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Determinants of awareness and adoption of mobile money technologies: Evidence from women micro entrepreneurs in Kenya

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ABSTRACT

Over the last decade mobile phone based money services continue to expand in most of the developing countries. The spread of the technology is believed to reduce transaction costs and promote market integration. Even with the introduction of mobile money technologies, financial exclusion remains endemic especially with regard to gender aspect. This paper analyses women entrepreneur's adoption of mobile money services in Kenya. The results suggest that women's membership to table banking groups would easily influence awareness and consequently increase adoption of mobile payments services. Also, we established that women's control of enterprise finances and decision making significantly impact on awareness and usage of mobile money technologies. However, women are less likely to adopt mobile banking technology perceived to be out of reach for their communities and those that have hidden charges irrespective of having knowledge of their existence.

1. Introduction

Globally mobile phone coverage has widely expanded from 1 billion users in 2000 to 6 billion in 2015 (GSMA, 2015). A Large part of the coverage is taking place in developing countries (Russell & Ciesliek, 2012). In Sub-Saharan Africa, > 60% of the population is connected to mobile coverage with > 367 million new phone subscribers by mid-2015 (GSMA, 2015). The ability to access mobile network coverage provides opportunities for micro-entrepreneurs to reduce business transaction cost and improve on efficiency (Aggarwal & Klapper, 2012). Increasingly, the expansion of mobile technologies has not only revolutionized the way business is conducted but has provided solutions to financial exclusion challenges (Asongu & Asongu, 2017; Omwansa & Sullivan, 2013).

Kenya has experienced phenomenal growth of mobile money services that have permeated in every sector of the economy. The technology has changed how people transact business and interact with one another (Hughes & Lonie, 2007). It has provided quick and secure person-to-person money transfers, cashless payment of goods and services, and links to bank accounts (Donovan, 2012). However, Kenya still grapples with disparities in the adoption of mobile technologies. A number of authors have examined the nature of mobile technology divide. For instance Kim, Shin, and Lee (2009); Malaquias and Hwang (2016); Zhou, Lu, and Wang (2010) investigated the dynamics of trust and usage of mobile banking. The issue is critical, given that consumers are exposed to mobile banking futures that can be ambiguous and inflexible compared to conventional banking technologies such as automated teller machine.

Considering the rising use of mobile money services and related innovations in Kenya, this study examines determinants of adoption of different mobile money technologies by women micro entrepreneurs in Kenya. We categorize mobile money technologies into four major types:

(i). Mobile money transfer - services allowing users to send or receive money through mobile phones, (ii). Mobile banking services- allowing customers of financial institutions to access their bank accounts and transact via mobile phones, (iii). Mobile payments - services allowing cashless payments for goods and services, (iv). Group transaction services – allowing members of table banking groups to send savings and loan repayments to virtual groups accounts.

2. Literature review

Financial inclusion levels in Sub-Saharan Africa still lag behind other regions; only 25% of the adult population owns a bank account (Costa & Ehrbeck, 2015) in comparison to 39% of the population in Latin America and the Caribbean countries (Blechman, 2016). To spur economic growth and reduce poverty levels, microfinance policies that encourage financial inclusion have been established (Demirgüç-Kunt & Klapper, 2013). Mobile money has the potential to bring efficiency to banking sector by facilitating micro banking services at the convenience of clients. Suri and Jack (2016) observe that mobile phones can efficiently provide 100% financial services to the lower end of the market. Also, the innovation can provide loan disbursements, repayments, and savings exclusively through mobile money (Kikulwe, Fischer, & Qaim, 2013).

Despite the deepening of mobile money technology outreach, adoption is largely determined by access to relevant information. Studies on information systems theory advanced by Davis (1989) observe that adoption process starts with exclusive knowledge of particular technology and later the decision to reject or use the innovation. In addition (Zhou et al., 2010) reports that information regarding technology is a prerequisite before the adoption takes place. However, by its very nature, mobile phone is considered as the link that facilitates the flow of information between inventors and adopters (Chauhan, 2015). Indeed mobile phone technology has been proven to have higher propensity to create awareness of innovations than traditional information dissemination sources such as newspapers, and radio (Donovan, 2012).

