Determinants of Participation in Mobile Platforms among Smallholder Agrienterprises: A Case of Agriwallet Platform

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Abstract: *Improved performance and commercialization of smallholder agrienterprises is crucial for long-term sustainability in social and economic development in Kenya. Smallholder dairy agripreneurs struggle with inadequate links between different players in the agricultural value chain, such as input suppliers and buyers of their products. The aforementioned problem could be resolved by participation in mobile based platform like Agriwallet. Despite the benefits of mobile platforms, participation has been reported to be low. This study looked at the determinants of participation in Agriwallet platform among smallholder dairy agrienterprises in Kuresoi South Sub County, Nakuru County. 192 smallholder dairy agripreneurs were chosen using a systematic random sample approach. Main data was collected using a semi-structured questionnaire, and a literature review of prior research, journal articles, and conference publications was performed to obtain secondary data. STATA version 16 was utilized to assess this objective using average treatment estimation framework. Results reveal that Gender of the household head, Agricultural training, household income, Agriwallet training, group membership, education and farm size were found to be important drivers influencing awareness, knowledge and participation in Agriwallet platform. Therefore, the findings will assist policy makers in formulating appropriate policies geared to increased participation in mobile based platforms.*

Keywords: Smallholder dairy agrienterprise, Agriwallet, Participation

1. Introduction

In Kenya, dairy farming plays a significant role in the economy, it is the biggest sub-sector of agriculture contributing 14% of Agricultural GDP and 8% of the country's GDP, although smallholder dairy farmers makeup 80% of the total dairy producers and produces 56% of the total milk in Kenya, they are facing many challenges which include; low quantity and quality of feeds, lack of statistical information on milk market outlets, poor infrastructure, lack of collateral for loans, low technical skills on husbandry practices, reduced access to veterinary and artificial insemination (AI) services (Odero, 2017). Its transformation is crucial to developing the economy and reducing food expenditure.

According to food and agriculture organization and the united nation, ICTs have changed how agrienterprises work. They reduce transaction costs and facilitate communication (EST & Sylvester, 2017). The 21st century is marked by extensive expansion of mobile services, made possible by the most advanced mobile technology, which provide smart mobile phone users with constant access (Karim et al., 2020). The quick development of smartphones, smart payment systems, and wireless telecommunications has considerably enhanced the means of acquisition transactions in the real-world, apart from the use of cards and cash (Seetharaman et al., 2017).

An increase in agricultural productivity can be attributed to knowledge of and access to current information about the weather, the availability of farm inputs and their market prices, as well as modern agricultural technology (Aldosari

et al., 2017). There are now more readily available communication tools as a result of the advancement of information and communication technology (ICT) (Obong *et al.*, 2018). According to Taragola and Lierde (2010), farmer's capacity to make decisions is often impacted favorably by having access to relevant information, additionally, having access to relevant information enables farmers to communicate with one another, extension agents, and other stakeholders (Narine *et al.*, 2019).

Information communication and technology, and mobile phones in particular, are becoming an increasingly major resource for the distribution of information (Santosham & Lindsey, 2015). Mobile based platforms for agrienterprises in rural areas contribute to advancing development. They provide useful ways of information access, innovative marketing, financial access, and good systems of governance formerly inaccessible (Qiang et al., 2012). On the other hand, Mobile manufacturers and application developer enterprises are ever-increasing the capacity, quality, and functionality of platforms. The current mobile platforms are more capable and more usable and their global impacts are going high (Islam & Mazunder, 2010).

With the development of the internet and increased global connectivity, there is now a sizable possibility to raise the standard of living of farmers by implementing technological advancements like mobile applications. Unfortunately, most farmers have not fully embraced these benefits. The effective use of ICTs in developing countries is hampered by a variety of concerns, including a lack of knowledge and skills for using mobile phones and applications, an inability to afford mobiles, applications written in foreign languages,

and network problems (Emeana *et al.,* 2020; Hoang, 2020; Misaki et al., 2018; Rahman et al., 2020).

Ethiopia is among the countries in the world that have the most to gain from digitizing payments in the agricultural sector. With food security being a critical issue, the government has frequently used the e-wallet (an electronic voucher system) to issue food aid that can reach those in need quickly and efficiently (Girma, 2014). To reduce hunger and feed the future, the United States government's program has partnered with the Ethiopian government in using an e-wallet. The service enables farmers to save money, make and receive payments for agricultural products, and also receive government assistance should the need arise (Government of Ethiopia, 2014).

The ADVANCE II project, in conjunction with Mobile Telephone Network (MTN), the largest telecoms carrier in Ghana, identified and developed the mobile money service and built the capacity of a group of nucleus farmers, input merchants, and out growers. The smallholder farmers entered into agreements with the project and were subsequently trained on how to utilize the technology. Smallholder farmers began to use mobile money technology to buy production inputs and receive money from selling their produce. The technology is well-known for being user-friendly, ensuring quick and easy payment of farmers by food consumers, and granting additional access to financial services like insurance, savings, and loans (Abdul-Rahaman & Abdulai, 2022).

