Characteristics of Smallholder Potato Farmers of the Warumarket E-Commerce Program in Elgeyo Marakwet County, Kenya

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ABSTRACT

This paper set out to investigate the socio-demographic factors, farming history, and the digital literacy levels of small-scale potato farmers undergoing the Warumarket online shop program, in Elgeyo Marakwet County, Kenya. The key ones were to characterize the farmers by gender, age, education, income, and level of group membership, and their awareness and use of digital platforms, both prior to and following training interventions. It utilized a descriptive survey-based research design and used stratified random sampling to select a sample of 162 farmers out of a population of 3, 200 registered Warumarket farmers. Research data have been gathered using structured questionnaires, and analyzed in terms of frequencies, percentages and means.

The results indicated that the majority of respondents were women (52.5%) and that a large proportion was comparatively young since about half of them had less than 40 years of age. Majority of the farmers had attained secondary school education (66.7%), and a majority of them were in small households (72.2 with 1 to 3 persons). The income level was largely low and 60.5 percent earned below in Kenya shillings. Fewer had connections with farmer associations (only 21 percent) and an additional 65 percent were relatively inexperienced farmers. Before training, there was little prior awareness of e-commerce platforms (mean score 10.6/40) and after training, awareness levels increased significantly (mean 28.0/40), with men and better-educated farmers being more aware of them prior to training.

The conclusion of the study is that Warumarket clients are primarily low-income, medium to poorly educated, women and young farmers that need a specific support in the use of the digital tools. It suggests that digital literacy training should be made more solid, that access to the internet should be expanded, that customer service should be better and that outreach to more elderly and female as well as less-educated farmers should be managed to make digital agriculture a more inclusive phenomenon.
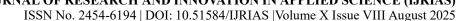
Keywords: E-commerce, small holders' farmers, Warumarket, digital literacy, digital inclusion, Elgeyo Marakwet County, agricultural marketing

INTRODUCTION

Background of the study

Agriculture continues to be an important part of the Kenya economy with the sector contributing about 33% to the nation GDP and more than 70% of rural population working in the sector (FAO, 2023). Potato farming is one of the leading agricultural products in Kenya and forms one of the main sources of household income and food security in the highland's areas of Kenya such as Elgeyo Marakwet County (CIP, 2019). Potatoes are the second biggest staple food crop after maize and they underpin the livelihood of over 800 thousand smallholder farmers (Njuki et al., 2021). Nonetheless, potato is a promising industry, which is undergoing serious predicament, especially in relation to market entry, fluctuation in prices, and middlemen exploitation (Kirui, Okello & Njiraini, 2019).

Due to the growth of the digital technologies, agricultural e-commerce has begun to be perceived as the possible way to overcome these ages-old inefficiencies (Aker & Blumenstock, 2022). Electronic commerce will enable

the smallholder farmers to sell their produce directly to consumers or other buyers and avoid exploitative middlemen and increase the level of transparency in price and trade (Su, Xu & Zhang, 2021). The platforms provide an avenue through which aggregation, logistics, and timely market information can be attained as well (Smidt & Jokonya, 2022). Digital agriculture, applied efficiently, can serve to achieve better incomes, reduced costs, and enhance resistance among agricultural producers in the rural world (Mani & Singh, 2022).

Kenya has also experienced a growing demand of digitizing agriculture by using mobile applications, USSD services and the Internet (Munyua & Adera, 2021). Digital innovations have been introduced by the government and the development partners in order to modernize value chains, increase financial inclusion, and increase productivity (Gao, 2022). Some of these initiatives include Warumarket, an emarketing enterprise introduced in Elgeyo Marakwet County to enable smallholder farmers to market their products, potatoes. Warumarket aims at enabling the farmer to reach customers, make bulk deals, and eliminate brokers (Maina, Mburu & Nyangang, 2023).

Although such types of platforms have great potential in many areas, there is unit adoption among rural farmers. Digital illiteracy, lack of access to smartphones, gender difference, a lack of a proper education, and socio-economic drawbacks contribute to uptake barriers (FAO, 2022). It has been revealed that educated, young, and mostly affluent farmers tend to use digital platforms more than other farmers, especially those who are less educated, older, and female, thus remaining behind (Agholor, 2024).

In addition, the majority of the existing studies concentrate on either technical structure or economic possibility of the digital platforms, with very few players examining the nature of the users (Smidt & Jokonya, 2022). It is necessary to know who is using the websites such as Warumarket and how they interact with it and the barriers and enablers that are involved in this participation (Shakhovskoy & Saab, 2021). It is also important to create a socio-demographic and awareness-based profile of the users so that interventions can be devised that is inclusive and responsive to local realities (Vavekanand & Kumar, 2024).

