Global Journal of Agricultural Research, 14 (1),1-18, 2026
Print ISSN: 2053-5805(Print),
Online ISSN: 2053-5813(Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

Infrastructure and Market Factors Influencing Implementation of Agri E-Commerce Platforms among Smallholder Potato Farmers in *Kenya*

Julius L. Livondo [1]*, Stephen W. Maina [1] and Justus M. Ombati [1]
1 Department of Agricultural Education and Extension, Egerton University
Email: livondo@uoeld.ac.ke jombati@egerton.ac.ke, stephen.wambugu@egerton.ac.ke*

doi: https://doi.org/10.37745/gjar.2013/vol14n1118 Published January 31, 2026

Citation: Livondo J.L, Maina S.W., and Ombati J.M. (2026) Infrastructure and Market Factors Influencing Implementation of Agri E-Commerce Platforms among Smallholder Potato Farmers in Kenya, *Global Journal of Agricultural Research*, 14 (1),1-18

Abstract: The implementation of Agri e-commerce platforms among smallholder potato farmers is increasingly recognised as a pathway to improving market efficiency, transparency, and better farmer incomes. However, adoption in rural settings remains constrained by critical infrastructure and market-related factors. This study examined the influence of these factors on the uptake of Agri e-commerce among potato farmers in Elgeyo Marakwet County, Kenya. Using a mixed methods research design, the study targeted smallholder farmers, Farmer association representatives and ICT county official. Data was collected from 162 farmers, 10 FA representatives and 2ICT officials from the county through structured questionnaires supported by qualitative insights from focus group discussions and key informant interviews respectively. Findings revealed that infrastructural limitations, particularly inadequate internet connectivity, low smartphone ownership, and limited digital literacy significantly hinder farmers' ability to engage with e-commerce platforms. Market factors also severely reduced participation; high transportation costs (40.37%), excessive dependence on brokers (32.92%), poor market structures (21.12%), and lack of storage facilities (5.59%) created substantial barriers to market engagement by the farmers. Chi-square test through a Tobit regression analysis further indicated a significant association between farmers' main source of income and the challenges they experience ($\chi^2 = 25.577$, $p < 0.001$), as well as between marketing challenges and main buyers ($\chi^2 = 21.574$, $p < 0.001$). Qualitative findings reinforced these results, highlighting persistent market inefficiencies, power imbalances caused by broker dominance, and the economic burden of logistics as key deterrents to digital market participation. The study concludes that effective implementation of Agri e-commerce requires parallel investments in rural digital infrastructure, affordable access to smart devices, and value-chain improvements that reduce transaction costs enhancing the farmers' bargaining power. Strengthening market systems and addressing structural constraints remain critical for realising the transformative potential of Agri e-commerce among smallholder farmers in potato production.

Keywords: Agri e-commerce, market access, infrastructure, market constraints, smallholder farmers, Kenya

INTRODUCTION

The agriculture sector of Kenya's economy is significantly impacted by the potato industry. The yearly production of the crop is estimated to be between 40 and 50 billion Kenyan shillings,

making it one of the most significant commodities after maize (Ministry of Agriculture, Livestock and Fisheries [MOALF], 2016). Majority of potato cultivation takes place in mountainous regions, where they make a substantial contribution to the provision of food security, the generation of income, and the creation of employment opportunities. Potatoes, in point of fact, have developed into an indispensable means of subsistence for thousands of smallholder farmers (Bsrat et al., 2025). They not only offer a reliable source of revenue but also constitute a vital component of the diets of millions of consumers in Kenya (Okello e al., 2022).

The potato subsector remains a central component of Kenya's agricultural economy, yet its performance continues to fall short of its potential due to persistent productivity constraints. Recent research indicates that yield levels remain low largely because farmers rely on poor-quality seed, have limited access to improved cultivars, and face recurring pest and disease challenges (Muthoni & Kabira, 2020). Many smallholders continue to depend on outdated production practices and varieties that are highly vulnerable to post harvest and handling losses, leading to depressed output and unstable household incomes. At the same time, changing consumption patterns driven in part by rapid urbanisation have increased demand for uniform, high-quality potatoes suited for processing into products such as crisps and chips (Kaguongo et al., 2021). While a section of farmers has begun adjusting to this emerging market niche, the wider value chain remains affected by limited adoption of modern technologies.

Beyond production-related constraints, access to reliable and profitable markets presents an additional challenge. Smallholder farmers often encounter high transaction costs, dependence on intermediaries also known as brokers, and limited access to price information, all of which diminish their bargaining power and reduce farm-gate prices (Maina et al., 2024). Although agri e-commerce platforms have emerged as a promising solution for improving market linkages by connecting farmers directly to buyers, adoption rates remain low. Recent evidence attributes this slow uptake to weak infrastructure, limited digital literacy, and the absence of coordinated farmer institutions that can drive collective participation (Kiprono & Mutai, 2023).

Infrastructure development, in particular, forms the foundation upon which successful agri e-commerce systems operate. Weak rural physical and digital infrastructure including poor roads, inadequate storage, unreliable transport networks, and limited mobile or internet coverage significantly constrains farmers' ability to effectively use digital platforms. Studies emphasise the need for strategic investments in rural roads, cold storage, and efficient logistics, as well as expanded broadband and mobile connectivity, to unlock the potential of digital agricultural markets (Zhang et al., 2020). Strengthening these systems not only facilitates farmers' engagement with e-commerce platforms but also reduces post-harvest losses, improves supply chain efficiency, and enhances timely access to wider, more lucrative markets (He et al., 2020).