Agriwallet platform in Kenya is providing input finance to smallholder agripreneurs, and trade to input providers and buyers, thus improving on food security and incomes for agripreneurs. It works under blockchain technology providing a digital wallet account in which savings and credits are reserved explicitly for use in agricultural input acquisition (MFRAF et al., 2019). According to Emeana et al. (2020) the platform permits smallholder agripreneurs to channel their payment of credits using mobile phone technologies, hence, saving transportation costs to banks as well as improving on-time planning, safety, efficiencies, and openness. In recent times, there has been an increase in acquisition and use of agricultural inputs including certified seeds, inorganic fertilizer, farm equipment, land lease, and paid labor in Kenya. This is associated with the significant role of mobile based financial platforms that contributes to access to loans and savings in agriculture (Kirui *et al.,* 2013). As a result, this study aimed to have more empirical evidence on the determinants of participation in mobile based platforms among smallholder dairy agrienterprises.

2. Literature Review

The use of mobile platforms in agri enterprises can be influenced by several factors such as socio-economic, institutional, entrepreneurial factors, and phone-related factors. These factors could influence the use of mobile wallets negatively or positively.

According to a study done by Uduji and Okolo-Obasi (2018), they found that in rural areas young males participated more than females in the use of e-wallet

program due to the cultural and traditional context, thus increasing women's exposure to poverty. They also found that farmers' level of education, mobile phone access, revenues, mobile network coverage, installed electricity, and access to extension services influenced positively farmer participation in the e-wallet program. In addition, the use of mobile money services needed literacy in operating the mobile phone for searching, managing, and using financial information over the phone (Mohan et al., 2013). According to Poushter (2016), millennials, also known as Generation Y and Generation X are more likely than their more senior counterparts to own and use cellphones. Alampay (2006), study in the Philippines show that people who have attained greater levels of both education and income are more likely to use information and communication technologies (ICT).

Group membership was found to increase awareness and adoption of mobile money technologies among women entrepreneurs in Kenya (Gichuki & Mulu-Mutuku, 2018). Most of the women in rural areas are not educated so groups help them to gain new skills including reading, writing, farming, and the use of a mobile wallet. Akinbile et al., (2014), investigated factors influencing farmer's use of e-wallet in accessing agricultural information; they found out that farmers' cooperative participation influences their use of e-wallets. According to Cao *et al* (2020) research, social and human capital positively affects family farmers' adoption of new technologies. It improves their competitiveness of production and strengthening their organizational structures, consequently, accessing services, marketing, and achieving economies of scale.

In another study done by Abdullahi et al. (2019), experience on farming activities, awareness, and understanding the use of mobile applications had a positive influence on the use of mobile apps. The more farmers get involved in farming for several years the more it becomes their primary activity. These influenced their attitude towards the use of mobile applications, increased awareness, and knowledge of available mobile apps. Abdul-Aziz et al. (2015) and Anselme *et al.* (2012) established a direct relationship between farmers' years of farming experience and their use of mobile phone apps, suggesting that as the farmers' years of farming experience increase, so will their scope of operation, resulting in a greater demand for inputs and a broader reach for output disposal, a circumstance that is very likely to increase the rate of contacts using mobile phone apps.

Mobile payment systems require user trust, which is correlated with their perception of the system's security (Qasim & Abu-Shanab 2016). It is anticipated that the adoption of mobile payment systems will influence customers' potential intent to utilize such payment systems (Sinha & Singh, 2019). Potnis et al. (2017) found that trust was among key factors influencing the use of mobile money. Relative benefits, the extent of trust, and structural assurances were found to have a significant influence on mobile banking. However, the underlying process by which mobile wallets work is very secure as the parties involved are left with a confirmation message of any transaction done.

Training is the cornerstone of future agriculture and the development of farmer capacity, with training informational materials and research support an increase in agricultural innovations. Innovations may be distributed and promoted among farmers more swiftly with the use of mobile technologies and agricultural information and knowledge-sharing platforms (Châtel, 2017; Baumüller, 2013).Boamah and Murshid (2019), reported that training on mobile apps was key in increasing the adoption and use of a mobile wallet. They found that those who received training became regular users and felt comfortable to do transactions themselves; these transactions include receiving and sending cash, making payment, checking their balance, and recharging mobile airtime. Based on data from a 2017 study of family farms in the provinces of Heilongjiang, Jiangsu, and Sichuan, Xia et al. (2019) found that family farmers who have more education and training are more likely to employ green production technology.

