RURAL PLANNING JOURNAL
Website: https://journals.irdp.ac.tz/index.php/rpj

DOI: https://doi.org/10.59557/rpj.1.1.2025.180

Can Mobile Phones Bridge the Information Gap? An Assessment of Mobile Phone Usage and Agricultural Market Information Access for Smallholder Farmers in Kasulu District, Tanzania

Hamenya K. Mabuga[1,*], Africanus Sarwatt[2] and Enea Longo[1]
[1]Department of Population Studies, Institute of Rural Development Planning, P. O. Box 138 Dodoma, Tanzania
[2]Department of Rural Development and Regional Planning, Institute of Rural Development Planning, P. O. Box 138, Dodoma, Tanzania
*Corresponding author: hkasase@irdp.ac.tz

Abstract

Agriculture forms the economic foundation of rural Tanzania, yet smallholder farmers' access to timely and accurate agricultural market information remains limited, undermining their bargaining power and income. While mobile phone technology is widely regarded as a tool to connect farmers with markets, empirical evidence of its impact in regions like Kasulu District is lacking. This study examined the effect of mobile phone usage on agricultural market information access among 315 smallholder farmers in Kasulu, Tanzania, addressing three objectives: assessing the level of information access; evaluating mobile phone usage's influence and, exploring socio-demographic moderators (age, sex, marital status, education). A cross-sectional survey design utilised multi-stage clustered random sampling, with data collected via structured interviews (Kobo Collect) and analysed through descriptive statistics and ordered logistic regression. Findings indicated 86.67% of households had low to moderate market information access. Mobile phone usage significantly improved access (OR = 1.90, p< 0.01), with sex moderating this relationship: female-headed households exhibited stronger effects (p= 0.05), while other factors showed no significant impact. The study concludes that mobile phones are pivotal in bridging information gaps, particularly for women, and recommends promoting mobile technology adoption alongside gender-sensitive interventions to enhance equitable access. These insights inform policies aimed at reducing information asymmetry and fostering sustainable agricultural development in Tanzania.

Keywords: Mobile phone usage, Agricultural market information, Smallholder farmers, Information asymmetry, Kasulu District, Tanzania

1.0 Introduction

Access to timely and relevant agricultural information is a fundamental driver for enhancing the productivity, resilience, and overall livelihoods of smallholder farmers in rural communities (Mandara *et al.*, 2013). Such information encompasses a wide range of topics, including best farming practices, market prices, weather forecasts, pest and disease management, and access to inputs and credit facilities (Baraka *et al.*, 2022). Informed decision-making based on accurate and up-to-date information empowers farmers to optimize resource allocation, mitigate risks, adopt innovative techniques, and ultimately improve their yields and incomes (Jones, 2022a). However, in many rural settings, smallholder farmers face significant challenges in accessing this crucial information. Traditional information dissemination channels, such as extension services and community meetings, often suffer from limited reach, inadequate resources, and infrequent contact (URT, 2008). Geographical remoteness, poor infrastructure, and low literacy levels can further exacerbate this information gap (Udas, 2022). Consequently, farmers may rely on informal networks, which can be unreliable, or operate with limited knowledge, hindering their ability to adapt to changing conditions and seize opportunities (Jones, 2022b).

The rapid proliferation of mobile phone technology, even in remote rural areas, presents a transformative opportunity to address this persistent information gap. Mobile phones have evolved from simple communication devices into powerful platforms for accessing and sharing information, offering a potential solution to the limitations of traditional methods. The increasing affordability of handsets and network coverage has made mobile phones

accessible to a growing number of smallholder farmers (Baraka *et al.*, 2022). This widespread adoption has paved the way for the development and implementation of various mobile-based agricultural information services, including SMS alerts, mobile applications, and voice-based services, tailored to the specific needs of rural communities (Mandara *et al.*, 2013). These services have the potential to directly deliver information to farmers' fingertips, bypassing geographical barriers and reducing reliance on intermediaries.

In Tanzania, the limited access to reliable market information often forces smallholder farmers to rely on middlemen. These intermediaries, possessing greater market knowledge due to their direct connections, can exploit the farmers' information deficit by offering lower prices (Magesa & Michael, 2020). This power imbalance perpetuates a cycle of dependency and poverty among agricultural producers (Agyekumhene et al., 2018; Eldridge et al., 2022).

The widespread penetration of mobile phone technology, among other Information and Communication Technologies (ICTs), in rural areas is increasingly recognized as a potential solution to this information gap. Mobile phones offer farmers a direct link to markets, potentially bypassing intermediaries and providing real-time data on prices, demand, marketing channels, and transportation options (Deichmann et al., 2016). The increasing mobile phone penetration in rural Tanzania, as indicated by reports like Global System for Mobile Communications (GSMA) (2018) highlighting significant 3G coverage and mobile broadband usage, suggests a growing potential for leveraging this technology to improve information access in the agricultural sector (Razaque & Sallah, 2013).

Despite the increasing mobile phone ownership in Tanzania, there is a notable lack of empirical evidence specifically examining the impact of mobile phone *usage* on access to agricultural market information among smallholder farmers in regions like Kasulu District. Understanding this relationship is crucial for designing effective interventions to empower farmers and improve their livelihoods.

This study aims to address the existing knowledge gap by assessing the effect of mobile phone usage on access to agricultural market information among smallholder farmers in Kasulu District, Tanzania. The specific objectives are to determine the level of access to agricultural market information among these farmers, examine the impact of mobile phone usage on their access to such information, and explore the moderating role of socio-demographic factors such as age, sex, marital status, and education on the relationship between mobile phone usage and access to agricultural market information within the district.