Theoretical Underpinning

This study was guided by the Theory of Constraints (TOC) as proposed by Goldratt (1992). The theory focuses on identifying critical limitations within a system that hinder optimal performance

and implementing targeted interventions to overcome them (Goldratt, 1992). In respect to this study, the theory helps look into infrastructure and market factors that promote or impede implementation of e-commerce platforms among smallholder farmers. According to this theory, any system has at least one constraint that restricts its ability to achieve desired outcomes. By addressing these constraints, system performance can be significantly improved (Taylor & Esan, 2012). The Theory of Constraints (TOC) provides a useful analytical lens for understanding and improving systems by identifying critical bottlenecks that limit overall performance. As Taylor and Esan (2012) observe, TOC offers strategic leverage points for enhancing system efficiency in this case, improving farmers' market accessibility. Through its Thinking Process, the theory systematically identifies existing constraints ("what to change"), evaluates feasible alternatives ("what to change to"), and determines practical implementation strategies ("how to bring about the change"). This structured approach is particularly valuable in contexts where constraints are not immediately obvious.

Applied to this study, TOC helps clarify the key bottlenecks hindering effective implementation of Agri e-commerce among potato farmers. The analysis revealed that significant postharvest challenges including high perishability, seasonal fluctuations, and extensive losses act as major constraints that weaken farmers' participation in digital markets. As highlighted by De Silva et al. (2014), potato losses often stem from periods of glut, where surplus production exceeds market absorption capacity, or scarcity, where limited supply constrains market engagement. For smallholder farmers, these challenges are compounded by limited access to reliable market information, inadequate storage facilities, and insufficient understanding of market dynamics, all of which inhibit their ability to leverage e-commerce platforms effectively.

However, the theory's application must acknowledge certain limitations. TOC assumes that constraints are stable over time, yet agricultural markets are highly dynamic. For instance, changes in consumer demand, supply fluctuations, or price volatility may alter existing bottlenecks irrespective of the solutions implemented. As Jorge-Vázquez et al. (2021) emphasise, continuous monitoring through mechanisms such as market surveys is essential to determine whether identified constraints remain relevant and whether interventions remain effective. In essence, the Theory of Constraints provides a strong theoretical grounding for this study by helping identify infrastructural and market bottlenecks such as poor roads, limited digital connectivity, high transport costs, and weak market information systems that must be addressed for Agri e-commerce platforms to gain dominance effectively among smallholder potato farmers.

LITERATURE REVIEW

As the agriculture landscape continues to evolve globally, the integration of digital technologies has become essential for transforming farming practices and improving market access for farmers (Adnan, Mutlu & Durmaz, 2025). According to Adnan et al. (2025) among these innovations, agri e-commerce platforms hold significant potential to connect farmers directly with markets, reduce post-harvest losses, and enhance profitability. However, the successful implementation of such platforms among smallholder farmers in developing regions like Elgeyo Marakwet County

depends not only on the technical capabilities of the platforms but also on a complex interplay of infrastructural and market factors.

Limited access to digital infrastructure, low digital literacy, and inadequate institutional support often hinder effective utilisation of Agri-e-commerce platforms. To address these challenges, Castella et al. (2022) observe that many countries have adopted Innovation Platforms (IPs) as catalytic mechanisms that bring together diverse stakeholders to jointly identify bottlenecks, co-design solutions, and coordinate the implementation of digital market innovations. Innovation Platforms have been particularly instrumental in countries like India and China, where they have facilitated shared learning, strengthened local ownership of digital tools, and aligned technological solutions with farmers' needs and socio-economic contexts (Dror et al., 2016).

Infrastructure gaps however remain one of the most persistent barriers to the effective adoption of agri-e-commerce among smallholder farmers across both developed and developing countries (Johnson et al., 2022). In the United Kingdom, for example, limited access to affordable and reliable internet services continues to disadvantage farmers in remote rural areas. Despite government subsidies supporting broadband expansion, studies still show a pronounced divide in digital access between rural and urban farming communities (Johnson et al., 2022). This inequality restricts the ability of many smallholders to participate fully in digital marketplaces.

The purpose of the E-Agriculture Strategy that Uganda has devised is to provide assistance to smallholder farmers in gaining access to digital platforms and marketplaces. Increasing digital literacy, broadening access to the internet, and forming partnerships with private businesses in order to provide mobile-based e-commerce solutions are the primary focusses of the plan. According to Kintu et al. (2021), the government has made headway in expanding mobile network coverage, which has enabled farmers to access agricultural information and market opportunities using mobile phones. This has been made possible by the government's efforts. In addition, Kintu et al. (2021) argues that for Uganda to reap the full benefits of agri-e-commerce, the government should make a greater investment in internet infrastructure and digital training programmes.

Adebayo et al. (2021) contend that despite technological advancements, adoption of e-commerce platforms is delayed due to the high costs of mobile data, inadequate internet infrastructure, and poor levels of digital literacy among elderly farmers. In this respect, there is a model that might be adapted to Kenya's agricultural policies, and that model is the incorporation of smallholder farmers into digital agriculture in Ghana and Nigeria. However, as Adebayo et al. (2021) point out, in order to overcome these obstacles, inclusive policies that place emphasis on inexpensive internet access, training in digital literacy, and subsidies for mobile phones are required.

In East Africa, Kenya has made notable strides through initiatives such as the Digital Farmers Programme and partnerships supporting mobile-based trading systems like M-Farm and Twiga Foods. These innovations have improved market linkages for many producers. Nevertheless, rural areas continue to suffer from weak network coverage and inconsistent access to affordable devices, constraining the broader impact of digital agriculture (Njeri & Onyango, 2021). While the

government has subsidised mobile phones and internet services to encourage uptake, these efforts require further expansion to reduce persistent infrastructure gaps.

In Kenya, the Digital Farmers Initiative has been instrumental in facilitating the connection of smallholder farmers with agri-e-commerce platforms. This initiative has received backing from both the government and private sector partners. According to Mwaura (2022), mobile platforms such as M-Farm and Twiga Foods have revolutionised market access for Kenyan farmers. These platforms have made it possible for farmers to sell their products directly to consumers, hence lowering the costs of transactions and boosting the profitability of their businesses.