Past studies have confirmed that mobile phones and related technologies are indeed improving the livelihoods of rural communities in developing countries. Murendo and Wollni (2016) found that the adoption of new mobile technologies has the potential to increase agricultural productivity. While investigating effects of the information service on crop varieties, Kirui, Okello, and Nyikal (2012) note that information delivered via mobile phone enables farmers to increase yields. Further, knowledge awareness explicitly implies learning and understanding characteristics of a particular innovation. Different authors have examined the nature of cell phone technologies in remittances between rural and urban areas (Adams & Cuecuecha, 2013; Kikulwe et al., 2013) while other studies have focused on the role of cell phones in linking poor communities to microcredit markets (Kaffenberger, 2011; Stuart & Cohen, 2011), Hughes and Lonie (2007) found that access to the mobile phone did improve rural communities market participation, credit access, and spatial arbitrage. However, these studies did not empirically consider factors related to micro-entrepreneurs decisions to adopt mobile money. Nevertheless, the convenience, speed of transaction, as well as lower cost of transferring funds has led to the integration of mobile money technologies in other fronts. Asongu and Asongu (2017) showed that remittances sent through mobile money tend to reduce the impact of negative economic shocks for households, thus providing a form of insurance.

In Kenya, the use of mobile phone technology has become a study case study of financial inclusion. The value of mobile phone-based money transaction had reached \$1.5 billion by 2015,

with an average value of individuals transfers records valued at \$190.3 million (FSD, 2016). From an enterprise perspective, mobile money has increased transfers between business partners (Mbiti & Weil, 2011). This has reduced transaction costs and promoted market integration and exchange. Indeed, studies have identified the potential impacts of mobile money. However, there are a few studies that have empirically analyzed determinants of awareness and adoption of money technologies. This study specifically focused on women entrepreneurs who are likely to be financially excluded from access to formal financial services in Sub-Saharan Africa.

3. Materials and methods

This paper is based on data collected through a survey that was conducted between 2016 January and February 2016 in Nakuru, Kenya. The target population of the study was women micro-entrepreneurs participating in table banking groups. Table banking is a credit kitty raised by group members through monthly savings and interest on both long- and short term credit. Using community based organizations and programmes that promoted table banking groups; multistage sampling procedure was used to select the respondents. The respondents were clustered into table banking groups, using purposive sampling, 392 women micro-entrepreneurs were selected to participate in the study survey.

3.1. Empirical frame work

To empirically establish factors that influence awareness and the adoption of mobile money services, the study focused on mobile technology features. We classify features of mobile wallet technologies into; (i) mobile money transfer services, (ii) mobile banking services, (iii) mobile payments, (iv) group transactions. With regard to empirical model researchers in the past have widely considered the approach of evaluating the adoption of technologies using contingent valuation models. However, contingent valuation models used in the past studies are limited when analyzing the extent of adoption technologies. Two step Heckman model has been applied in some studies because it allows for selection bias. Unfortunately, it is not applied in randomly selected samples studies. In this study, we use double hurdle model to allow for randomly selected samples as recommended by Jones (1989).

In the first hurdle, we apply Probit model to determine the probability of women entrepreneurs awareness of available mobile technology. While in the second hurdle Tobit model is used to determine the extent of adoption of mobile technologies. According to Mignouna, Manyong, Mutabazi, and Senkondo (2011), the model is specified as;

$$\begin{aligned}
 y_{i1}^* &= w_i' \alpha + \mu_i \\
 y_{i2}^* &= x_i' \beta \alpha + \mu_i \\
 y_{i1}^* &= x_i' \beta \alpha + \text{if } y_{i1}^* > 0 \text{ and } y_{i2}^* > 0
 \end{aligned} \tag{1}$$

where y_{i1}^* is denoted as latent variable describing women entrepreneurs knowledge level regarding the four types of mobile technologies while y_{i2}^* is a latent variable describing the extent of women's adoption of the technologies, μ_i represent the error terms distributed as