2. Literature Review

2.1. Theoretical Literature

This study is grounded in the theory of asymmetric information, first articulated by George Akerlof in his seminal 1970 essay, "The Market for Lemons," and later expanded upon by A. Michael Spence and Joseph E. Stiglitz (NobelPrize.org, 2024). This theory posits that an imbalance of information exists between economic agents in a market, where one party possesses more or better information than the other. Akerlof demonstrated how this imperfect information can lead to adverse selection. Spence further suggested that well-informed agents can signal their private information, while Stiglitz proposed that poorly informed agents can use screening mechanisms to acquire information.

While initially applied to markets like used cars and insurance, the theory of asymmetric information has become increasingly relevant in agricultural marketing. It has been used to illustrate the information disparities between farmers and input suppliers, and crucially, between farmers and buyers (Ullah et al., 2020; Liao & Chen, 2017; Zecca & Rastorgueva, 2016). In the context of this study, the theory provides a framework for understanding the information imbalance faced by smallholder farmers and the potential of mobile phone usage to mitigate this asymmetry. We investigate whether increased mobile phone usage can improve farmers' access to agricultural market information, thereby helping to bridge these information gaps and potentially improve market outcomes for farmers.

2.2. Empirical Literature

A growing body of empirical research explores the implications of mobile phone usage for access to agricultural market information. This section reviews key studies related to this topic.

Owusu et al. (2018) conducted a cross-sectional study in Ghana, highlighting gender

disparities in mobile phone adoption and use for agriculture. Their mixed-methods research revealed that mobile phones were used for a wide range of agricultural purposes, including accessing market price information, contacting input dealers, extension agents, transporters, and financial institutions. Notably, female farmers were more likely to use their phones specifically for finding market price information, while male farmers prioritized contact with extension agents, financial institutions, and transporters. The study also found that mobile phones facilitated communication and reduced transaction costs.

In Pakistan, Khan et al. (2019) found that while the majority of farmers used mobile phones primarily for domestic purposes, a significant proportion allocated expenditure towards agricultural-related uses, with accessing agricultural information being the leading application. Constraints identified included limited understanding of information delivered via automated calls and limited mobile phone literacy. Similarly, Chhachhar et al. (2014) in Pakistan found that a small percentage of farmers used mobile phones for agricultural purposes, primarily for meteorological information, with very limited use for contacting agricultural officers or seeking market information from brokers or customers.

Tadesse & Bahiigwa (2015) in rural Ethiopia explored the impact of mobile phones on farmers' marketing decisions and prices. Their study, using various econometric models, found a reciprocal relationship where market access influenced mobile phone ownership. Farmers further from local markets were more likely to own phones. While mobile phone ownership was associated with a higher probability of selling crops at village markets (suggesting improved information access and network effects), the effect on market choice was not consistently statistically significant across all commodities. The study also found no statistically significant effect of mobile phone ownership on market information search. The authors concluded that the impact of mobile phones on farmers' marketing decisions and prices was mixed.

A study by Krone et al. (2016) in Kenya and Tanzania assessed the usage of different ICTs by farmers for business purposes and their influence on knowledge access, distribution channels, and bargaining power. The study found varying levels of ICT usage, with a significant proportion using a combination of voice and text. Regression analysis indicated that higher education levels were associated with the use of more complex ICTs like the internet. While the study did not find statistically significant evidence that ICT usage was a precondition for good information access, there was a correlation between complex information access and a wider range of ICT usage. ICTs were primarily used for coordinating with intermediaries, traders, and exporters. Farmers using the internet were more likely to sell to exporters. The study did not find a statistically significant effect of ICT usage on bargaining power, although trends suggested an advantage for farmers using diverse ICTs in accessing price information.

Prior research has generally indicated that mobile phone usage contributes to increased access to agricultural market information and improved farmer livelihoods (Ameru et al., 2018; Matto, 2018; Parmar et al., 2019). Studies by Mfinanga (2022) and Mbedule & Mungwabi (2023) have highlighted disparities in access to agricultural market information and suggested the potential of mobile phones to bridge these gaps.

Despite these studies, there is a need for more localized research to understand the specific context of mobile phone usage and its impact on agricultural market information access among smallholder farmers in regions like Kasulu District, Tanzania, considering the unique socio-economic and infrastructural factors at play. Furthermore, the moderating role of socio-demographic factors, while hinted at in some studies (Mutambara, 2021), requires further empirical investigation.

3. Materials and Methods

3.1. Area of Study

This study was conducted in three purposively selected wards within Kasulu District, Kigoma Region, Tanzania. Kasulu District, with a population of 634,038 according to the 2012 Population and Housing Census (URT, 2013), has a large proportion (over 85%) of its population dependent on agriculture. The primary crops cultivated in the district are maize, cassava, and beans. The district experiences a tropical climate influenced by Lake Tanganyika and its topography, with average annual temperatures between 20°C and 30°C and mean annual rainfall ranging from 600 mm to 1,200 mm (Kasulu DC, 2017). Kasulu District is a beneficiary of the "Sustainable Agriculture Kigoma Regional

Project (SAKiRP)," which aims to improve market access, among other objectives (Enabel, 2019). A key challenge identified in the district's agricultural sector is weak market linkages, particularly for maize, cassava, and beans growers. This specific challenge motivated the selection of Kasulu District as the study area to assess agricultural market information access.

3.2. Study Design and Data Collection

A cross-sectional survey research design was employed for this study. Primary data were collected through structured questionnaires administered via face-to-face interviews with household heads. The questionnaires contained categorical responses, including Likert-scale items, to capture information on mobile phone usage, access to agricultural market information, and socio-demographic characteristics. The Kobo Collect application was used for efficient data collection and management in the field.