In addition, the government of Kenya has made it easier for farmers to participate in digital trade by providing subsidies for mobile phones and internet services. Nevertheless, as Njeri and Onyango (2021) point out, difficulties continue to exist, particularly in rural areas where internet access is restricted and digital literacy is still at a low level. Despite these obstacles, Kenya has witnessed a substantial increase in the number of agricultural services that are based on mobile devices. Furthermore, the government's ongoing investment in digital infrastructure is anticipated to encourage a wider use of e-commerce platforms throughout the years to come. This study adopts the conceptual framework illustrated in Figure 1 to address the main objective of this study

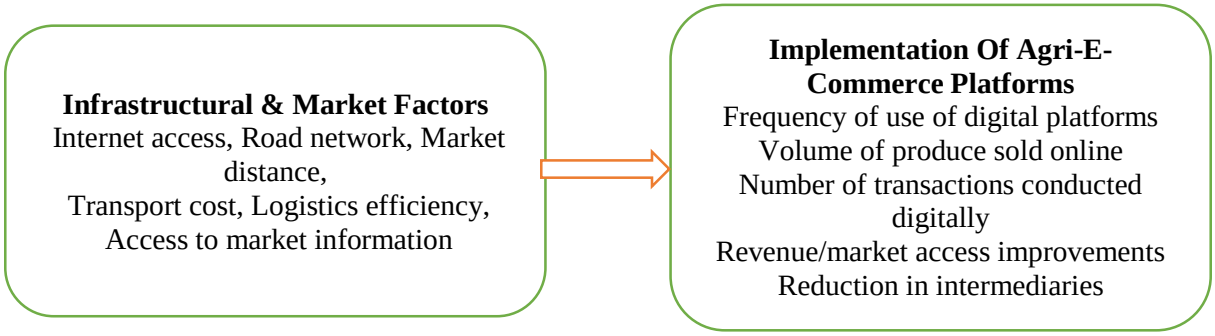

Figure 1: Conceptual Framework

Digital infrastructure, including internet access, road networks, transportation systems, and market information flows and distance from the market play a central role in enabling or hindering the implementation of agri-e-commerce platforms. Poor infrastructure and market access conditions restrict platform usability and limits farmers' access to online buyers. Recent research confirms that limited or unreliable internet connectivity, long distances to major roads or markets, inadequate logistics, and high transport costs remain major barriers to digital agriculture adoption in Africa and globally (Johnson et al., 2022; Mokoena, 2022). Hence, infrastructure determines whether the technological components of e-commerce platforms can be properly implemented and accessed by smallholder farmers.

Global Journal of Agricultural Research, 14 (1),1-18, 2026
Print ISSN: 2053-5805(Print),
Online ISSN: 2053-5813(Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

MATERIALS AND METHODS

This study adopted a participatory action research (PAR) design integrated within a mixed-methods approach. According to Feekery (2023), participatory action research is appropriate for studies that not only seek to understand a phenomenon (not only to document farmers' experiences with agri e-commerce in the case of this study) but also involve participants collaboratively in diagnosing problems, planning actions, implementing interventions, and reflecting on outcomes (Feekery, 2023). The mixed methods research approach Creswell (2021) involved collection and analysis of both quantitative and qualitative data to provide a more complete understanding of the research problem. The study was conducted in Elgeyo Marakwet County, Kenya, one of Kenya's 47 counties. The target population consisted of 629 potato farmers, 10 staff members from the Elgeyo Marakwet Farmers' Association and 2 ICT county officials. A sample of 245 farmers is drawn through

In research, sampling has been defined as the process of selecting a sub-set of cases to be included in a study from which a researcher draws conclusions about the entire set of population (Hernandez et al., 2019). Reilly et al. (2019) adds that a sample is a small set of cases a researcher selects from a large pool and generalises its findings to the entire population.

A multistage sampling technique was used to select study participants. At first level, a stratified random sampling was used to select potato farmers proportionally from the four sub-counties of Elgeyo Marakwet County. This approach ensured that each sub-county was adequately represented and helped minimise selection bias. The sample size of farmers was obtained using Slovin's formula as illustrated below:

$$n = \frac{N}{1 + Ne^2}$$

$$n = \frac{629}{2.5725} = 244.57$$

$$\boxed{n \approx 245}$$

Where:

n= desired sample size
N= size of the population (629)
e = margin of error (0.05 for 95% confidence level)
Substituting the elements;
The estimated sample size was 245 farmers

A structured questionnaire guide was used for data collection and analysed using SPSS version 26. Interviews were also conducted with FA officials and county officials and analysed using thematic analysis.

Global Journal of Agricultural Research, 14 (1),1-18, 2026
Print ISSN: 2053-5805(Print),
Online ISSN: 2053-5813(Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

RESULTS AND DISCUSSION

The study examined infrastructure and market factors influencing the level of participation and implementation of agri e-commerce platforms among potato farmers in Elgeyo Marakwet County, Kenya. Table 1 displays the four infrastructural factors in relation to market access by the farmers. The findings as presented in the table present statistical comparisons between farmers whose source of income was from potatoes or business. Such factors as the main buyer, quantity sold, distance to the market, and buyer assessment are therefore presented with associated statistical tests and p-values indicating significant differences between the two groups.