3. Methodology

3.1 Study area

The study was conducted in Kuresoi South Sub County, Nakuru County. The Sub County has an area of 548.2 km^2 with a population of 155,324 persons (KNBS, 2019). It borders Narok County to the South, Bomet County to the South West, Kuresoi North Sub County to the North, and Molo Sub County to the East. The area is divided into four wards, 13 locations, and 28 sub-locations. It lies about 1845m.a.s.l. with a latitude and longitude of $0^0$31'S and $35^0$38'E respectively. Dairy farming is a major economic activity in the area contributing to food security and income for farmers, other economic activities include: food crop farming, cash crop farming, fruit production, and sheep rearing.

3.2 Sampling procedure

A systematic random sampling procedure was used to select 96 participants and 96 non-participants of the Agriwallet platform. Kuresoi South was selected due to the high numbers of Agriwallet users as well as a good establishment of Agriwallet technology.

3.3 Empirical model

Many studies have applied probit, logit and to bit modelling in analyzing technology adoption (Masinde *et al.,* 2013; Ouma, 2014). The classic adoption models place heavy assumption on the homogeneity of study units. However, in most cases, homogeneity assumption does not hold. In this study, for example, all agripreneurs could be assumed not only to be aware of Agriwallet but also to have equal knowledge about technology attributes (Kabunga, Dubois & Qaim, 2012). Where exposure bias is evident, classic models estimates becomes inconsistent leading to lack of internal and external validity of the results (Diagne & Demont, 2007).

Homogeneity assumption is violated in a number of ways such as where exposure to agricultural technologies is biased towards or against certain population groupings based on

characteristics such as social status, leading to non-exposure bias (Nguezet et al., 2013; Kabunga, Dubois & Qaim, 2012; Diagne & Demont, 2007). It is envisaged that in this study, agripreneurs with higher social status could be favored by extension agents by being considered as innovators and endowed with persuasiveness in their community. Some of the Agriwallet non-participants are simply not aware of Agriwallet platform and therefore their failure to participate is not deliberate.

To estimate consistently the factors that influence participation in agri-wallet platform, the Average Treatment Effect (ATE) estimation framework was used (Diagne & Demont, 2007; Nguezet et al., 2013). In this study, ATE is the expected effect of exposure on randomly selected agripreneurs from a population (Wooldridge, 2010). A sub-sample of exposed and non-exposed agripreneurs in the agri-wallet platform will be identified during the ATE estimation framework. Sub-sample members were randomly selected to estimate the effect of treatment on the treatment (effect of exposure on agri-wallet platform participation).

This study will expect two levels of exposure to the agri-wallet platform: awareness exposure (having heard of agri-wallet) and knowledge exposure (understanding the attributes of agri-wallet). Given a sample N and assuming that $e = 1$ denotes that an agripreneur is aware, and $e = 0$ denotes otherwise, k=1 denotes that an agripreneur knows agri-wallet attributes and k=0 denote otherwise, N_e denotes all the agripreneurs who are exposed and N_a denotes agri-wallet participants, two outcome levels are expected at the population and individual levels.

Following Diagne and Demont (2007), the population outcomes can be expressed as follows:

$$N_e/N; \ N_a/N; \ \text{and} \ N_e/N_a \dots\dots\dots\dots (1)$$

Where N_e/N is the sample exposure rate, N_a/N is the sample participation rate and N_e/N_a is the sample participation rate among the exposed. Therefore, the mean participation rate in the population due to exposure will be specified following Wooldridge's (2010) methodology:

$$ATE = E(A_1 - A_0/X)\dots\dots\dots\dots\dots (2)$$

Where ATE is the potential population participation outcome, E is the population participation function, A_1 is the mean participation outcome when the agripreneur is exposed and A_0 is the mean participation outcome when the agripreneur is not exposed.

According to Nguezet et al. (2013), at the individual level, three important outcomes can be studied (the ATE when an agripreneur is aware, ATE_1; the ATE when agripreneur is aware and knowledgeable, ATE_2; the ATE when an agripreneur is not exposed, ATE_0).

The ATE when an agripreneur is exposed to the three essential outcomes can be expressed as shown in Equations (3), (4), and (5):

$$ATE_1 = E(A_1 - A_0/X, e = 1)\dots\dots\dots\dots.(3)$$
$$ATE_2 = E(A_1 - A_0/X, e = 1 : k = 1)\dots\dots\dots.(4)$$

$$ATE_0 = E(A_1 - A_0/X, e = 0: k = 0)\ldots\ldots\ldots(5)$$

Where:

A_1 Denote the mean participation outcome for exposed agripreneur

A_0 Denote the mean participation outcome for unexposed agripreneur.