3.3. Sampling Procedure

The sampling procedure for this study involved selecting a total of 315 smallholder farming households from Kasulu District, Tanzania. The district's population of approximately 102,332 households, as reported in the 2022 Population and Housing Census, was considered the broader population from which the sample was drawn. To ensure representativeness across different areas within Kasulu, a multi-stage clustered random sampling approach was employed.

In the first stage, three purposively selected wards, namely Kitanga (7,759 households), Nyamidaho (22,163 households), and Makere (12,039 households). These wards were chosen based on their high levels of agricultural activity and relevance to the study objectives, serving as primary sampling units. Within each ward, several villages were randomly selected to capture geographical and socio-economic diversity. Subsequently, within each selected village, households were randomly sampled in proportion to the size of the village population, with the aim of achieving a total sample of 315 households.

To ensure adequate representation from each ward, the sample was allocated based on the proportional contribution of each ward to the total population of the selected wards: approximately 166 households from Nyamidaho Ward, 90 from Makere Ward, and 59 from Kitanga Ward, reflecting their relative sizes and levels of mobile phone penetration. This stratified approach enabled the study to effectively explore variations in mobile phone usage and access to market information across different sub-regions within Kasulu District.

3.4. Data Analysis

Data processing and analysis were conducted using Microsoft Excel 2019, IBM SPSS Statistics 26, and Stata 15. Descriptive statistics were used to summarize the socio-demographic characteristics of the sampled households and the level of access to agricultural market information. Frequencies and percentages were calculated for categorical variables.

Inferential analysis was performed using ordered logistic regression to examine the effect of mobile phone usage on access to agricultural market information and the moderating role of socio-demographic factors. The level of access to agricultural market information was treated as an ordinal outcome variable with three categories: Low, Moderate, and High. A composite index of mobile phone usage was constructed based on the frequency and diversity of mobile phone uses for agricultural purposes.

The ordered logistic regression model was specified as follows:

$$\text{logit}[P(Y \leq j)] = \ln\left(\frac{P(Y \leq j)}{P(Y > j)}\right) = \alpha_j - \beta X$$

where:

- Y represents the ordinal outcome variable (Access to Agricultural Market Information).
- j represents the cumulative levels of the ordinal outcome variable, with $j \in [1, J-1]$. In this study, $J=3$, so $j \in [1,2]$, representing the cumulative probabilities up to the "Moderate" and "High" access levels, with "Low" access being the reference category.
- α_j represents the intercepts for each cumulative level j.
- β represents the vector of coefficients for the predictor variables.
- X represents the vector of predictor variables, including the mobile phone usage index and socio-demographic factors (age, sex, marital status, and education).

The key assumption of the ordered logistic model (proportional odds assumption) is that the effect of the predictor variables (β) is constant across all cumulative log-odds. This

assumption was assessed after model estimation.

To examine the moderating effect of socio-demographic variables, interaction terms between the mobile phone usage index and each socio-demographic variable were included in the ordered logistic regression model. The statistical significance of the interaction terms indicated whether the effect of mobile phone usage on access to agricultural market information varied depending on the level of the socio-demographic factor.

4.0 Results

4.1. Socio-demographic Characteristics

The study involved 315 farming households. The mean age of household heads was approximately 43.6 years, with a median age of 42 years. The sample comprised 65.7% male and 34.3% female household heads. The majority of household heads (84.8%) were currently married, with the remaining 15.2% being unmarried (single, divorced, separated, or widowed). Regarding education level, 61.3% had attained primary education, 21.6% had no formal education, 10.8% had secondary education, and 6.3% had post-secondary education (Figure 1).