The given study, thus, aims at addressing such a gap in the literature by defining the demographic and economic picture of smallholder potato farmers engaging in Warumarket, understanding their level in terms of knowledge of digital marketing, their level of awareness after a training intervention, and the level of platform adoption. The results will guide the implementation of measures to boost the representation of underserved populations and the inclusiveness of e-commerce agriculture in the Kenya countryside.

Statement of the Problem

Digitizing agriculture holds the transformative potential to revolutionize smallholder farmers in terms of access to markets, asymmetric prices, and ineffective value chains, which were historically encountered (Agholor, 2024). The use of online platforms such as Warumarket has been seen in Kenya so as to connect farmers directly to buyers to reduce the interference of the middlemen and to increase the efficiency of marketing farm produce (Maina, Mburu, &Nyangang, 2023). Nonetheless, even though there is more focus on digitizing agriculture, the reality is that smallholder farmers are not using e-commerce platforms equally or in high numbers (ARCHAIC, USE 2020-2025).

Digital adoption is very challenging to many of the rural and disadvantaged farmers. They are poor digital literacy, inability to access a smartphone or stable internet, social-cultural rules particularly in application to women and lack of knowledge about the functionality of digital platforms or the advantages they bring (FAO, 2022). Among the farmers better-educated, their fresher, and younger farmers are ready to accept such kind of innovations, among the others: older, female, and less-educated farmers are likely to fall behind, exercising the already present digital divides and deepening vanities of rural inequalities (Agholor, 2024; Maina et al., 2023).

In Elgeyo Marakwet County one of the largest producers of potato farmers are still principally relying on the traditional marketing channels where middlemen tend to suppress the farm gates price and lowers the bargaining strength of farmers (Kenya News Agency, 2022). Warumarket was developed to address these inefficiencies by delivering a well organised e-commerce system. However, not much has been said about demographics, knowledge levels or even digital preparedness of the actual users of it. It is critical to know the users of the

platforms, the manner they are used and the rationale surrounding the use in order to make these platforms work and be successful.

This paper narrows down the research and fills in this very important gap by profiling smallholder potato farmers who work with Warumarket. It examines the variables: gender, age, education, income, experience in farming, group membership and baseline digital awareness. Such understanding will aid in designing outreach and capacity-building programs that will foster inclusive digital agriculture and be able to avoid the sidelining of vulnerable populations of farmers.

Research Question

What are the social-demographic attributes and magnitude of awareness of e-commerce amidst the smallholder potato farmers in the Warumarket platform within Elgeyo Marakwet County?

Objectives of the Study

This paper has aimed at investigating the social-demographic profile and internet use among smallholder potato producers in the Warumarket online market in Elgeyo Marakwet County. To be more specific, the study was aimed at:

1. Evaluate the extent of digital interaction and platform a potato farmer as a smallholder in solving how to access information.

2. Identify the economic gains that the smallholder farmers would get by using the agri-e-commerce platform.

3. Interview all social and capacity development effects related to taking part in Warumarket.

4. Establish the issues that smallholder potato farmers experience when adapting and fully implementing the Warumarket application.

LITERATURE REVIEW

Agriculture and E-Commerce in Kenya

The agricultural sector is the mainstay of Kenya, accounting about 33 percent of GDP and employing more than 70 per cent of the rural evocoches population (FAO, 2023). Potatoes rank among the staple stock, right after maize and are a much-needed source of food security and household income, particularly in highlands such as Elgeyo Marakwet (CIP, 2019). Irrespective of this significance, the potato value chain experiences numerous bottlenecks as they include post-harvest loss, poor infrastructure, market access restrictions, and exploitative brokerage systems (Njuki et al., 2021).

The digital technology has come as a possible solution to these inefficiencies. Agricultural online stores enable smallholder farmers to reduce the presence of middle men, get fair prices, organize large sales, and be informed about latest growth on the market (Aker et al., 2020). Warumarket is one of such initiatives operating as a mobile-based platform and the web in Kenya, which tends to open more access to markets and new income among rural farmers (Maina et al., 2023). Nevertheless, uptake of the digital has not been even in terms of socio-economics, demographics, and infrastructural dynamics.

Smallholder Farmer Characteristics and Technology Adoption

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Awareness and Impact of Digital Platforms

E-commerce participation is facilitated by the farmer awareness. It is also reported that basic understanding of digital means of communication has a significant impact on intention to participate (Munyua et al., 2020). Many farmers lack the knowledge about how to gain benefits out of e-commerce due to lack of structured sensitization and might be sceptical or might not utilize them to the best of their abilities. Besides, training and other types of interventions have been found to work in the development of digital competence and use of platforms (Gichamba & Lukandu, 2012).