$\mu_i \sim N(0, 1)$ and $\mu_i \sim N(0, \delta^2)$. In such case Yen and Jones (1997) recommend allowing for heteroscedasticity that can be estimated using maximum likelihood expressed as;

$$L(\alpha, \beta, h, 0) = \prod_0 \left[1 - \Phi(w_i' \alpha) \Phi\left(\frac{x_i'}{\delta_i}\right) \right] \times \prod_1 \left[(1 + \theta^2 y_i^2)^{-\frac{1}{2}} \Phi(w_i' \alpha) \alpha_1^{-1} \Phi\left(\frac{T(\theta y_1) x_i' \beta}{\sigma_i}\right) \right] \quad (2)$$

In non-linear model it becomes difficult to estimate coefficient directly, we therefore calculate marginal effects to provide a better understanding of the magnitudes of the extent of adoption as recommended by (Green, 2012). This is expressed as;

$$E(y_i | y_i > 0) = \Phi\left(\frac{x_i \beta}{\sigma_i}\right)^{-1} \int_0^\infty \left(\frac{y_i}{\sigma_i \sqrt{1 + \theta^2 y_i^2}} \Phi\left(\frac{T(\theta y_1) x_i' \beta}{\sigma_i}\right) \right) \quad (3)$$

4. Results

Descriptive analysis was used to show the characteristics of women entrepreneurs. Overall we observe that the average education level was ten years of schooling which is an equivalent of secondary education under the Kenyan education system. Information presented in Table 1 suggests that only 35% of sampled women belonged to business associations while majority attended a business training event. Further results indicated that 78% of the women micro-entrepreneurs owned and managed a personal bank account; this was higher than the national bank account ownership which stands at 28%. The descriptive statistics indicate that only 35% of women were household heads.

Table 1
Descriptive statistics.

Variables	
Male headed households	63%
Average education level in years	10
Age of respondents	37.5
Business association membership	35%
Entrepreneurial training	75%
Own bank account	78%
Control of enterprise decisions	72%

4.1. Knowledge and usage of available mobile money services

More than half of the respondents were aware of the mobile money services available to them. We note that women entrepreneurs were aware of four categories of mobile money services namely; mobile money transfer, mobile banking, mobile payments, micro-savings and credit services. The services have been in the market for more than Ten years. However, we observe that the services were utilized but in varying degrees, as shown in Fig. 1.

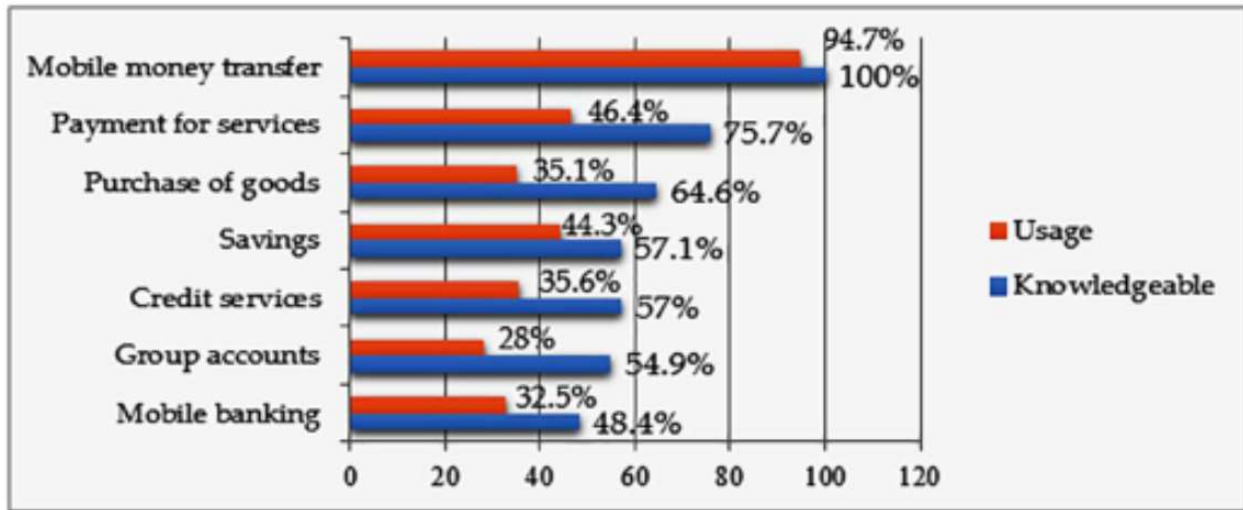


Fig. 1. Knowledge and usage of selected service.