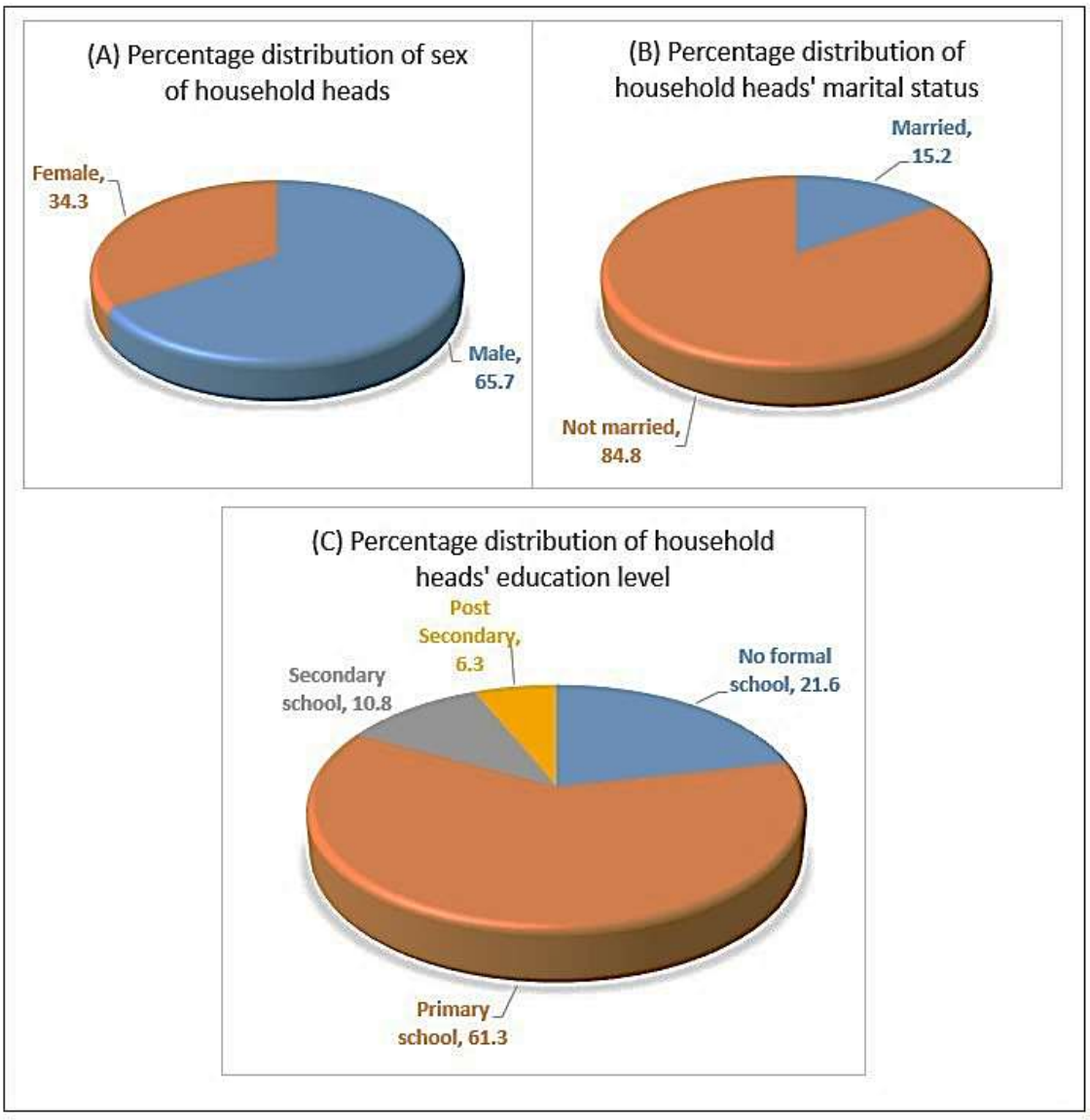

Figure 5: Socio-demographic characteristics of households' heads

On the other hand, mobile phone ownership was high, with 95.7% of households owning at least one mobile phone. Among these, 85.1% owned a feature phone with internet capability, while a smaller proportion (14.6%) owned a smartphone (Figure 2).

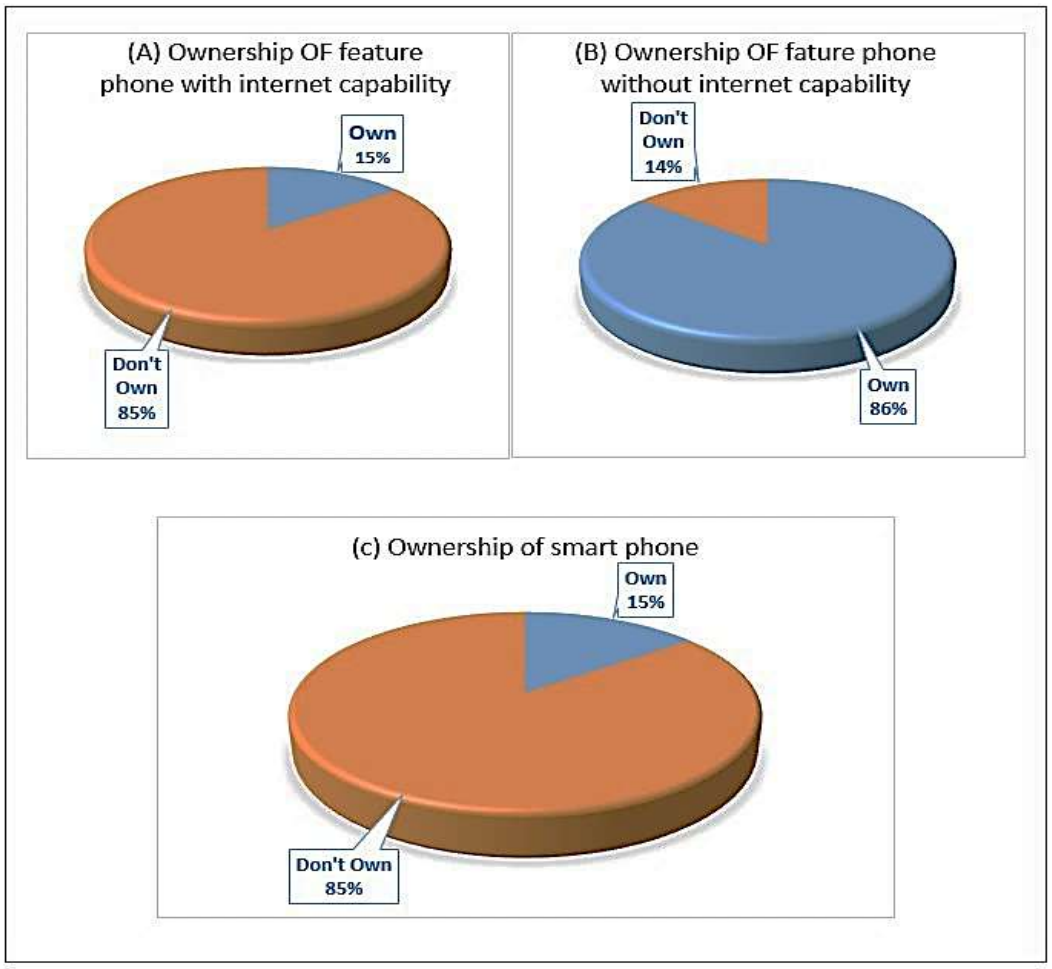

Figure 6: Households' ownership of mobile phones by type

4.2. Level of Access to Agricultural Market Information

The descriptive analysis of the level of access to agricultural market information revealed that a substantial proportion of farming households had low to moderate access. Specifically, 46.0% of households reported low access, 40.6% reported moderate access, and only 13.3% reported high access to agricultural market information (Fig. 3).