Table 1. Infrastructural Factors

Factor	Potatoes %	Business %	Statistical Test	P
Main buyer				
collection centre	60.0	40.0	Pearson Chi-Square=	
Broker	86.9	13.1	14.494a	0.000
Quantity Sold				
<10 bags	100.0	0.0	Pearson Chi-Square=	
21-30 bags	76.9	23.1	11.412a	0.003
>30 bags	81.8	18.2		
Distance to the market				
<1 km	68.9	31.1	Likelihood Ratio=	0.000*
2-5 km	100.0	0.0	55.739	
>9 km	100.0	0.0		
Buyer assessment				
Reliable	75.7	24.3	Likelihood Ratio=	0.000*
High income	100.0	0.0	34.543	
Timely payment	100.0	0.0		
Others	100.0	0.0		

*Likelihood ratio

Regarding main buyers the majority of the farmers (83.3%) sold their produce to brokers with 16.7% choosing to sell their produce at the collection centre. A statistically significant differences of $\chi^2(1, N = 162) = 14.49, p = .000$ was found between the main source of income of the farmers and their respective main buyer with 86.9% of those whose main income was potato/vegetable production selling their produce to-brokers. For those whose main source of economic activity was business, a representation of 13.1% of the respondents who sold their produce to brokers. With respect to the main source of monthly income, 60% of potato/vegetable farmers sold their produce at the collection centre while 40% of those whose main source of income was business sold their product at the collection centre. Nevertheless, it was significantly noted that majority of the participants preferred to sell their to brokers than collection centres ($p<0.000$).

The preferences of the farmers to sell more of their produce to brokers rather than at the collection centres might be due to the outreach activities of the brokers who found farmers at their homestead and paid in cash. Moreover, selling to brokers in this case may save the farmers transportation logistics that may need to be met if selling to the collection centres. It is for this reason that the researcher in making recommends for the study, looks into develop marketing strategies to motivate farmers to sell more of their produce at the collection centres as opposed to brokers. The findings however contradicted those of Tumukunde (2018) whose study findings showed that most farmers sold to potato collection centres as they account for almost a half of respondents (48%). Though, the researcher's explanation on choice of the brokers by farmers were in line with current finding such that the farmers preferred brokerage to farmer associations or collection centres because they would access the produce at the at the farm gate, therefore reducing transportation costs to collection centres.

Regarding the quantity sold 52.4% of the participant sold more than 30 bags of the production, followed by 28.1% who sold 21-30 bags and 19.5% selling less than 10 bags. A statistically significant association was found between quantity sold and the main source of income with Pearson Chi-Square of $\chi^2(1, N = 162) = 11.412, p = .003$. It is worth noting that for those whose main source of income was potatoes the quantity sold varied from 76.9% (21-30 bags) to 100.0 (less than 10 bags). On the other hand, for the farmers whose main source of income was business tended to sell less quantity of bags ranging from 0% which is less than 10 bags to 23.1% which ranged from 21-30 bags as shown in Table 1.

A statistically significant association (Likelihood Ratio=33.774, p = 0.000) was found between the quantity of bags sold and the main buyer with 93.4% of the participant selling more than 30 bags to brokers compared to 6.6% of the participants selling over 30 bags at the collection centre. The preferences of the farmers to sell more of their produce to brokers rather than at the collection centres might be due to the outreach activities of the brokers who found farmers at their homesteads and paid them in cash in situ. Moreover, selling to brokers in this case may save the farmers transportation fees to the collection centres. To this end, at the conclusion of the study, the researcher recommends that institutional centres integrate and promote digital marketing technologies as part of their strategy, in order to motivate farmers to channel more of their produce through the collection centres (Farmer Associations) rather than relying on brokers.

Additionally, Table 1 revealed that the distance is an important infrastructural factor with 51.5% of the participant preferring to sell their produce in a distance of less than one (1) kilometre. Distance is essential when considering where to sell produce for in terms of market accessibility. The results as presented in Table 1 revealed that most farmers preferred to sell their produce to a distance of less than a kilometre. This could be attributed to the high cost of transportation and the road infrastructures in most regions of the county which were mostly murram roads. Consequently, majority of the farmers by deciding to sell their produce in smaller distances meant that they sold to the next available or nearest markets without considering better markets that could be in existence in longer distances. Soe et al. (2015) in their study found that the distance to the market

and timely payment positively influenced the choice of brokers. Brokers reduce transportation costs and costs of searching for markets for the farmers as they move from farm to farm. However, farmers reported that they were exploited by brokers through weighing because their scales were not accurate. More so, the prices that are offered by brokers depend on farmers` bargaining power, thus making them price takers than price makers.

The findings are in line with Slamet et al. (2017) who reported that a unit increase in the distance to asphalt road increased farmer`s probability of selling at the farm gate due to increased travel time and transportation costs. Similarly, Maina et al. (2015) found that older mango farmers in Kenya preferred brokers compared to other marketing channels because they have built a strong network with them due to repeated transactions.

The current study did not use a certain criterion to measure the distance between the collection and farmers choice of selling their produce. However, it can be assumed that the sale of potato produce in a distance less than one kilometre indicate that the farmers would rather sell to brokers who come to buy from their farms. Collection centre is mainly built in shopping centres or small towns which are considerably far from the farmers thus the results are in agreement with the finding by Tumukunde (2018) that farmers in regions further from well-established roads sold their produce to collection centres. The findings concur with Martey et al. (2012) and Muthini et al. (2017) who observed that farmers further from the paved road prefer selling collectively to gain from economies of scale.

When asked to appraise the preferred mode of selling their potato produce, 65.8% of the participants selected reliability as the main reason for selling their produce (see Table 1). Across the main buyers, 67% of the participant selected the main buyers because of its reliability with 76.7% preferring brokers compared to 23.3% who posited that collection centres are reliable. The remaining 33% preferred to sell their produce to brokers because of high income, timely payment and others.

4.4.2 Market factors influencing agri e-commerce platform implementation

4.4.2.1 Famer – buyer relationships

First, the participants were asked to indicate the factors that buyers looked out for when buying potatoes. These factors were measured by the size and quality of production and membership of farmers to associations. The findings are illustrated in Figure 2.