There is little research on demographic characteristics of Warumarket users and also the effect of training on them in terms of knowledge and confidence. This knowledge gap needs to be addressed and this is necessary to improve outreach in such platforms and to make agricultural digitalization more inclusive.

RESEARCH DESIGN AND METHODOLOGY

Research Design

The research study design is descriptive survey because it is appropriate in the process of presenting specific and detailed details about the demographic background and the awareness rate of digital awareness among smallholder potato farmers making use of the Warumarket platform in the county of Elgeyo Marakwet. According to Seeram (2019), descriptive surveys are a viable means to achieve results on how people in the community feel, think, and act in relation to a particular phenomenon- adoption of agri-e-commerce platforms in this case. The structure enabled the researcher to capture a picture of the farmer profile and examine how the aspect of training intervention affected the level of awareness and use of the platform.

Study Area

The research was carried out in the County of Elgeyo Marakwet which falls under the region of the Rift Valley in Kenya. The county is also one of the main potato producing regions in Kenya and it is typified by high levels of dependence on smallholder agriculture. Potatoes are a primary source of household food security and income in this region and farmers are subjected to the problems of inefficiencies of the market, exploitation by middlemen and fluctuations in prices. To deal with these issues, an agri-e-commerce platform called Warumarket was launched in the county to allow farmers to have direct access to buyers, fairer prices and better logistics.

Sampling Procedures

The records of the County Agriculture Office and the administrators of the Warumarket platform indicated the number of the smallholder potato farmer members of the platform as around 3,200. A sample size of 160 farmers (5 percent of the total population) was then sampled according to the rule of thumb of sample size determination by (Curry,1984) (Table 1).

Table 1: Sample Size Determination

Size of Population	Sampling Percent

0–100	100%
101–1,000	10%
1,001–5,000	5%
5,001–10,000	3%
10,000 and above	1%
Source: Curry (1984)	

The sample frame was stratified to main four sub-counties of potato-growing places (Marakwet West, Marakwet East, Keiyo North, and Keiyo South) and simple random sampling was used to select individual respondents proportionally (Table 2).

Table 2: Sampling Frame

Sub-County/Cluster	Target Population	Sample Size
Marakwet West	1,200	≈60
Marakwet East	1,000	≈50
Keiyo North	600	≈30
Keiyo South	400	≈20
Total	**3,200**	**≈160**

Besides, main actors or key informants would include some agricultural extension officers, farmer group leaders and Warumarket coordinators that would be selected purposively due to their roles, knowledge and experience in agricultural marketing and digital platforms.

Data Collection and Sources

Primary information was obtained using a structured questionnaire given to the sampled farmers. The questionnaires were used to acquire demographic data, experience of farming, knowledge about the presence of online platforms, extent of usage of Warumarket, positive economic and social impacts, and hurdles they experienced. Additional qualitative information was gathered in the form of key informant interviews with extension officers and platform administrators in order to verify and complement farmer responses. The secondary data was collected through county agricultural reports, Warumarket records and through the literature.

Tools of Data Analysis

The data that was collected was coded and input into the Statistical Package of Social sciences (SPSS) and then analyzed. Demographic and socio-economic variables were captured in descriptive statistics in the form of frequencies, percentages, and means. Interpretations were reported in the form of tables and charts.

Analytical Technique

This paper utilized descriptive analysis to describe the demographic backgrounds of the farmers, platform use, and economic gains, social and other challenges. A comparative analysis was also provided in terms of gender, age, and education on the areas of digital awareness. Triangulation of qualitative data was done by using interviews to provide insight.

Measurement of Study Variables

- Demographic factors: gender, age, education level, income and household size, farming experience and group affiliation.

- Digital relationship measures: possession of smartphone, access to internet, the degree of training, and frequency of platform use.

- Economic advantages: this includes: market accessibility, predictable income, transaction cost reduction, and fair prices.

- Social and capacity delivery: networking, access to farming information, and confidence in making decisions about agriculture.

- Challenges: internet access, digital literacy, slowness in payments, and the support of the platform.