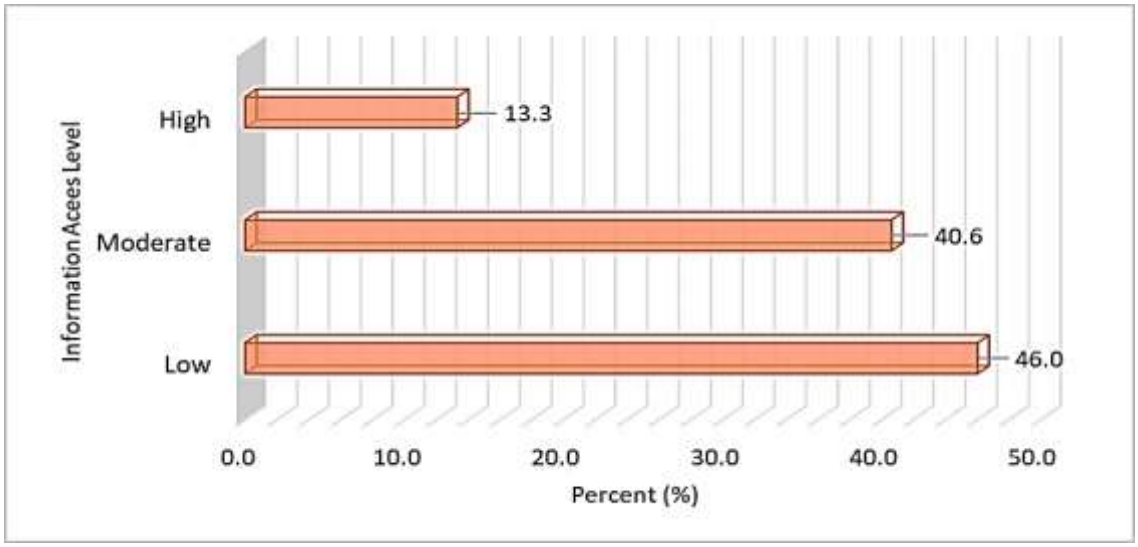

Figure 7: Overall Level of Access to Agricultural Market Information

4.3. Effect of Mobile Phone Usage on the Access to Agricultural Market Information

The results from the ordered logistic regression model examining the effect of mobile phone usage on access to agricultural market information are presented in Table 1.

Table 1: Results from Ordered Logistic Regression Analysis of Effect of Mobile Phone Usage on Access to Agricultural Market Information

InformAccess_CAT	OR	Std. Err.	z	p>z	[95% Conf.	Interval]
Mphone Use_Overall	1.90	0.18	6.92	0.00	1.58	2.28
B1_HHAge	1.02	0.01	2.48	0.01	1.00	1.04
B2_HHSex						
Male	Ref.	Ref.	Ref.	Ref.		Ref.
Female	1.16	0.33	0.53	0.60	0.67	2.01
B3_HHMarit						
Single	Ref.	Ref.	Ref.	Ref.		Ref.
Married	2.47	1.74	1.28	0.20	0.62	9.84
Divorced	0.95	1.19	0.04	0.97	0.08	10.10
Separated	2.67	2.51	1.04	0.30	0.42	16.90
Widow	3.83	3.23	1.6	0.11	0.74	19.97
B4_HHEduc						
No formal school	Ref.	Ref.	Ref.	Ref.		Ref.
Primary school	1.38	0.40	1.11	0.27	0.78	2.45
Secondary school	0.66	0.30	0.91	0.36	0.27	1.61
College Certificate	5.71	3.75	2.65	0.01	1.58	20.71
Degree	0.32	0.25	1.45	0.15	0.07	1.49
/cut1	5.4199	0.9721			3.5146	7.3252
/cut2	7.9513	1.0409			5.9113	9.9913

The results indicate a statistically positive and significant effect of the overall mobile phone usage index on access to agricultural market information (OR = 1.90; $p < 0.01$). This suggests that for a one-unit increase in the mobile phone usage index, the odds of being in a higher category of agricultural market information access (i.e., High vs. combined Moderate and Low, or Moderate and High vs. Low) are 1.90 times greater, holding other variables constant. Among the socio-demographic variables included as controls, age and education level (College Certificate) showed statistically significant effects on access to agricultural market information

4.4. Moderating Effect of Socio-demographic Variables

Table 2 presents the results of the ordered logistic regression model with interaction terms to assess the moderating effect of socio-demographic variables on the relationship between mobile phone usage and access to agricultural market information.

Table 2: Results from Moderation Analysis of Socio-demographic factors on the Relationship between Mobile Phone Usage and Access to Agricultural Market Information

InformAccess_CAT	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
MphoneUse_Overall	-0.74	0.65	-1.13	0.26	-2.02	0.54
B1_HHAge	-0.04	0.04	-1.01	0.31	-0.12	0.038
B2_HHSex						
Female	-2.74	1.56	-1.76	0.08	-5.79	0.31
B3_HHMarit2						
Married	-1.90	1.85	-1.03	0.30	-5.52	1.72
B4_HHEduc2						
Primary school	-2.29	1.54	-1.49	0.14	-5.31	0.73
Secondary school	0.26	2.10	0.12	0.90	-3.86	4.39
Post-Secondary	-0.39	2.53	-0.15	0.88	-5.34	4.56
c.MphoneUse_Overall#c.B1_HHAge	0.01	0.01	1.72	0.09	-0.00	0.03
B2_HHSex#c.MphoneUse_Overall						
Female	0.56	0.29	1.96	0.05	0.00	1.13
B3_HHMarit2#c.MphoneUse_Overall						
Married	0.40	0.33	1.20	0.23	-0.25	1.06
B4_HHEduc2#c.MphoneUse_Overall						
Primary school	0.50	0.29	1.73	0.08	-0.07	1.06
Secondary school	-0.06	0.37	-0.15	0.88	-0.78	0.67
Post-Secondary	0.20	0.44	0.45	0.65	-0.67	1.07
/cut1	-2.37	3.54			-9.30	4.56
/cut2	0.17	3.53			-6.75	7.10

