



Mobile Money and its Users: A Firm-level Analysis with the TOE Framework

by

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Abstract

Mobile money (MM) is a promising innovation on the African continent. This paper aims to research the diffusion process of mobile money services and uses the firm-level technology, organisation, and environment (TOE) framework to structure its findings. Kenya is used for analysis because the country is perceived frontrunner in MM usage. Main focus within the framework is on the organisational context as prior studies have overlooked its importance. Four firm characteristics: size, manager gender, family ownership, and firm location are hypothesised to have an effect on the likeliness to adopt a MM platform for firm usage. A logistic regression with firm-level data from the World Bank's Enterprise Surveys is used to form several conclusions. Current MM adopters in Kenya seem to be smaller in size than non-adopters, nonetheless, firm size is not a significant predictor of the likelihood to adopt MM services. Alongside that, no difference was found between firms with male or female managers. Surprisingly, high levels of family ownership increase likeliness of adopting a MM platform as does being located in an urban area. With these results, service providers and policy makers in Africa can amend their offerings and regulations to best support further diffusion of mobile money.

Keywords: Mobile Money, TOE Framework, Firm Characteristics, Adoption Decision, Enterprise Surveys.

Table of Contents

1. Introduction.....	4
2. Literature review.....	9
2.1. The TOE framework.....	9
2.2. Technological context.....	10
2.2.1. Mobile money and its alternatives.....	11
2.2.2. Corporate usage of mobile money.....	13
2.3. Environmental context.....	15
2.4. Organisational context.....	18
2.4.1. Firm size and mobile money adoption.....	20
2.4.2. Gender and mobile money adoption.....	20
2.4.3. Family ownership and mobile money adoption.....	21
2.4.4. Location and mobile money adoption.....	22
2.4.5. Conceptual model.....	23
3. Methodology.....	24
3.1. Enterprise Surveys.....	24
3.1.1. Sampling method.....	24
3.1.2. Research ethics.....	25
3.2. Dependent variable.....	28
3.3. Independent variables.....	28
3.3.1. Firm size.....	28
3.3.2. Gender.....	29
3.3.3. Family ownership.....	29
3.3.4. Firm location.....	30
3.4. Control variables.....	31
3.4.1. Export.....	31
3.4.2. Type of industry.....	32
3.5. Method.....	32
3.5.1. Justification of methodological choices.....	33
3.5.2. Limitations of the method.....	34

4. Analysis.....	36
4.1. Data assumptions and cleaning	36
4.2. Descriptive results	38
4.3. Econometric results	40
4.4. Assessing the model fit.....	43
5. Discussion and conclusion.....	45
5.1. Discussion	45
5.2. Implications.....	47
5.2.1. Theoretical implications.....	47
5.2.2. Practical implications.....	48
5.3. Limitations	49
5.4. Suggestions for future research.....	50
5.5. Conclusion	51
6. References.....	52
7. Appendices.....	58
7.1. Appendix 1: Research integrity form	58
7.2. Appendix 2: Consent form.....	59

1. Introduction

Mobile money (MM) financial services are among the most promising financial innovations in the emerging world (Donovan, 2012). The technology offers firms, households and individuals a new possibility to transfer money digitally in a way that is cheap and safe (Aron, 2018; Lashitew, van Tulder, & Liasse, 2019). With mobile money, users can store value on the SIM cards of their mobile device which transforms its value into an electronic currency (Ndung'u, 2018). It allows for easy and real-time transfers to other users but can also be utilised to pay for goods and for the conversion to cash.

The invention of mobile money is prevailing on the African continent; however, adoption rates vary widely across countries (Lepoutre & Oguntoye, 2018). Where major players like Nigeria failed to get a MM platform off the ground, the East-African nation of Kenya did manage to create widespread adoption of a mobile money system. It is estimated that more than 70 percent of the adult population in the country utilises a mobile money account (Muthiora, 2015). The invention seems to be flourishing in Kenya because of the enabling environment in the country provided by its financial regulators (Buku & Meredith, 2012; Burns, 2018; Lepoutre & Oguntoye, 2018). For other nations on the continent, this is not the case.

Although several providers are active in Kenya, major breakthrough in the adoption of mobile money services came in March 2007, when Vodafone's Safaricom launched M-Pesa (Jack & Suri, 2011). At that time, Safaricom already was the largest mobile phone provider in Kenya which allowed them to reach a widespread platform of potential users. M-Pesa (from "M", for mobile, and "Pesa", Swahili for money), became the company's mobile money transfer system allowing users to deposit, send, and withdraw funds with the use of their Safaricom SIM card (Markus & Nan, 2020). The payment system was far safer, cheaper and faster than existing payment methods like formal banking and cash payments (Mbiti & Weil, 2013).

