These programs can include workshops, online courses, and hands-on training sessions designed to teach farmers how to use digital tools for agricultural purposes (Anderson & Rainie, 2018). Building digital skills is critical for maximizing the benefits of ICT and promoting its integration into everyday agricultural practices.

4. Supportive Policies and Regulations: Crafting supportive policies and regulations that promote digital inclusion and protect users' rights is another key aspect of addressing the digital divide. This includes creating policies that encourage private sector investment in rural ICT infrastructure and ensuring that digital services are accessible and affordable. Additionally, regulations that protect data privacy and cybersecurity can help build trust in digital technologies among rural users (van Deursen & van Dijk, 2019).

5. Collaborative Partnerships: Successful interventions often involve collaborations between various stakeholders, including government agencies, private companies, NGOs, and local communities. Partnerships can facilitate the development and implementation of comprehensive digital inclusion strategies that address the specific needs of rural farmers. Collaborative efforts can also help leverage resources, share knowledge, and drive innovation in ICT solutions for agriculture (Bertot et al., 2016).

### **Impact of Digital Divide on Rural Farming Communities**

The digital divide in agricultural extension has profound implications for rural communities, influencing various aspects of their socio-economic development and overall quality of life. Access to information and communication technologies (ICTs) can significantly impact agricultural productivity, economic opportunities, and social inclusion among rural farmers.

1. Agricultural Productivity and Economic Growth: Improved ICT access has been shown to enhance agricultural productivity by providing farmers with timely information on weather forecasts, pest management, and market prices. Zhang, Liu, and Chen (2022) found that farmers with better ICT access reported increased crop yields and improved market access. This boost in productivity can lead to higher incomes for farmers, contributing to economic growth in rural areas (Zhang et al., 2022). Enhanced agricultural output also promotes food security and can reduce rural poverty by creating more economic opportunities within these communities.

2. Enhanced Agricultural Extension Services: ICT accessibility can significantly improve the effectiveness of agricultural extension services. Patel, Kumar and Sharma (2021) demonstrated that digital tools facilitate better communication between extension workers and farmers, leading to more effective dissemination of agricultural advice and innovations. This improved communication can result in better-informed farmers who are able to adopt modern agricultural practices and technologies (Patel et al., 2021). Consequently, rural communities benefit from increased agricultural efficiency and the adoption of best practices, which can drive sustainable development in agriculture.

3. Bridging the Digital Divide: Policy interventions aimed at bridging the digital divide can lead to positive outcomes for rural communities. Williams, Roberts and Singh (2023) highlighted that targeted policies, such as subsidies for ICT infrastructure and digital literacy programs, have successfully improved ICT access in rural areas. These interventions can foster greater inclusion and reduce disparities between urban and rural communities (Williams et al., 2023). By addressing

the barriers to ICT adoption, rural areas can experience improved access to information, better engagement with extension services, and enhanced social and economic integration.

4. Digital Literacy and Social Inclusion: Digital literacy plays a crucial role in ensuring that rural farmers can effectively use ICT tools. Johnson, Lee and Garcia (2022) found that higher levels of digital literacy among farmers were associated with more effective ICT usage and better agricultural outcomes. Improving digital literacy can help bridge the gap between those with and without access to technology, promoting greater social inclusion and equal opportunities for all members of the community (Johnson et al., 2022). This can lead to more equitable development and reduce the socio-economic divide between rural and urban populations.

### **Theoretical Framework**

This study is theoretically underpinned on Technological Determinism

Technological Determinism is a theory that posits technology as the primary driver of social and cultural change. This theory suggests that the introduction and development of new technologies fundamentally shape societies, influence human behavior, and determine social structures. The theory is propounded by Marshall McLuhan. It emphasizes the role of technology in shaping and transforming various aspects of life, including communication, work, and social interactions.

In the context of this study on the digital divide in agricultural extension, Technological Determinism is relevant because it helps explain how the availability and use of ICTs can fundamentally alter agricultural practices and rural development. The theory underscores the idea that advancements in digital technologies can have a profound impact on how farmers access information, adopt new agricultural practices, and improve productivity.

Understanding that technology can drive change allows for a focus on how improved ICT infrastructure and accessibility might influence agricultural extension services and rural farming communities. If rural areas are equipped with better ICT resources, it could lead to transformative changes in farming practices, knowledge dissemination, and overall agricultural efficiency. Conversely, the lack of technological access might perpetuate existing disparities and limit the potential benefits of technological advancements.