Figure 2. Buyers demands when buying potatoes

From the foregoing, the results indicate that buyers place considerable emphasis on specific product attributes when sourcing potatoes from farmers. Nearly half (45.1%) of the respondents reported that quality was the primary requirement buyers focused on, highlighting the importance of well-graded, disease-free, and visually appealing produce in meeting market expectations. Additionally, 36.4% of the farmers noted that buyers were equally concerned about the size of the potatoes, suggesting that uniformity, maturity and consistency play a significant role in determining marketability and pricing. The fact that 16.0% of farmers reported that buyers consider group membership implies that organised farmers' groups are viewed as more reliable or capable of supplying produce that meets required standards. This could likely be attributed to better coordination, training, and collective bargaining. Only 2.5% indicated that buyers did not specify any requirements, confirming that most transactions in the potato value chain are guided by explicit quality and size standards. Overall, these findings underscore the structured nature of buyer expectations and the need for farmers to align their production and post-harvest practices with market demands to enhance competitiveness and income.

The study further assessed farmers' level of satisfaction with the demands made by buyers when purchasing potatoes. The results show that a majority of the farmers (70.4%) reported being dissatisfied with the buyers, while only 29.6% indicated that they were satisfied with the buyers who purchased produce directly from them. The results are presented in Figure 3.

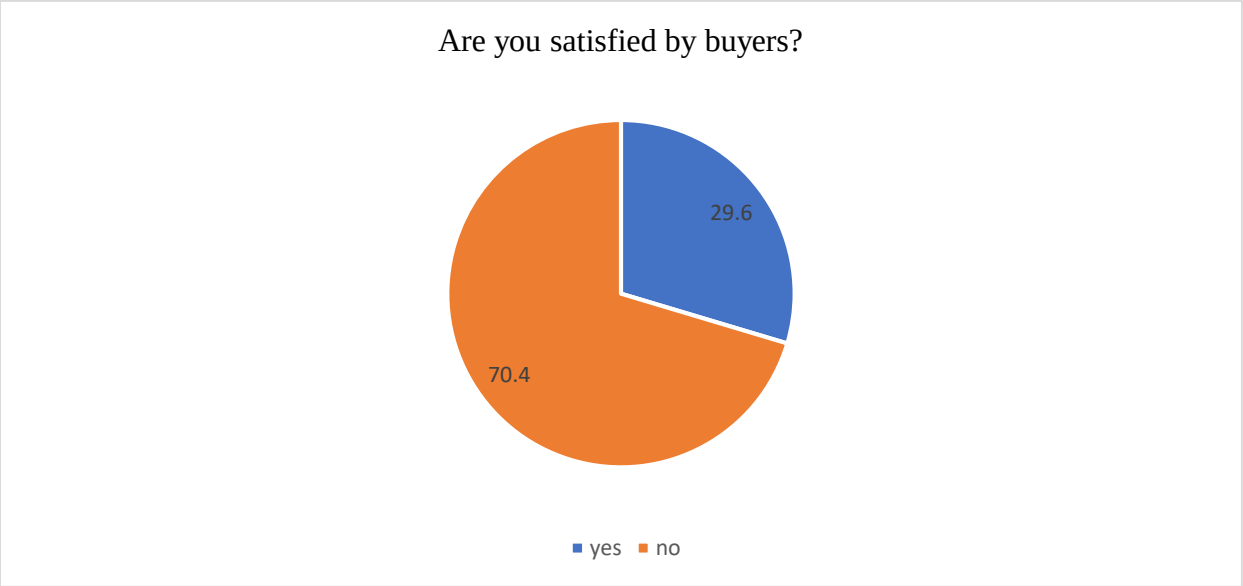

Figure 3. Farmers satisfaction with the buyers

The dissatisfaction displayed by the farmers was attributed to the fact that most buyers imposed stringent quality and size specifications yet they were not willing to pay the price for the good quality potatoes. As a result, farmers felt disadvantaged by the unreliable buyers. The findings also suggest a disconnect between buyers' expectations and the support provided to farmers. The dissatisfaction is likely exacerbated by the lack of capacity-building initiatives. Without training on quality standards, post-harvest handling, and grading techniques, farmers are ill-equipped to produce potatoes that meet market specifications. This not only affects their income but also limits their competitiveness in structured markets.

This brought about the question as to why the farmers were dissatisfied with the by the buyers. As shown in Figure 4, majority (67.9%) indicated that low income in terms of sale price was the main reason while others (17.3%) were of the view that the buyers were unreliable. Nonetheless, 14.8% considered the response to the question not applicable. It was evident that farmers had issues regarding the selling price of their produce and they were not in agreement with the prices that buyers were setting.