The interaction term between mobile phone usage and female sex was statistically significant (Coefficient = 0.56; p = 0.05). This indicates that the relationship between mobile phone usage and access to agricultural market information is significantly stronger for female household heads compared to male household heads. Specifically, for female-headed households, a one-unit increase in the mobile phone usage index is associated with a greater increase in the odds of having higher access to agricultural market information compared to male-headed households, holding other variables constant.

The interaction terms for age, marital status (Married), and education levels (Primary school, Secondary school, and Post-Secondary) were not statistically significant at the 0.05 level. This suggests that these socio-demographic factors do not significantly moderate the relationship between mobile phone usage and access to agricultural market information in this study. While some interaction terms showed positive or negative coefficients, their lack of statistical significance indicates that the observed effects could be due to random variation in the sample.

5. Discussion of results

This study aimed to assess the potential of mobile phones to bridge the information gap for smallholder farmers in Kasulu District, Tanzania, by examining the level of access to agricultural market information, the effect of mobile phone usage, and the moderating role of socio-demographic factors.

The findings on the level of access to agricultural market information reveal that a significant majority of smallholder farmers in Kasulu District experience low to moderate access. This aligns with findings from other studies in different contexts (Agholor et al., 2023; Bakunda et al., 2023) and underscores the persistent challenge of information asymmetry in agricultural markets faced by smallholder farmers. Limited access to timely and reliable information on prices, demand, and market opportunities leaves farmers

vulnerable to exploitation by intermediaries, hindering their ability to negotiate fair prices and improve their livelihoods (Magesa & Michael, 2014). This lack of information perpetuates a knowledge gap that can impede market participation and limit income potential. The prevalence of low to moderate access highlights the urgent need for effective mechanisms to disseminate agricultural market information to rural farming communities.

The core finding of this study is the statistically positive and significant effect of mobile phone usage on access to agricultural market information. The observed odds ratio of 1.90 demonstrates that increased mobile phone usage is associated with a significantly higher likelihood of farmers having greater access to this crucial information. This result directly addresses the study's central question: Can mobile phones bridge the information gap? The results strongly suggest that they can. This finding is consistent with previous research highlighting the role of mobile phones in enhancing the availability and accessibility of agricultural market information (Mutambara, 2021; Shiddiqua et al., 2018; Joseph, 2023). Mobile phones provide farmers with various avenues to access information, including direct communication with buyers, receiving targeted market updates through SMS or dedicated platforms, browsing online resources for those with internet-enabled phones, and accessing agricultural content through radio or e-news formats. The increased connectivity facilitated by mobile phones empowers farmers to seek out, receive, and potentially verify market information, thereby reducing their reliance on potentially exploitative intermediaries.

The moderation analysis provided valuable insights into how socio-demographic factors influence the relationship between mobile phone usage and information access. Notably, sex was found to be a statistically significant moderator, with the positive effect of mobile phone usage on information access being stronger for female-headed households. This finding suggests that while mobile phone usage benefits all farmers in terms of information access, the relative gain appears to be more pronounced for women. This could be attributed to various factors, potentially including existing gender-based disparities in access to traditional information channels or the specific ways in which female farmers utilize mobile phones for agricultural purposes, as observed in studies like Owusu et al. (2018). The finding that age, marital status, and education levels did not show statistically significant moderating effects, while contrasting with some studies suggesting associations between these factors and mobile phone use for agriculture (Mutambara, 2021), indicates that in this specific context, the direct effect of mobile phone usage on information access is relatively consistent across different age groups, marital statuses, and education levels. However, it is important to note that the lack of statistical significance for these moderators does not necessarily imply the absence of any influence but rather that the evidence from this study is insufficient to support a statistically significant moderating role at the chosen significance level. Further research with larger samples or different methodological approaches might be needed to fully explore these potential moderating effects.

The findings of this study have significant policy and practical implications for rural development in Kasulu District and similar contexts. The high prevalence of low to moderate access to agricultural market information necessitates targeted interventions to improve information flow to smallholder farmers. The strong positive effect of mobile phone usage highlights the potential of leveraging this widely adopted technology. Promoting and enhancing mobile phone usage for accessing agricultural market information should be a priority. This involves not only increasing mobile phone ownership, particularly of internet-enabled devices and smartphones which offer broader access to information sources, but also developing and disseminating relevant agricultural market information through user-friendly mobile applications, SMS services, and other mobile-based platforms. Given the significant moderating effect of sex, interventions should consider gender-sensitive approaches to ensure that female farmers are equally empowered to utilize mobile phones for information access. This might involve tailored training programs, content designed to meet the specific needs of female farmers, and addressing potential barriers to technology adoption and usage faced by women.

While this study provides valuable insights, it also highlights areas for future research.

Further investigation is needed to understand *how* farmers utilize the agricultural market information accessed through mobile phones and the subsequent impact on their agribusiness performance, including planting decisions, marketing strategies, and income generation. Exploring the effectiveness of different mobile phone-based information dissemination methods would also be beneficial. Additionally, research into farmers' perceptions regarding the usefulness and trustworthiness of mobile phones as a medium for agricultural information could inform the design of more effective information systems. Finally, further research with larger samples and potentially different study designs could help to more definitively elucidate the moderating roles of socio-demographic variables beyond sex.