By applying Technological Determinism, the study can better explore how bridging the digital divide in rural areas can lead to significant improvements in agricultural extension and productivity, thus providing a framework for understanding the potential impacts of technological interventions on rural development.

### **Empirical Review**

It is worth noting that this is not the first review on the potential of ICTs in agriculture. Several other papers evaluate the contribution of digital tools to transforming agriculture, albeit with different foci and coverage. Aker and Cariolle (2016) provide a comprehensive review of the earlier literature on the potential of ICTs to provide various types of agricultural extension and related services.

Fabregas et al. (2019) and Spielman et al. (2021) review recent literature on the effectiveness of ICTs to deliver agricultural extension and advisory services in developing countries, while Benami and Carter (2021) synthesize the potential of digital technologies to reshape rural microfinance.

Zhang, Liu and Chen (2022) investigated the relationship between ICT access and agricultural productivity in rural areas. Utilizing a mixed-methods approach, the researchers conducted a survey of 300 rural farmers and in-depth interviews with agricultural extension agents. Their findings indicated a positive correlation between ICT access and productivity, with farmers reporting enhanced crop yields and better market access due to the availability of digital tools. The study also identified significant barriers, including inadequate infrastructure and low digital literacy, which hindered the effective use of ICT in these communities.

Patel, Kumar and Sharma (2021) explored the effects of ICT accessibility on agricultural extension services through a quantitative survey of 250 extension workers and 500 farmers in rural India. Their analysis revealed that ICT significantly improved the effectiveness of extension services, facilitating better communication and the dissemination of agricultural advice. However, the researchers noted that limited infrastructure and varying digital literacy levels among farmers restricted the full utilization of these services. The study highlighted the need for targeted training and infrastructure development to enhance the impact of ICT in agricultural extension.

Williams, Roberts and Singh (2023) conducted a case study analysis of policy interventions aimed at bridging the digital divide in agricultural extension across several developing countries. Their research, which involved policy document reviews, interviews with policymakers, and farmer surveys, demonstrated that targeted interventions such as subsidies for ICT infrastructure and digital literacy programs were effective in improving ICT access. Successful case studies showed increased farmer engagement with extension services and the adoption of modern agricultural practices. The study emphasized the importance of a comprehensive approach, combining infrastructure development, financial support, and educational initiatives, to overcome barriers to digital inclusion.

Johnson, Lee and Garcia (2022) examined the role of digital literacy in ICT adoption among rural farmers through a cross-sectional survey of 400 farmers and interviews with extension agents. Their findings underscored that higher levels of digital literacy were crucial for effective ICT use, leading to improved agricultural outcomes. The study identified gaps in digital literacy as a significant barrier to ICT adoption and recommended targeted training programs to enhance digital skills. This research highlights the essential role of digital literacy in ensuring that ICT resources can be fully utilized to benefit agricultural practices.

### **3. Methodology**

This study utilizes a cross-sectional survey design to examine the digital divide in agricultural extension by exploring ICT accessibility and its effects on rural farming communities. The research is conducted in various rural areas of Enugu State, focusing on a target population comprising 400 rural farmers and 100 agricultural extension workers. A stratified random sampling technique is employed to ensure diverse representation across different regions and demographics, while purposive sampling is used to specifically select extension workers due to their relevant insights. Data collection involves structured questionnaires and semi-structured interviews. The questionnaires, which cover ICT access, usage patterns, and their impacts, are administered both face-to-face and online. In-depth interviews provide qualitative insights into participants' experiences. To ensure the validity of the instruments, experts review and pilot-test them, while reliability is assessed through internal consistency (Cronbach's alpha) and test-retest

methods. Quantitative data are analyzed using descriptive and inferential statistics such as correlation analysis were adopted to access the relationship.

#### 4. Results

**Table 1: Descriptive Statistics on ICT Accessibility among Rural Farmers**

Variable	Category	Frequency	Percentage (%)	Mean	Standard Deviation
Access to Mobile Phones	Yes	320	80.0		
	No	80	20.0		
Access to Computers	Yes	150	37.5		
	No	250	62.5		
Internet Access	Yes	180	45.0		
	No	220	55.0		
Digital Literacy Training	Yes	120	30.0		
	No	280	70.0		
Average Hours Online/Week				5.0	2.5
Number of ICT Devices				1.3	0.8

*Source: Field Survey, 2024*

Table 1 illustrates ICT Accessibility among Rural Farmers which were elucidated using the following variables:

**Access to Mobile Phones:** A significant majority (80%) of rural farmers have access to mobile phones, indicating that mobile technology is widely available in these communities. However, 20% of farmers still lack access, which may limit their ability to benefit from mobile-based agricultural services and information.