4.2. Determinants of awareness levels and adoption of mobile money services

To estimate the probability of factors that influence knowledge awareness of mobile money services, we use the Probit model built upon random effect maximum likelihood estimation method. While Tobit model is used to determine factors influencing the extent of adoption of mobile money services. The uncensored observation was 11 while uncensored were 394. As previously indicated the magnitudes of the coefficients are difficult to interpret therefore we use marginal effects to interpret awareness levels and extent of adoption.

The results presented in Table 2 specifically focus on mobile money transfer services that enable users to send or receive money through mobile phones. Overall the results presented indicate that marginal effect of education is positive and statistically significant for awareness levels and adoption of money transfers services. We observe table banking membership was less likely to increase women's entrepreneurs' awareness of available services and determine adoption of money transfers services. Owning personal bank account does not create awareness of money transfers services but increases the potential to use the service. Further, women's control of enterprise finances increased the probability of awareness and adoption of mobile money services. Personal savings increased the probability of awareness and adoption levels of mobile money transfers. However, we must take into account that sending and receiving money service is the more dominant use of mobile money in Kenya as evidenced in Fig. 1.

Table 2
Money transfer services.

Variables	Level of awareness		Adoption of technologies	
	First hurdle		Second hurdle	
	Marginal effect	Z-value	Marginal effect	Z-value
Women's age	0.052(0.059)	- 0.09	- 0.004(0.005)	- 0.87
Education (years)	0.260(0.002)*	- 0.95	0.078 (0.018)	4.20***
HH gender	0.019(0.014)	- 1.36	0.001 (0.114)	0.02
Table banking membership	- 0.003 (0.012)	0.31	- 0.162(0.094)	- 1.71***
Business trainings	- 0.016 (0.017)	0.96	0.006 (0.124)	0.06
Personal bank account	- 0.017 (0.017)	1.00*	0.190 (0.132)	1.44*
Control of enterprise finances	0.005 (0.015)	- 0.03	- 0.074(0.118)	- 0.63
Ownership of assets (land)	- 0.040(0.013)	3.34***	0.108 (0.092)	1.18
Personal savings	0.004 (0.0176)	- 0.25	- 0.209(0.163)	- 1.28
Access credit formal banks	- 0.043 (0.016)	2.90***	0.237 (0.117)	- 2.02**

Note: Censored observations 6,11,11. *,**,***Significant at 10%, 5% and 1%.

With regard to mobile payments services that provide cashless payments for goods and service, the results are presented in Table 3. The analysis suggests that women's control of enterprise finances positively and significantly influenced the probability of awareness of services and usage of mobile payments services. Further, findings indicate that table banking membership, and education level was likely to influence level of awareness of available services and determine the usability of mobile payments. Nevertheless, having savings in mobile phones had a higher likelihood to influence level of awareness on mobile payment services than the extent of adoption of service. Interestingly we also observe that male household headship increased level of awareness and adoption levels of mobile payments.

Table 3
Mobile payments.

Variables	Level of awareness		Adoption of technologies	
	First hurdle		Second hurdle	
	Marginal effect	Z-value	Marginal effect	Z-value
Women's age	- 9.87(1.59)	0.71	0.005 (0.011)	0.45
Education (years)	0.001(0.002)	3.63***	0.142 (0.042)	3.31***
HH gender	0.004 (0.007)	- 1.72*	0.394 (0.262)	- 1.50
Table banking membership	0.001 (0.019)	5.31***	0.474 (0.218)	2.18**
Business trainings	0.016 (0.042)	0.49	- 0.308 (0.286)	- 1.08
Personal bank account	- 0.001 (0.017)	3.45***	0.425 (0.304)	1.40*
Control of enterprise finances	0.082 (0.011)	2.69**	0.175 (0.271)	0.65
Ownership of assets (land)	- 0.013(0.019)	5.77***	0.141 (0.212)	0.67
Personal savings	2.68(0.004)	0.06	- 0.296(0.376)	- 0.79
Access credit formal banks	9.97 (0.003)	0.31	- 0.391 (0.269)	- 1.45

Note: Censored observations 6,11,11. *,**,***Significant at 10%, 5% and 1%.