RESULTS AND DISCUSSIONS

Socio-Demographic Characteristics of Smallholder Farmers

A sample survey of 162 is employed in the study by surveying active potato farmers on the Warumarketagri-e-commerce platform in Elgeyo Marakwet County. The spread in gender of the respondents was relatively balanced with female farmers slightly out numbering their male counterparts, i.e. 52.5 percent (n=85) were women as compared to 47.5 percent (n=77) who were men. This is a positive change in the digital agricultural environment related to gender inclusivity that does not embrace the classical notion of the male dominance in farming practices. It also points out the new empowerment of women through the medium of digital devices, especially in accessing market and making free independent economic decisions.

Regarding the age bracket of the respondents, the sample has a great percentage of youthful and Middle Ages. To be more precise, 19.8 percent of the total population was aged between 20-29, 31.5 percent was aged 30-39, 24.7 percent belonged to the age category of 40-49 and 24.1 percent was aged 50 and above. This heterogeneity in age implies that the proportion of the economically active and potentially innovative farmers who show openness to the use of technology in the process of farming is high. The indication of the younger farmers in the age bracket 20-39 is also evident since online market tools such as Warumarket can prove productive in ensuring that there are more young farmers in this sector compared to what would normally be the case since the farming sector is perceived as being unattractive or less profitable by the younger generation. Generally speaking, the demographic makes it clear it is a technologically willing, gender, and age-diversified community of farmers that participates in platform-based commerce.

Table 3: Demographic Profile of Smallholder Potato Farmers

Demographic Profile	Category	Frequency (n=162)	Percentage (%)
Gender	Male	77	48
	Female	85	53
Age Group	20–29	32	20
	30–39	51	32
	40–49	40	25
	50 and above	39	24

These all indicate that there is a high level of female involvement in the use of agri-e-commerce and a relatively young population that shows a good opportunity of accepting digital technology and innovation in the long run.

Digital Engagement and Platform Usage

In response to the question pertaining to digital interaction, an overwhelming majority of participants (73.5%) claimed to commonly use their smartphones, which means that they rely on the mobile technology as the main interaction tool on their platforms. In addition, 69.1 percent of them confirmed that they had access to quality internet services, and this allowed them to take part in the Warumarket without a problem. The results indicate the high degree of digital preparedness of the smallholder farmers, which contradicts the stereotypes of digital exclusion of the rural populations.

It is important to note here that 56.8 percent of the farmers claimed to have been given some kind of digital literacy training which was offered by government or non-governmental organizations (NGOs). The other respondents used peer to peer learning, informal networks or ground-based knowledge sharing. Another positive projection indicating the migration of smallholders toward the incorporation of technological integration into their daily agricultural activities is the change in adoption of smart phones and the use of the internet coupled with minimal digital setup training. This factor means that smallholders are now taking agriculture technologies more seriously in their day-to-day activities including accessing market info, posting of produce products up to sale, ordering and logistical backing.

Economic Benefits of Using Agri-E-Commerce Platforms

Table 2: presents data on the perceived economic improvements as a result of using the Warumarket platform.

Economic Benefit Indicator	Agree (%)	Disagree (%)
Increased market access	84.6	15
Improved income stability	78.3	22
Reduction in transaction costs	73.5	27
Access to fair pricing	81.4	19

A major purpose of the research was to establish whether the Warumarket platform provides an economic value to smallholder potato farmers in realistic terms. Table 2 shows a self-perception by the farmers of diverse economic indicators. Most of the respondents (84.6%) concurred that there was a huge improvement to their market access since they joined the platform. This is an important result since the smallholder profitability has been hampered by limited market reach in the past.

The 78.3 percent of respondents reported having stronger income stability due to which it can be said that the platform is lessening the volatility usually driven by changing market rates or dependence on middlemen that is made by a market. The question that 73.5% said yes to was that, it trades cost reduced due to either lower transport cost or saved time as they do not have to attend to the physical market. In addition, 81.4% reported that now they obtained better prices on their goods. Part of the reason could be the fact that price comparisons and a direct-to-consumer concept are available through Warumarket.

These findings complement the general body of knowledge that underscores the potential of e-commerce to introduce changes in agricultural sectors. According to Aker et al. (2021), digital platforms are crucial in overcoming market inefficiency, heightening price visibility, and establishing fair trade relationships between rural producers and buyers. Thus, it can be said that the economic consequences of Warumarket extend beyond convenience as it directly helps in reducing poverty and financial sustainability among small holder farmers.

Social and Capacity Development Outcomes

Besides the economic benefit, the research also involved the contribution made by the platform to its users in terms of social and personal growth. A large percentage of the respondents (67.9%) acknowledged that Warumarket has assisted them to connect with other farmers, suppliers of inputs, and buyers. The creation of networked knowledge-sharing ecosystem adds value to the platform in the form of the extended use of the knowledge.