**Access to Computers:** Only 37.5% of farmers have access to computers, while 62.5% do not. This disparity suggests that while mobile phones are common, more advanced ICT tools like computers are less prevalent, which could impact the depth of information and resources available to farmers.

**Internet Access:** The data show that 45% of farmers have internet access, whereas 55% do not. This reflects a substantial gap in internet connectivity, which is crucial for accessing online agricultural resources, weather forecasts, and market information.

**Digital Literacy Training:** Only 30% of farmers have received digital literacy training, leaving 70% without formal training in using digital tools. This lack of training may hinder the effective use of available ICT resources and limit the potential benefits of digital inclusion.

**Average Hours Online/Week:** On average, farmers spend 5 hours online per week, with a standard deviation of 2.5 hours. This variability suggests differences in internet usage among farmers, possibly influenced by access and personal needs.

**Number of ICT Devices:** The average number of ICT devices per farmer is 1.3, with a standard deviation of 0.8. This indicates that while many farmers have access to at least one ICT device, the overall number of devices is relatively low.

Therefore, while mobile phone access is widespread among rural farmers, significant gaps remain in access to computers and internet connectivity. The lack of digital literacy training and limited

use of multiple ICT devices further underscore the need for targeted interventions to improve ICT accessibility and utilization in rural farming communities.

**Table 2: Correlation Analysis for Hypotheses Testing**

Variable	ICT Access Score	Agricultural Productivity	Effectiveness of Extension Services	Strategies for Bridging Digital Divide
ICT Access Score	1.0000	0.6512	0.7201	0.7831
Agricultural Productivity	0.6512	1.0000	0.5810	0.7034
Effectiveness of Extension Services	0.7201	0.5810	1.0000	0.7521
Strategies for Bridging Digital Divide	0.7831	0.7034	0.7521	1.0000

*Source: SPSS Output from field survey, 2024*

Table 2 above depicts the correlation analysis which reveals that improved ICT access is positively related to agricultural productivity, the effectiveness of extension services, and the implementation of digital inclusion strategies. The association can be explained vividly below:

**ICT Access Score and Agricultural Productivity:** There is a moderate to strong positive correlation ( $r = 0.65$ ,  $p < 0.01$ ) between ICT access and agricultural productivity. This suggests that better ICT access is associated with a significant increase in crop yields. Improved access to technology likely provides farmers with valuable information and resources that enhance their farming practices.

**ICT Access Score and Effectiveness of Extension Services:** The correlation between ICT access and the effectiveness of extension services is strong ( $r = 0.72$ ,  $p < 0.01$ ). This indicates that higher ICT access is associated with more effective agricultural extension services, as technology enables better communication and information dissemination between extension workers and farmers.

**ICT Access Score and Strategies for Bridging Digital Divide:** A strong positive correlation ( $r = 0.78$ ,  $p < 0.01$ ) is observed between ICT access and the implementation of strategies for bridging the digital divide. This suggests that effective strategies to improve digital inclusion are associated with higher levels of ICT access in rural communities.

**Agricultural Productivity and Effectiveness of Extension Services:** There is a moderate positive correlation ( $r = 0.58$ ,  $p < 0.05$ ) between agricultural productivity and the effectiveness of extension services. This implies that more effective extension services are linked to better agricultural productivity, potentially due to improved advice and support provided to farmers.

**Agricultural Productivity and Strategies for Bridging Digital Divide:** A strong positive correlation ( $r = 0.70$ ,  $p < 0.01$ ) exists between agricultural productivity and the implementation of digital inclusion strategies. This indicates that communities with more robust strategies for improving ICT access tend to experience greater increases in agricultural productivity.

**Effectiveness of Extension Services and Strategies for Bridging Digital Divide:** There is a strong positive correlation ( $r = 0.75$ ,  $p < 0.01$ ) between the effectiveness of extension services and the implementation of strategies for bridging the digital divide. This suggests that effective strategies for digital inclusion contribute to more effective extension services.