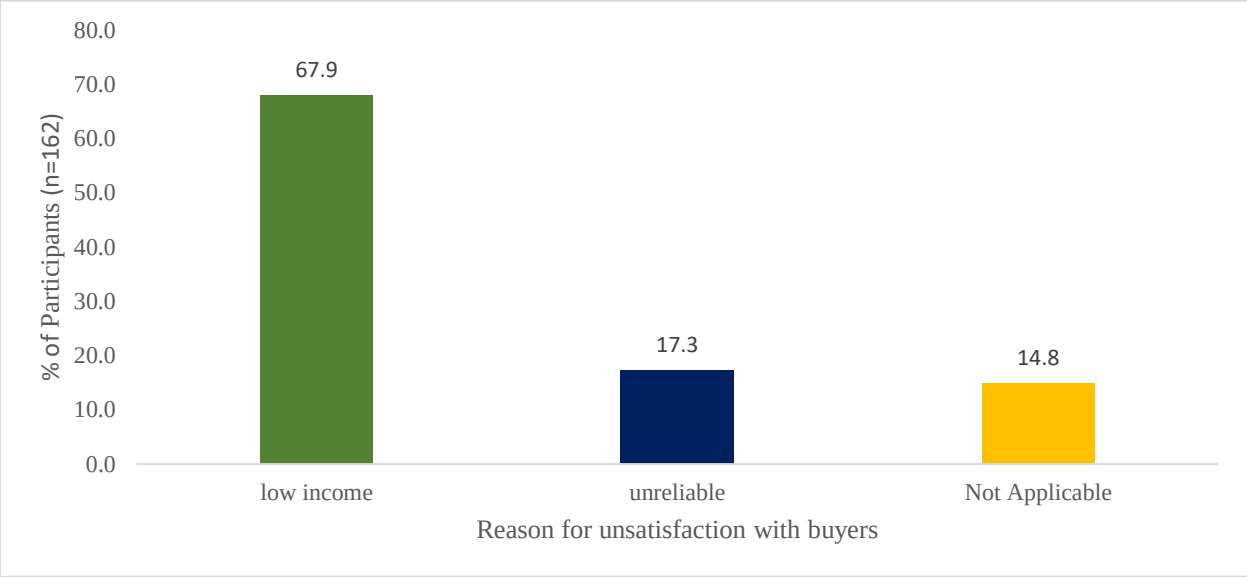

Figure 4: Reason for unsatisfaction with buyers

From Figure 4 above, the findings suggest farmers' dissatisfaction with buyers largely driven by economic concerns, particularly the perception of unfair pricing. This leads to farmers feeling undervalued and inadequately compensated for their produce. The unreliability aspect implies buyers failing to adhere to agreed terms, which undermines trust and stability in market relationships. Overall, these findings highlight a strained farmer-buyer relationship characterised by pricing disagreements and unreliable market behaviour, underscoring the need for more transparent, predictable, and equitable market systems to support farmer livelihoods.

Finally, on whether farmers received any support from the buyers, the findings in Figure 5 show that most of the participants did not receive any support from the buyers. Of the 162 farmers who sold their potatoes to the buyers, only 24.1% received support. A large proportion, 75.9% did not receive any support. This implies that there is lack of support to the farmers from the buyers despite the demands they set when buying the potatoes.

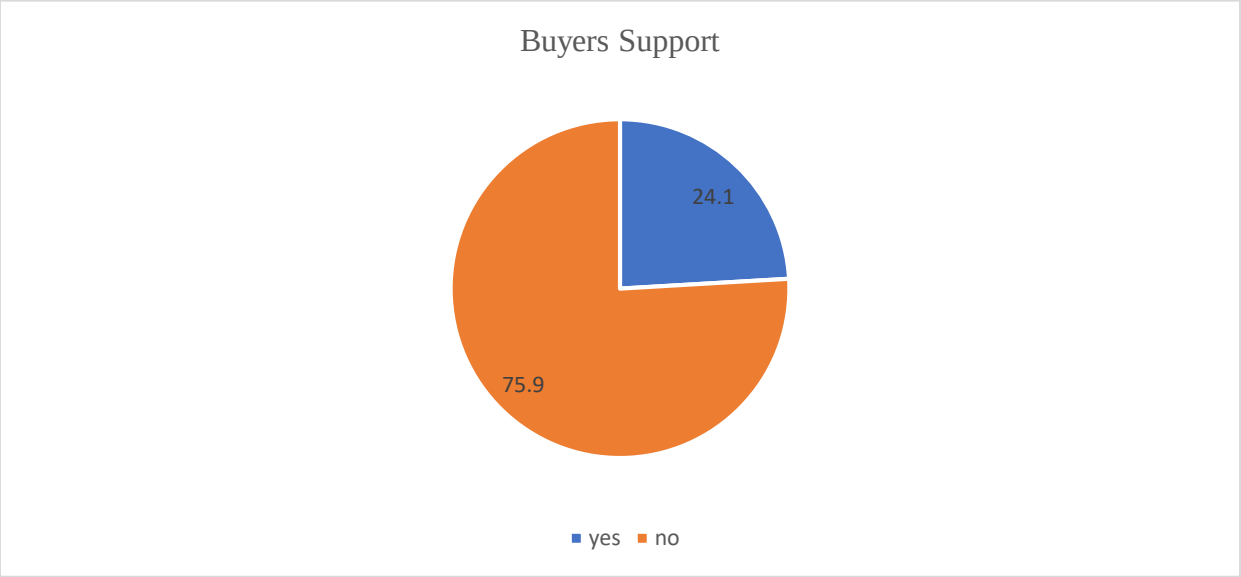

Figure 5: Proportion of farmers getting support from buyers

Farmers' access to market information

In efforts to establish the farmers access to information they were asked; whether they had any information on the market and the prices, what the source of their information was, the frequency at which they received such information and the medium through which they received information on market and price. The findings on these items are presented in Table 2.

Table 2. Farmers' access to information (n=162)

Item	Measure / Value	Frequency	Percentage (%)
Access to information on market and prices	Yes	67	41.4
	No	95	58.6
Source of Market information	Buyer	109	67.3
	Farmers	53	32.7
Frequency of Receiving Market Information	Daily	91	56.2
	Weekly	61	37.7
	Monthly	4	2.5
	Seasonal	6	3.7
Medium of information for farmers	Mobile	17	9.9
	Television	25	15.4
	Word of Mouth	50	30.9
	Internet	52	32.7
	Print Media	18	11.1

The results as illustrated in Table 2 indicate that the majority of farmers lack access to reliable market information, with 58.6% reporting that they do not receive any information on potato market conditions or price trends. This highlights a substantial information gap that may limit farmers' ability to negotiate fair prices, plan production effectively, or respond to market fluctuations. Only 41.4% had access to such market information, suggesting unequal distribution of information resources within the potato farming community in Elgeyo Marakwet County.

Among those who receive market information, most depend heavily on informal and less structured sources. Buyers were identified as the primary source of information by 67.3% of respondents, while 32.7% relied on fellow farmers for any information on market and pricing. The absence of government institutions both national and county as cited by FAO (2017) in Agriculture practicing countries suggests weak institutional involvement in market information dissemination. This indicates that farmers are largely dependent on actors whose interests may not always align with their own, potentially exposing them to exploitation or misinformation.