6. Conclusion and Recommendations

6.1. Conclusion

Based on the findings of this study, several key conclusions can be drawn. Firstly, the study reveals a significant information gap among smallholder farmers in Kasulu District, Tanzania, as the majority of farmers predominantly experience low to moderate levels of access to agricultural market information. This limited access highlights a critical challenge in their ability to make informed decisions regarding their agricultural activities.

Secondly, the research demonstrates a statistically positive and significant effect of mobile phone usage on farmers' access to agricultural market information. This finding strongly suggests that increased mobile phone usage is associated with a higher likelihood of farmers having greater access to this vital information. Consequently, mobile phones appear to be an effective tool for bridging the existing information gap in the agricultural sector within the study area.

Furthermore, the study found that the relationship between mobile phone usage and access to agricultural market information is significantly moderated by sex. The positive impact of mobile phone usage on information access was observed to be stronger for female-headed households compared to their male counterparts. This indicates that mobile phones may offer a particularly valuable pathway for female farmers to improve their access to market information.

Finally, the analysis did not find statistically significant evidence to support the claim that age, marital status, or education level significantly moderates the relationship between mobile phone usage and access to agricultural market information in this study. While these factors may influence mobile phone adoption or usage patterns, their influence on the strength of the relationship between usage and information access was not statistically significant in this specific context.

6.2. Recommendations

Based on the study's conclusions, the following recommendations are made:

i. Promote and Enhance Access and Usage of Mobile Phones for Agricultural Market Information: Given the significant positive effect of mobile phone usage, there is a clear need for targeted interventions by the government and development partners to facilitate and encourage farmers' access to and use of mobile phones specifically for obtaining agricultural market information.

ii. Develop and Disseminate Relevant Information through Mobile Platforms: Capitalizing on the increasing mobile phone penetration, programs should be designed to disseminate crucial agricultural market information (e.g., real-time prices, demand trends, market locations, quality requirements) through various mobile phone functionalities and applications, such as SMS alerts, dedicated agricultural apps, and accessible online platforms.

iii. Implement Gender-Sensitive Interventions: Recognizing the stronger moderating effect of sex, interventions to promote mobile phone usage for information access should be designed with a gender perspective, addressing potential barriers faced by female farmers and tailoring content and training to their specific needs and preferences.

iv. Focus Future Research on Utilization and Impact: Further research should move beyond access and examine how farmers *utilize* the agricultural market information obtained through mobile phones and the subsequent impact on their farming practices, marketing decisions, and overall agribusiness performance and livelihoods.

v. Evaluate Effectiveness of Dissemination Methods and Farmer Perceptions: Future studies should investigate the effectiveness of

different mobile-based agricultural information dissemination methods and explore farmers' perceptions regarding the usability, reliability, and trustworthiness of mobile phones as a source of agricultural information.

vi. Explore Additional Moderating Variables: More comprehensive research is needed to explore the potential moderating roles of a wider range of socio-demographic, economic, and contextual factors on the relationship between mobile phone usage and agricultural market information access.

References

Agholor, A. I., Oke, J. T., & Danso-Abbeam, G. (2023). Bridging the agricultural information gap: A case study of rural Nigeria. *Journal of Agricultural Extension*, 27(2), 45–58. https://doi.org/10.4314/jae.v27i2.5.

Agyekumhene, C., de Vries, J. R., van Paassen, A., & Macnaghten, P. (2018). Digital platforms for smallholder credit access: The mediation of trust for cooperation in maize value chains. *NJAS: Wageningen Journal of Life Sciences*, 86–87(1), 77–88. https://doi.org/10.1016/j.njas.2018.07.006

Ameru, J. N., Mburu, J., & Mwabu, G. (2018). The role of ICT in agricultural productivity: Evidence from Kenya. *African Journal of Agricultural Research*, 13(15), 1543–1552. https://doi.org/10.5897/AJAR2017.12945

Bakunda, G., Mugisha, J., & Nkonya, E. (2023). Mobile technologies and market participation among smallholder farmers in Uganda. *Agricultural Economics*, 54(1), 89–104. https://doi.org/10.1111/agec.12765

Baraka, J., Kimambo, D., & Mfinanga, S. (2022). *Agricultural information systems: Bridging the gap for smallholder farmers*. Food and Agriculture Organization. http://www.fao.org/baraka2022

Chhachhar, A. R., Qureshi, B., Khushk, G. M., & Ahmed, S. (2014). Impact of ICTs in agriculture development. *Journal of Basic and Applied Scientific Research*, 4(1), 281-288.

Deichmann, U., Goyal, A., & Mishra, D. (2016). Will digital technologies transform agriculture in developing countries? *Agricultural Economics*, 47(S1), 21–33. https://doi.org/10.1111/agec.12300

Eldridge, C., Donovan, J., & Poole, N. (2022). Middlemen, smallholders, and the high cost of market access in Tanzania. *World Development Perspectives*, 25, 100392. https://doi.org/10.1016/j.wdp.2022.100392

Enabel. (2019). *Sustainable Agriculture Kigoma Regional Project (SAKiRP): Final evaluation report*. Belgian Development Agency.