## 5. Summary of Findings

The findings revealed several key insights which are summarized below:

- i. **ICT Accessibility and Rural Farming Communities:** The correlation analysis reveals a significant relationship between ICT accessibility and various factors including agricultural productivity, effectiveness of extension services, and digital inclusion strategies. The strong positive correlation between ICT access and the implementation of digital inclusion strategies ( $r = 0.78$ ,  $p < 0.01$ ) contradicts the hypothesis that there is no significant difference in ICT accessibility between rural farming communities. This indicates that ICT accessibility does indeed vary significantly among communities, with more effective strategies leading to better access.
- ii. **Impact of ICT Accessibility on Agricultural Extension Services:** The strong positive correlation ( $r = 0.72$ ,  $p < 0.01$ ) between ICT access and the effectiveness of agricultural extension services demonstrates that higher ICT accessibility significantly enhances the effectiveness of these services. This finding refutes the hypothesis that ICT accessibility does not impact the effectiveness of agricultural extension services, highlighting that improved ICT access is crucial for better extension outcomes.
- iii. **Strategies for Bridging the Digital Divide and ICT Access:** The analysis shows a strong positive correlation ( $r = 0.78$ ,  $p < 0.01$ ) between ICT access and the implementation of strategies for bridging the digital divide. This significant relationship suggests that effective strategies for improving digital inclusion are associated with better ICT access, countering the hypothesis that there are no effective strategies for significantly improving ICT access for agricultural extension in rural communities. This indicates that well-implemented strategies play a key role in enhancing ICT accessibility.

## Conclusion

The analysis of ICT accessibility and its impact on agricultural extension services in rural farming communities reveals several important insights. Rural communities show significant variations in ICT accessibility, indicating that the availability of these technologies is not evenly distributed. Communities with more effective strategies to bridge the digital divide tend to have better access to ICT, demonstrating the effectiveness of targeted efforts to promote digital inclusion.

Furthermore, the strong connection between ICT accessibility and the effectiveness of agricultural extension services confirms that improved access to technology enhances the delivery and quality of these services. This finding emphasizes the importance of investing in ICT infrastructure and resources to support agricultural development and provide farmers with valuable information and tools.

Finally, the analysis suggests that well-implemented strategies for bridging the digital divide are crucial for improving ICT access. Effective strategies contribute significantly to better ICT accessibility, which in turn supports enhanced agricultural productivity and more efficient extension services. Therefore, policymakers and practitioners should prioritize the development and implementation of comprehensive digital inclusion strategies to bridge the digital divide and foster agricultural advancement in rural areas.

## Recommendations

Based on the findings of the study, the following recommendations are proposed:

- i. To address the significant differences in ICT accessibility across rural communities, it is crucial to invest in and improve ICT infrastructure. This includes expanding internet connectivity, increasing the availability of computers and mobile devices, and ensuring that these resources are accessible to all farmers. Government and private sector partnerships can play a pivotal role in building and upgrading ICT infrastructure to ensure that even the most remote areas are covered.
- ii. Given the strong relationship between ICT accessibility and the effectiveness of agricultural extension services, it is recommended to integrate more advanced ICT tools and platforms into extension programs. This could involve equipping extension workers with digital tools, providing online training resources, and utilizing mobile applications to deliver real-time agricultural advice and support. By leveraging technology, extension services can become more responsive and effective in meeting the needs of rural farmers.
- iii. To bridge the digital divide and improve ICT access, it is essential to develop and implement comprehensive digital inclusion strategies. This should include initiatives to provide digital literacy training for farmers, create awareness about the benefits of ICT, and establish support systems to help communities adopt and use digital tools effectively. Strategies could also involve collaborating with local organizations to tailor digital solutions to the specific needs of rural farming communities, ensuring that these solutions are practical and impactful.

## References

- Aker, J. C., & Cariolle, J. (2020). *The use of digital for public service provision in sub-Saharan Africa* (Ferd Policy Brief 11 – 209). La Fondation pour les Etudes et Recherches sur le Développement International.
- Anderson, M., & Rainie, L. (2018). The impact of digital tools on farmers' productivity and incomes. Pew Research Center.
- Bongiovanni, R., & Lowenberg-Deboer, J. (2020). The role of ICT in agricultural development: An overview. *Agricultural Economics*, 51(5), 781-790.
- Benami, E., & Carter, M. R. (2021). Can digital technologies reshape rural microfinance? Implications for savings, credit, and insurance. *Applied Economic Perspectives and Policy*, 43(4), 1196-1220. <https://doi.org/10.1002/aep.13189>
- Beine, M., & Dymond, J. (2020). The digital divide and rural development: A review of current issues and future research. *Telecommunications Policy*, 44(6), 101-115.
- Bertot, J. C., Jaeger, P. T., & McClure, C. R. (2016). The impact of the digital divide on rural communities: Evidence and insights. *Library Quarterly*, 86(1), 1-24.
- Chen, W., & Wellman, B. (2021). The digital divide in rural areas: Barriers and opportunities for improvement. *Information Society*, 37(4), 275-290.
- Dey, S., Choudhury, N., & Miah, M. A. (2019). Bridging the digital divide in rural areas: Challenges and opportunities. *Journal of Rural Studies*, 68, 161-169.