Regarding the frequency of receiving information, more than half of the farmers (56.2%) reported accessing information daily, while only a small proportion (2.5%) received it monthly. Others accessed information weekly (37.7%) or seasonally (3.7%). The relatively high daily and weekly access implies that farmers who do receive information are actively engaged with market dynamics. This however may relative to a recent study by Magakwe et al. (2025) still holds the quality and reliability of informal channels to market access information questionable.

The channels through which information is accessed further reveal important technological and infrastructural trends. A significant proportion (32.7%) used the internet, suggesting growing digital engagement among farmers, possibly through smartphones or social media platforms. This indicates strong potential for the adoption of agri–e-commerce platforms if farmers receive adequate training and sensitization, contrary to Olatinwo et al. (2024) who found that most maize farmers lacked internet connectivity and therefore could not access market information. Word of mouth (30.9%) remains a dominant channel, showing continued reliance on interpersonal networks for market decisions. Meanwhile, traditional media television (15.4%) and print media (11.1%) still serve as key information conduits, while only 9.9% used mobile phones as a direct information channel, which may reflect low usage of structured mobile-based agricultural information platforms. The result of low usage of mobile phones aligns with studies that have shown mobile phones being a costly requirement for farmers in rural areas who cannot afford smart phones (Olatinwo et al., 2024).

Overall, the findings suggest a mixed readiness for digital agricultural transformation. While the high use of the internet indicates potential for adoption of agri e-commerce, the continued reliance on informal sources such as buyers and fellow farmers, combined with limited government participation in information dissemination, pose challenges to potatoes farmers not just in Elgeyo Marakwet but also other regions in the country. Strengthening institutional support and promoting

digital literacy among farmers would be essential to enhance market transparency and improve farmers' market outcomes (Kolapo & Didunyemi, 2024).

Farmers main source of market information was from brokers who are the buyers. The findings concur with Tumukunde (2018) who found 86% of farmers information was from the buyers. Collection centres provided the farmers with daily information while brokers on weekly basis. It can be assumed that the efficient release of market information uses a mean of communication which did not require face to face meeting between the centres and the farmers, it could be farmers receive information through their mobile phones. The brokers not releasing information to farmers can be a way of ensuring they have the upper hand during price negotiation with the farmers. According to Mitra et al. (2013), the imbalance in market information between farmers and buyers leads to uncompetitive markets which are characterized by low prices. Additionally, under asymmetric market information, farmers become uncertain which increases risks and limits their choices (Oduor, 2015). Moreover, it exposes the farmers to price manipulation by the brokers leading to exploitation as the study by Bizimana (2013) established.

In line with this finding, studies according to Yassin et al. (2016) and Kumilachew (2016) indicated that access to information affect proportion of the value of potato sold positively and significantly. Similarly, Rehima, (2007) and Bezabih et al. (2015) found that access to market information was among the variable that influence surplus. Consistent to this finding; Mahlet et al. (2015) and Yassin et al. (2016) study indicated that access to market information affect farmers' extent of potato sales positively. Similarly, Kassa's (2014) and Million and Belay's (2004) study showed that lack of market outlets and information as important constraints in vegetable production and marketing.

CONCLUSION

The study found that farmers face significant challenges in engaging with Agri e-commerce, including high transportation costs, the dominance of brokers, limited access to reliable markets, and inadequate storage facilities. These challenges disproportionately affect farmers whose primary source of income is potato production, thereby limiting their ability to benefit from digital market systems. The results highlight the infrastructural weaknesses within the potato value chain and emphasise that Agri e-commerce can only be effective when supported by complementary improvements in logistics, infrastructure, and market regulation.

Recommendations

i. Farmer associations and the County Government should prioritise investment in rural digital infrastructure, including expansion of reliable internet connectivity across potato-growing areas, to enhance farmers' ability to access and utilise Agri e-commerce platforms effectively.

ii. The County Government, in partnership with ICT stakeholders should initiate programmes aimed at reducing the cost of smartphones and other digital tools for smallholder farmers, ensuring that affordability is not a barrier to participating in digital markets.

iii. Farmer associations should collaborate with financial institutions to develop subsidy schemes, flexible credit packages, or digital tool financing programmes that enable farmers to acquire mobile devices and connectivity services, thereby encouraging widespread adoption of Agri e-commerce.

REFERENCES

Adnan, N., Rehman, H.M. & Alam, M.N. Exploring agricultural innovation: an empirical investigation of factors influencing the adoption and non-adoption of smart fertilizer technology among farmers in developing countries. *Agric & Food Secur* 14, 11 (2025). https://doi.org/10.1186/s40066-025-00529-0

Belay, K., & Abebaw, D. (2004). Challenges facing agricultural extension agents: A Case Study from South-western Ethiopia. *African development review*, *16*(1), 139-168.

Bezabih, M., Holden, S., & Mannberg, A. (2016). The role of land certification in reducing gaps in productivity between male-and female-owned farms in rural Ethiopia. *The Journal of Development Studies*, *52*(3), 360-376.

Bizimana, D. (2013). *Health, Education, Agriculture & Land Rights among Batwa (HEAL) Project.* CARE Uganda, Kampala.

Bsrat, A.B., Gebru, K.M., Ayele, T.H. Lema, G.G. (2025). Impact of potato business on household food security: An empirical study from Tigray regional state, Ethiopia. *Journal of Agriculture and Rural Development in the Tropics and Subtropics 126*(1), 53–63 https://doi.org/10.17170/kobra-2025011410818

Castella, J.-C., Lestrelin, G., Phimmasone, S., Tran Quoc, H., & Lienhard, P. (2022). The Role of Actor Networks in Enabling Agroecological Innovation: Lessons from Laos. *Sustainability*, *14*(6), 3550. https://doi.org/10.3390/su14063550

De Silva, M. J., Breuer, E., Lee, L., Asher, L., Chowdhary, N., Lund, C., & Patel, V. (2014). Theory of change: A theory-driven approach to enhance the Medical Research Council's framework for complex interventions. *Trials*, *15*(1), 1–13.