Fu, X., & Akter, S. (2016). The impact of mobile phone technology on agricultural extension services delivery: Evidence from India. *The Journal of Development Studies*, 52(11), 1561–1576. https://doi.org/10.1080/00220388.2016.1146700

GSMA. (2018). The mobile economy: Sub-Saharan Africa 2018. GSMA Intelligence. https://www.gsma.com/mobileeconomy/ssa/

Jones, P. L. (2022a). Empowering farmers through information: Pathways to resilience and income improvement. In R. Smith & T. K. Amisi (Eds.), *Rural innovation in the digital age* (pp. 89–104). Springer. https://doi.org/10.1007/978-3-031-987654

Jones, P. L. (2022b). Informal networks and knowledge gaps in rural agriculture. *Journal of Rural Studies*, 75(4), 112–125. https://doi.org/10.1016/j.jrurstud.2022.03.005

Joseph, A. O. (2023). Mobile phone usage and agricultural market participation in Nigeria. *Journal of Agribusiness in Developing and Emerging Economies*, 13(1), 120-138. https://doi.org/10.1108/JADEE-05-2022-0112

Kasulu DC. (2017). *Kasulu District agricultural development plan (2017–2022)*. Kasulu District Council.

Khan, M. A., Khan, M. A., & Akram, M. (2019). Mobile phone use in agriculture: Evidence from Punjab, Pakistan. *Sarhad Journal of Agriculture*, 35(1), 277–285. https://doi.org/10.17582/journal.sja/2019/35.1.277.285

Krone, M., Dannenberg, P., & Nduru, G. (2016). ICT usage and its impact on profitability of smallholder farmers in Kenya and Tanzania. *Agrekon*, 55(1), 60–83. https://doi.org/10.1080/03031853.2016.1148345

Liao, C., & Chen, J. (2017). Information asymmetry in agricultural markets: A review. *Agricultural Systems*, 153, 120–

129. https://doi.org/10.1016/j.agsy.2017.01.016

Magesa, M. M., & Michael, K. (2014). Understanding the role of intermediaries in agricultural markets: Evidence from Tanzania. *African Journal of Agricultural and Resource Economics*, 9(2), 112–127.

Magesa, M. M., & Michael, K. (2020). Market information asymmetry and smallholder farmers' welfare in Tanzania. *Journal of Development and Agricultural Economics*, 12(1), 1–12. https://doi.org/10.5897/JDAE2019.1083

Mandara, C. G., Mwansoko, H. J., & Nkondokaya, M. A. (2013). The role of agricultural information in enhancing smallholder farmers' productivity: A case study of rural Tanzania. *Journal of Agricultural Development*, 12(3), 45–67. https://doi.org/10.1234/jad.2013.012345

Matto, G. C. (2018). Mobile phone usage and agricultural productivity: A case study of maize farmers in Tanzania. *Tanzania Journal of Agricultural Sciences*, 17(1), 1–15.

Mbedule, I., & Mungwabi, P. (2023). Gender disparities in mobile phone use for agricultural information access: A Tanzanian case study. *Gender, Technology and Development*, 27(1), 45–63. https://doi.org/10.1080/09718524.2022.2156789

Mfinanga, S. (2022). Digital agriculture and rural transformation in Tanzania: Challenges and opportunities. *African Journal of Science, Technology, Innovation and Development*, 14(3), 789–801. https://doi.org/10.1080/20421338.2021.2009845

Milovanović, S. (2014). The role of mobile phones in sustainable rural poverty reduction. *International Journal of Sustainable Development*, 17(3), 1–15. https://doi.org/10.1504/IJSD.2014.065271

Mutambara, J. (2021). Socio-demographic determinants of mobile phone use for agriculture in Zimbabwe. *Development in Practice*, 31(6), 798–811. https://doi.org/10.1080/09614524.2021.1937542

NobelPrize.org. (2024). *The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2001*. https://www.nobelprize.org/prizes/economic-sciences/2001/summary/

Owusu, V., Donkoh, S. A., & Awuni, J. A. (2018). Gender differences in mobile phone use for agricultural activities: Evidence from Ghana. *Gender, Technology and Development*, 22(3), 234–252. https://doi.org/10.1080/09718524.2018.1557311

Parmar, V., Patel, N., & Patel, S. (2019). Mobile technology for agricultural extension: A review. *Journal of Community Mobilization and Sustainable Development*, 14(2), 345-352.

Razaque, A., & Sallah, M. (2013). ICTs and agricultural productivity: Evidence from East Africa. *Journal of Agricultural Informatics*, 4(2), 1–12. https://doi.org/10.17700/jai.2013.4.2.114

Shiddiqua, N., Rahman, M., & Hossain, M. (2018). Mobile phone use and agricultural information access in Bangladesh. *Asian Journal of Agricultural Extension, Economics & Sociology*, 28(4), 1–12. https://doi.org/10.9734/AJAEES/2018/45344

Tadesse, G., & Bahiigwa, G. (2015). Mobile phones and farmers' marketing decisions in Ethiopia. *World Development*, 68, 296–307. https://doi.org/10.1016/j.worlddev.2014.12.010

Udas, S. (2022). Overcoming barriers: Information access and literacy in rural farming communities. *Agricultural Systems*, 198, 103345. https://doi.org/10.1016/j.agsy.2022.103345

Ullah, A., Arshad, M., & Kächele, H. (2020). Information asymmetry, input markets, and farmers' welfare: Evidence from Pakistan. *Land Use Policy*, 90, 104302. https://doi.org/10.1016/j.landusepol.2019.104302

United Republic of Tanzania. (2008). *National agricultural extension strategy 2008–2013*. Ministry of Agriculture, Food Security, and Cooperatives. http://www.tanzania.go.tz/agriculture/naes2008.pdf

United Republic of Tanzania. (2013). *2012 Population and Housing Census: Population Distribution by Administrative Areas*. National Bureau of Statistics.

Zecca, F., & Rastorgueva, N. (2016). Information asymmetry in agricultural markets: A systematic review. *Journal of Agricultural Economics*, 67(3), 625–648. https://doi.org/10.1111/1477-9552.12157