Table 4 presents results on table mobile banking services; these services enable clients to access their bank accounts and make the transaction via mobile phones. Mainly three transactions are involved (i) money withdrawals and deposit from a bank account using mobile phones, (ii) money withdrawal from ATM using mobile phones; and (iii) money withdrawal from agents' outlets. The analysis suggests that control of enterprise finances was significant and likely to influence women entrepreneur's knowledge of mobile banking services. However, awareness did not translate into adoption of the mobile banking services. We also observe that personal savings have positive and statistically significant effects on adoption levels. Taking into account that 77% of the respondents operated bank accounts, the estimates in Table 4 reveal that ownership of bank account increased awareness and adoption of mobile banking services. Also, we find that accessing credit from formal banks increased awareness levels and adoption of mobile banking. Education level increased the probability of using mobile banking services, attending business training did not.

Table 4
Mobile banking services.

Variables	Level of awareness		Adoption of technologies	
	First hurdle		Second hurdle	
	Marginal effect	Z-value	Marginal effect	Z-value
Women's age	- 0.009 (0.006)	1.50	- 0.005 (0.007)	- 0.73
Education (years)	0.011 (0.002)	0.47	0.065 (0.027)	2.34**
HH gender	- 0.006 (0.013)	0.44	- 0.201 (0.169)	- 1.19
Table banking membership	- 0.070 (0.015)	5.38***	- 0.207 (0.141)	1.47
Business trainings	- 0.023 (0.018)	1.31	- 0.165 (0.185)	0.89
Personal bank account	0.039 (0.019)	2.03**	0.529 (0.197)	2.69
Control of enterprise finances	0.046 (0.016)	3.06***	0.301 (0.175)	1.72**
Ownership of assets (land)	- 0.055 (0.012)	5.33***	- 0.027 (0.137)	- 0.20
Personal savings	0.004 (0.025)	0.18	0.58 (0.225)	2.59***
Access credit formal banks	0.003 (0.014)	0.24	0.198 (0.174)	1.14

Note: Censored observations 6,11,11. *,**,***Significant at 10%, 5% and 1%.

Table 5
Groups transactions.

Variables	Level of awareness		Adoption of technologies	
	First hurdle		Second hurdle	
	Marginal effect	Z-value	Marginal effect	Z-value
Women's age	0.065 (0.001)	- 0.61	- 0.005 (0.003)	- 1.34
Education (years)	0.006 (0.045)	0.14	0.029 (0.014)	2.10**
HH gender	- 0.017 (0.024)	0.70	0.203 (0.087)	2.33
Table banking membership	- 0.061 (0.021)	2.83**	- 0.103 (0.072)	1.42
Business trainings	0.047(0.030)	1.61	- 0.078 (0.095)	0.82*
Personal bank account	0.030 (0.031)	- 1.01	- 0.011 (0.101)	- 0.12
Control of enterprise finances	0.008 (0.025)	- 0.34	- 0.007 (0.090)	- 0.08
Ownership of assets (land)	- 0.135 (0.023)	6.55	0.050 (0.070)	0.72
Savings	0.029 (0.037)	- 0.08	0.139 (0.125)	- 1.11
Access credit formal banks	- 0.011 (0.026)	0.45	- 0.059 (0.089)	- 0.66

Note: Censored observations 6,11,11. *,**,***Significant at 10%, 5% and 1%.

Group transaction service allows group members to send their group savings, loan repayments and group contributions via this mobile wallet application account. The results in Table 5 show that marginal effect of table banking membership variable is negative for knowledge of service indicating lack of familiarity with the service. Also accessing credit from formal banks reduced the probability of the knowledge and the will to adopt group transaction services. Owning a personal bank account and control of enterprise finances was likely to influence knowledge of group transaction but not a determinant of adoption. While attending business training increased awareness on mobile transactions, but was not a factor considered to determine to adoption.

4.3. Discussion

Discussion on the empirical findings is presented in Section 4.1. The analysis shows that membership to table banking groups would easily influence awareness levels and consequently

increase adoption of mobile payments services. The findings illustrate the important role that table banking groups can play in creating awareness and adoption of mobile money technologies. Also, this confirms the general belief that imitation and social learning can increase the adoption of innovations.