$e = 1$ Denote that the agripreneur is aware

$e = 0$ Denote that the agripreneur is not aware

X Denotes agripreneur characteristics;

k=1 Denotes agripreneur with knowledge of agri-wallet attributes

k=0 Denote agripreneur without the knowledge of agri-wallet attributes

Even with the application of ATE estimation of the parametric-based estimators for the exposed sub-sample, the final modeling will reduce to a standard probit estimation.

4. Result and Discussion

4.1 Determinants of participation in Agriwallet platform among smallholder dairy agrienterprises.

This study sought to explore the determinants of participation in Agriwallet platform among smallholder dairy agrienterprises in Kuresoi South Sub County, Nakuru County. To estimate consistently the determinants of participation in Agriwallet platform, this study used the Average Treatment Effect (ATE) estimation framework

Table 4. 2: Average Treatment Effect

	ATE linear model of Agripreneurs aware of Agriwallet	ATE linear model of Agripreneurs who have knowledge of Agriwallet
Control variables		
Household head gender	0.158285*(0.094)	0.089711(0.094)
Household head occupation	0.051022(0.045)	-0.00295(0.046)
Household head age	-0.00189(0.003)	-0.00077(0.003)
Household head experience	0.005927(0.004)	-0.00332(0.004)
Household head education	0.031506(0.018)	0.033027*(0.018)
Household head income	0.000000556**(0.00)	
Agriwallet training	0.313299*(0.085)	0.065499(0.085)
Agricultural training	0.077748***(0.082)	0.146852*(0.082)
Group membership	-0.19592*(0.0776)	-0.01591(0.078)
total members		0.026294(0.023)
Distance to market		-0.00839(0.011)
Farm size		0.01474*(0.008)
Number of observations	192	
Wald chi^2(10)	54.17	
Log likelihood	-167.29068	
Prob> chi^2	0.0000	

Note: ***, **, *= significant at 1%, 5% and 10% respectively

The determinants of participation in Agriwallet platform among smallholder agripreneurs in Kuresoi South Sub County are shown in the table above. In terms of agripreneurs awareness, the ATE results revealed that the gender of the household head, household income from dairy agrienterprise, Agriwallet training, Agricultural training, and group membership all had an effect. The gender of the household head had a positive relationship with the level of awareness effecting to 16%, implying that the likelihood of a man being aware was greater than that of a woman. A study conducted by (Amri & Kimaro, 2010) revealed that men are more involved in the production of cash crops than women who practice subsistence farming.

Income also had a positive relationship with awareness, which means that those with a higher income were more aware of Agriwallet platform than those with a lower income. Mashi et al. (2022) discovered that more sources of income and ownership of economic assets are both associated with a higher level of awareness of climate smart agricultural technologies.

A unit increase in Agriwallet training had a 31% increase in the level of awareness. For day-to-day farmers, modern agricultural strategies, such as the use of mobile platforms in our case, are always complicated. As a result, effective training is critical for the knowledge and capacity development of agripreneurs (Rasanjali et al., 2021). A unit increase in Agricultural training will lead to 7% increase in awareness, implying that those who received training were more informed than those who did not. Training results in increased knowledge (Eghbali-Babadi et al., 2018). It is also consistent with a study conducted by Joshi et al. (2019), who discovered that participation in training had a significant effect on knowledge/awareness of good agricultural practices he went further to say that extension programs like training and contact are important drivers of awareness. However, group membership had a negative effect on awareness; the reason could be because the platforms under block chain technology are fairly new to agripreneurs.

The study found that education level of the household head, Agricultural training, and farm size all had an effect on attribute knowledge. Harapan et al. (2018) back up the findings in Uganda, where he discovered that the odds of

having good knowledge were correlated with the level of education. This was in line with a study conducted by Oduro-ofori et al. (2014) who discovered that farmers with a higher level of education are likely to be aware compared to farmers with no or lower level of education. Training was discovered to be positively related to knowledge. Lastly, farm size was discovered to be positively related to knowledge level. Individuals with larger farm sizes are constantly looking for ways to improve their productivity (Sheng et al., 2019).

5. Conclusion and Recommendations

Conclusion

The objective of this research was to explore the determinants of participation in agriwallet platform among smallholder dairy agrienterprises. The ATE results showed that, gender of the household head, household income from dairy agrienterprise, Agriwallet training, Agricultural training, group membership, Education and Farm size were found to be important drivers for the awareness, Knowledge, and participation in Agriwallet platform.

Recommendations

The National and County government should set policies and programs that aim at sensitizing extension agents, training agripreneurs and more so target women on importance of mobile platforms , so that agripreneurs can increase their participation in agriwallet platform and consequently gain access to credit and inputs, and increase their yields and income.

6. Future Scope

This study explored the determinants of participation in Agriwallet platform among smallholder dairy agrienterprises. Further research needs to be done focusing on different value chains to give better understanding on the determinants of participation in Agriwallet platform. In addition comparison studies need to be done focusing on different mobile based platforms.

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