Also, 62.3 percent of farmers reported that they could receive timely farming advice or access farm inputs necessary via integrations or vendors affiliated with the platforms. These characteristics are key in improving efficiency, productivity and sustainability of farming. What matters more is that 70.4 percent of the respondents said that their confidence on running and operating agricultural processes and bargaining on market conditions has escalated by their awareness and exposure to the platform.

The discussion gives insights that digital agricultural platforms are not merely sources of commerce but as sources of learning, empowerment and community mobilizations as well. Capacity to seek expert advice, peer experiences, and logistical support enables the farmers to make decisions and implement superior methods and practices and develop resilience. Thus, Warumarket can not only be considered a virtual marketplace but also a digital extension service that helps in capacity building in the case of smallholder farmers.

Challenges Experienced

Although, there are perceived advantages in the application of using the Warumarketagri-e-commerce platform, there are still a few challenges that perennially leave smallholder farmers particularly unable to take full advantage of digital agriculture. Poor or unstable internet connectivity was the most reported issue which was experienced in 61.1 percent of people. This was particularly more rampant in other parts of Elgeyo Marakwet County that are more distant and infrastructure remains undeveloped. The other key barrier was the low level of digital literacy especially among the older farmers with 43.8 per cent of them reporting difficulty to navigate the platform or use smartphones efficiently. Moreover, 38.9 percent of farmers said that they have delays in payment, and/or system down times that were unreliable and did not make them trust the platform. Finally, 32.7% of respondents emphasised the unavailability of personalisation or approaches to collecting user feedback, which means that the platform was found to have a functional marketplace in place, but insufficient support to address issues or provide updates on training by relying on personalised factors. The findings highlight the necessity to implement technological and human-related barriers to make the agri-digital platform adoption convenient, broad-based, and sustainable with all demographic groups of farmers.

CONCLUSIONS OF THE STUDY

This paper aimed at describing the socio-economic profile of smallholder potato farmers using the Warumarketagri-e-commerce platform in Elgeyo Marakwet County as well as determine the advantages and issues that have been realized by using the Agri-e-commerce platform. The results indicate an equal distribution of genders with more women than men participating and a good representation of various age groups especially among the younger age bracket and in the middle-aged bracket of farmers. This implies that the economically active population is becoming more open to technology powered solutions through the digital agricultural platforms. Its adoption on a broader scale has helped in easier access to the market, better efficiency in price determination and less middlemen exploitation of farmers leading to more stable returns of the participating farmers. These gains are, however, curbed by the continued problems of low or unreliable internet connection particularly in more distant locations, low digital literacy upon older farmers, delays in payment, and poor user support. The paper concludes that although agri-e-commerce sites such as Warumarket could be found to change the landscape of smallholder farms, they can only exist and be inclusive in case of infrastructural, technological, and capacity building factors that restrict large-scale adoption and equal engagement in the industry.

RECOMMENDATIONS OF THE STUDY

Based on the findings, a number of recommendations are postulated as a way of improving the effectiveness of agri-e-commerce platforms. One is the necessity to upgrade the internet facilities in the countryside of farms. National and county administration must focus on the growth and stabilization of digital connectivity with the assistance of the privately owned internet service providers within that nation. Second, to close digital divide, more training on digital literacy should be undertaken with a special focus on older farmers and farmers who have low level of formal education. Third, sites such as Warumarket must consider strengthening their customer service capabilities inclusive of the interaction feedback options and address those with technical and operational complications in time. Fourth, the payment systems should be simplified to facilitate timely compensation of farmers on their produce which is critical in establishing a level of trust and loyalty. Finally, the stakeholders ought to be keen on active participation of women and youth in digital agriculture by providing specific empowerment opportunities and minimizing the social and cultural constraints that discourage them.

Suggestions for Further Research

There are some gaps that should be filled in due to the significance of the present study. Further studies may consider comparing the performance of the various agri-e-commerce platforms in Kenya or East Africa and the experience users receive to come up with the best practices and lessons on how to scale up. It would also be useful to study the effects of such platforms at a broader level and this would include the input supply, transportation logistics, and the post-harvest management's role in the agricultural value chain. It is also suggested to conduct longitudinal studies to determine the long-term impacts of using the platforms to improve farmers' incomes, productivity and household welfare. Besides, a deeper qualitative study should examine gender aspects of digital agriculture because access to such websites as Warumarket transforms the balance of power and intra-household decision-making processes. Lastly, we need policy-oriented study that is capable of assessing the extent to which the policy and regulatory conditions favour digital transformation in the Kenyan smallholder agriculture.

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