Nevertheless, we note that table banking groups are less likely to provide awareness of the money transfers services that is used by women. In essence, one gets to know how to send and receive money before knowing other services. Also, the service is dominant than other mobile money services in Kenya. Chauhan (2015) and Kusimba, Chagger, Elizabeth, and Kunyu (2013) report that the service increases remittances to rural areas. Essentially the service helps in meeting emergency needs such as purchasing of drugs for elderly parents and paying school fees, while at the enterprise level, the service has reduced the transaction cost associated with transport (Mullineux & Murinde, 2014).

Women's control of enterprise's finances and education level significantly increased awareness and adoption of mobile payments services. We observe that access to credit from formal banks and having personal savings influenced awareness of mobile payments services, but not adoption the service. This indicates that circumstances such as network coverage, availability of Pay-Bill, or Till numbers impact on the use of mobile payments services as reported by (BFA, 2017; Johnson, 2015).

Taking into account that 77% of the respondents operated bank accounts, we note that owning bank account was likely to influence awareness and increase adoption of mobile banking services. This is possibly due to access to information on linking bank accounts to mobile banking services. Muthiora (2015) observes that short message services increased adoption and awareness of technologies. Similar to the study findings, Omwansa and Sullivan (2013) notes that micro entrepreneurs use mobile bank accounts more actively for saving than payments partly because they are less likely to receive lump sum payments. However, linking bank accounts to mobile services has enabled women micro-entrepreneurs to save money in their bank accounts, conveniently service business loans, and pay bills. In essence, the service can reduce bank account dormancy especially for women who find it difficult to access bank branches due to distance and transaction cost involved. Never the less mobile money can also be a disruptive innovation. As Kaffenberger (2011) observes its acceptance into rural communities can upset existing habits and traditional financial practices.

We observe that table banking membership was not a factor that influenced women's knowledge and adoption of group transactions. However, attending business training increased knowledge on group transaction. Nevertheless, Muthiora (2015) examined the claim that microfinance banking groups are increasingly using mobile money application to facilitate disbursing and repayment of loan or savings by group members in Kenya. Indeed the use of group transaction application can be efficient, time-saving, convenient and secure especially for women who have time to attend to their errands. On the contrary, full adoption of group transaction services can be detrimental to group closeness and bonding (Aker, 2008). The mobile money group transactions are likely to affect peer monitoring and trust levels in savings and loan repayment systems, especially for the unregistered informal banking groups. In addition, financial recording, receipt-making, credit scoring and financial accountability for informal banking groups can be a daunting task.

5. Conclusion

This study examined possible factors that are likely to influence women micro-entrepreneurs' awareness and adoption of mobile money services. There is sufficient empirical evidence suggesting that education level increases awareness and adoption of mobile money technologies. We established that women's control of enterprise finances and making decisions has a significant impact on awareness and adoption of mobile technologies. Table banking groups are not able to create awareness and impact on the adoption of group-based transactions. Considering the benefits of the group's transaction services we find the service necessary for table banking groups, but women groups do not have information about the innovation. The study also observes women were likely to gain information on group transactions and mobile payment services after attended business training. However, the information gained from business training was not significant to influence adoption of most of the mobile money technologies.

The summary of the study discourse is that while mobile money services have permeated every part of Kenya's economy and contributed towards financial inclusion. The technology has afforded women an avenue to control productive resources through the saving platform. However, the discussions on financial inclusion must shift beyond marketing mobile money services as mere remittance mechanism used to send and receive money. The study findings suggest that women micro-entrepreneurs risk not drawing the benefits of the new mobile money technologies. Of particular concern is the adoption of mobile banking services perceived to be out of reach with the communities and have hidden charges. An argument here would be that mainstream banking institutions have rolled out mobile banking services such as *Mshwari*, *Equitel*, *KCB Mtaani* and *Co-op Kwa jirani*. But our study findings show that despite 78% of the women owning personal bank accounts, low adoption mobile technologies related to group transactions is evidenced. We find it prudent to consider promoting new mobile money technologies through group networks and social influence while creating trust in electronic payments by availing adequate information. In conclusion we recommend an in-depth study that would put into perspective how cost, network coverage, and consumer's incomes levels would impact on awareness and adoption of mobile innovations.

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