- Duncombe, R., & Heeks, R. (2018). Development, digital inclusion, and the role of ICT: Bridging the divide. *Journal of International Development*, 30(2), 170-184.
- Fabregas, R., Kremer, M., & Schilbach, F. (2019). Realizing the potential of digital development: The case of agricultural advice. *Science*, 366(6471), 1-8.  
<https://doi.org/10.1126/science.aay0664>
- Fisher, M., Kandiwa, V., & Kihoro, J. (2021). ICTs and agricultural extension: Innovations and impacts. *Development Policy Review*, 39(2), 189-205.
- Hargittai, E., & Walejko, G. (2020). The digital divide and its implications for social inequality. *Journal of Social Issues*, 76(1), 95-115.
- Higgins, K., & Moss, R. (2020). Technology access in rural areas: Challenges and strategies for bridging the divide. *Journal of Rural Studies*, 76, 257-268.
- Johnson, S., Lee, K., & Garcia, P. (2022). The role of digital literacy in ICT adoption among rural farmers. *Information Technology for Development*, 28(2), 159-175.
- Kiruja, N., Nyamweya, P., & Sanz, J. (2018). Access to ICT and its impact on rural agricultural extension services in Kenya. *International Journal of Agricultural Extension and Rural Development*, 7(4), 234-245.
- Lee, D., Kim, J., & McGarry, K. (2019). Connectivity and infrastructure gaps in rural broadband: Implications for digital inclusion. *Broadband Policy Review*, 8(2), 112-130.
- Miller, E. L., & Morrison, M. J. (2018). Financial barriers and support mechanisms for digital inclusion in rural areas. *Telecommunications Policy*, 42(1), 45-58.
- Morris, M., Rouse, J., & Buchanan, S. (2018). Infrastructure and access to ICT in rural regions: An overview of the current landscape. *Journal of Rural and Community Development*, 13(1), 45-60.
- Mossberger, K., Tolbert, C. J., & McNeal, R. S. (2019). *Digital citizenship: The internet, society, and participation*. MIT Press.
- Pardey, P. G., Beddow, J. M., & P. G. (2020). The role of ICT in agricultural research and extension: A review of the evidence. *Food Policy*, 94, 101-115.
- Pardo, C., & Villareal, E. (2016). ICT access and use in rural areas: Understanding the barriers and opportunities. *Information Technology for Development*, 22(1), 68-81.
- Patel, M., Kumar, R., & Sharma, A. (2021). ICT accessibility and its effects on agricultural extension services. *Journal of Rural Studies*, 81, 54-66.
- Perrin, A., & Duggan, M. (2015). *Americans' internet access: The digital divide and broadband adoption*. Pew Research Center.

- Reddick, C. G. (2017). ICT infrastructure and access in rural areas: Policies for digital inclusion. *Journal of Rural Studies*, 52, 154-164.
- Spielman, D., Lecoutere, E., Makhija, S., & van Campenhout, B. (2021). Information and communications technology (ICT) and agricultural extension in developing countries. *Annual Review of Resource Economics*, 13, 177-201. <https://doi.org/10.1146/annurev-resource-110119-055515>
- van Deursen, A. J. A. M., & van Dijk, J. A. G. M. (2019). The digital divide in a new era of digitalization: The role of policy in promoting digital inclusion. *Information, Communication & Society*, 22(8), 1157-1175.
- van Dijk, J. A. G. M. (2017). *The digital divide: Theoretical perspectives and research agendas*. SAGE Publications.
- Williams, A., Roberts, J., & Singh, T. (2023). Bridging the digital divide in agricultural extension: Policy interventions and outcomes. *Journal of International Development*, 35(1), 88-102.
- Zhang, Y., Wang, L., & Liu, Y. (2021). Bridging the digital divide in agriculture: A review of recent developments and future directions. *Agricultural Systems*, 192, 103-113.
- Zhang, L., Liu, Y., & Chen, H. (2022). Access to ICT and its impact on agricultural productivity in rural areas. *Agricultural Systems*, 192, 103-113.