Dror, I., Cadilhon, J.J., Schut, M., MisikoM M., & Maheshwari, S. (2016). Innovation Platforms for Agricultural Development: Evaluating the mature innovation platforms landscape. Routledge.

FAO. (2017). *The future of food and agriculture – Trends and challenges.* Rome

He, X., et al., (2020). Digital inclusion in Chinese agriculture: Government support for Rural Taobao. *Rural Transformation Journal*, *18*(2), 90-102.

Johnson, R., Matthews, P., & Edwards, A. (2022). Agri-tech strategy and the rise of e-commerce in UK agriculture. *Journal of Agricultural Policy*, *47*(3), 99-115.

Jorge-Vázquez, J., Chivite-Cebolla, M. P., & Salinas-Ramos, F. (2021). The digitalization of the european agri-food cooperative sector. Determining factors to embrace information and communication technologies. *Agriculture*, *11*(6), 514.

Kaguongo, W., Gildemacher, P., & Demo, P. (2021). Adoption and impact of improved potato varieties in Kenya. *African Journal of Agricultural Research*, 16(3), 444–456.

Kintu, M., Kabirizi, R., & Ndawula, S. (2021). The role of e-commerce in the Ugandan agricultural sector: Government policies and farmer adoption. Uganda Agricultural Review, 10(2), 37-51.

Kiprono, S. J., Mengich, G., Ondigo, B. N., Mutai, C., & Kimoloi, S. (2023). *Therapeutic uses of stingless bee honey by traditional medicine practitioners in Baringo County, Kenya.*

Kolapo, A., & Didunyemi, A. J. (2024). Effects of exposure on adoption of agricultural smartphone apps among smallholder farmers in Southwest, Nigeria: implications on farm-level-efficiency. *Agriculture & Food Security*, *13*(1), 31.

Magakwe, A., Olorunfemi, O., & Sithole, A. (2025). Factors influencing smallholder farmers' participation in collective marketing: micro-level evidence from Ehlanzeni, South Africa. *Frontiers in Sustainable Food Systems*, *9*, 1567943.Mahlet et al. (2015)

Maina, F., Mburu, J., & Nyang'anga, H. (2024). Drivers of extent of commercialization of potato farming through digital marketing platforms in Nakuru County, Kenya. *Front. Sustain. Food Syst. 8*,1307978. doi: 10.3389/fsufs.2024.1307978

Martey, E., Annin, K., Wiredu, A., & Attoh, C. (2012). Does access to market information determine the choice of marketing channel among smallholder yam farmers in the Brong Ahafo Region of Ghana? A multinomial logit regression analysis. *Journal of Economics and Sustainable Development, 3*(12), 18–28.

Mitra, S., Posarac., A.& Vick, B. (2013). Disability and Poverty in Developing Countries: A Multidimensional Study. World Development, 41(C), 1-18.

Ministry of Agriculture, Livestock and Fisheries [MOALF], (2016). *Climate Risk Profile for Meru. Kenya County Climate Risk Profile Series.* The International Center for Tropical Agriculture (CIAT) and the Kenya Ministry of Agriculture, Livestock and Fisheries (MoALF), Nairobi.

Mokoena, N. (2022). Private-public partnerships and their role in promoting agri-e-commerce in South Africa. *South African Agricultural Review, 8*(3), 76-89.

Muthini, D., Nzuma, J., & Qaim, M. (2020). Subsistence production, markets, and dietary diversity in the Kenyan small farm sector. *Food Policy*, *97*, 101956.

Muthoni, J., & Kabira, J. (2020). Potato production in Kenya: Current status and challenges. *International Journal of Horticulture*, 10(4), 45–56.

Oduor, F. O., Raburu, P. O., & Mwakubo, S. (2015). To conserve or convert wetlands: Evidence from Nyando wetlands, Kenya. *Journal of development and agricultural economics*, *7*(2), 48-54.

Okello, J. J., Zhou, Y., Kwikiriza, N., Ogutu, S., Barker, I., Geldermann, E. S., Atieno, E., & Ahmed, J. T. (2017). Productivity and food security effects of using certified seed potato: the case of Kenya's potato farmers. Agriculture & Food Security, 6(25), 1–9. doi: 10.1186/s40066- 017-0101-0.

Olatinwo, L., Yusuf, O., & Wahab, J.M. (2024).Farmers' use of phone applications in accessing information for maize production in Kwara state, Nigeria. *Journal of Kerbala for Agricultural Sciences 11*(4), 44-56 DOI:10.59658/jkas.v11i4.2787

Rehima, M., Belay, K., Dawit, A., & Rashid, S. (2013). Factors affecting farmers' crops diversification: Evidence from SNNPR, Ethiopia. *International Journal of Agricultural Sciences, 3*(6), 558-565.

Slamet, A. S., Nakayasu, A., & Ichikawa, M. (2017). Small-scale vegetable farmers' participation in modern retail market channels in Indonesia: the determinants of and effects on their income. *Agriculture*, *7*(2), 11.

Taylor, L. J., & Esan, T. O. (2012). Goldratt's theory applied to the problems associated with the mode of transportation, storage and sale of fresh fruits and vegetables in Nigeria. *J African Re Bus Technol*, 2012, 1–16.

Tumukunde, E. S. (2018). *Determinants of choice of marketing channels among potato farmers in Musanze District, Rwanda: evidence after the 2015 potato market reforms* (Doctoral dissertation, University of Nairobi).

Yassin, M. A., Alazba, A. A., & Mattar, M. A. (2016). Artificial neural networks versus gene expression programming for estimating reference evapotranspiration in arid climate. *Agricultural Water Management, 163*, 110-124.Zhang et al., 2020

Zhang, L., & Li, J. (2020). Exploring infrastructure improvements in rural China: Agri-e-commerce and beyond. Journal of Rural Development Studies, 18(3), 58-71.