The diffusion of M-Pesa and other mobile payment systems is crucial for emerging economies in Africa since it provides individuals, companies, and institutions with many new opportunities. Firstly and more general, is the fact that digital transactions provide better transparency, scalability and accountability (Ramya, Sivasakthi, & Nandhini, 2017). Many people and firms in emerging countries cannot afford the regular costs of a formal bank account. By adopting mobile money, the unbanked get access to a secure way of transferring

money at an affordable price (Suri & Jack, 2016). In turn, this may help improve the problem of asymmetric information that banks in these countries often face (Aron, 2018). Financial institutions do not know whether potential customers are able to repay their debt (Aron, 2018). Electric accounts like MM provide these banks, but also the government and financial institutions with data on transactions which may improve tax collection and protects users from theft and fraud.

Secondly, MM usage is found to significantly increase consumption of households in rural areas of Eastern Africa (Kikulwe, Fischer, & Qaim, 2014; Munyegeera & Matsumoto, 2016). Households using a mobile platform for their payments are found to have higher per capita expenditures on for instance health, education, and food. An important enabler for this increase in spending is receiving remittances from family and friends located elsewhere in the country or even abroad (Misati, Kamau, & Nassir, 2019; Munyegeera & Matsumoto, 2016). Previous research finds a strong positive relationship between remittances and long-term development in countries like Kenya (Misati et al., 2019).

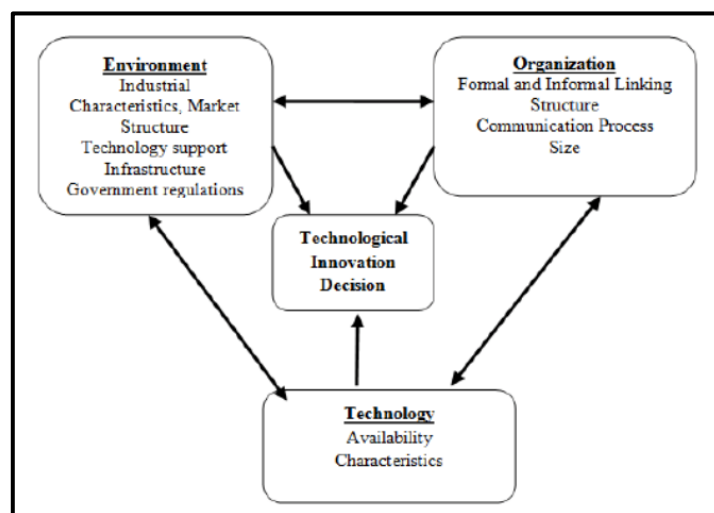
Finally, mobile money is seen as an important solution for the problem of financial inclusion in East-African businesses (Donovan, 2012; Gosavi, 2018; Misati et al., 2019; Ndung'u, 2018; Okello Candiya Bongomin, Ntayi, Munene, & Malinga, 2018). Financial inclusion can be described as distributing financial services across firms. It is generally found to have a positive impact on firm growth (Chauvet & Jacolin, 2017; Lee, Wang, & Ho, 2020). Bosire and Ntale (2018) specify this finding for the case of Kenya and find that mobile payments, mobile loans and mobile banking have a positive effect on SME growth in the country.

The examples above merely illustrate a tiny part of the abundance of studies on the effects of mobile money usage. Many of those mentioned, stress the fact that mobile money systems are promising and have the ability to change the lives of African people. Next to its effects, recent work has also focussed on the diffusion process of the technological innovation. In order to do so, MM is often conceptualised as a financial technology or IT innovation. In this way, general theories explaining technology adoption can be used. Among the most frequently used ones are the Technology Acceptance Model (TAM) by Davis (1989), the Theory of Planned Behaviour (TPB) by Ajzen (1991), the Innovation Diffusion Theory (DoI) by Rogers (1995), and the Technology, Organisation, and Environment (TOE) framework by Tornatzky and

Fleischer (1990). It is important to note that the former two primarily focus on the individual level of adoption whereas the latter two take a firm-level approach (Oliveira & Fraga, 2011). Over the years, research on mobile money adoption has predominantly focused on the individual level with studies adopting the TAM (Lule, Omwansa, & Waema, 2012; Narteh, Mahmoud, & Amoh, 2017; Tobbin & Kuwornu, 2011) and the TPB (Baganzi & Lau, 2017; Koloseni & Mandari, 2017). Although some work emphasises adoption at the firm-level with the DoI theory (Osei-Assibey, 2015; Tobbin & Kuwornu, 2011), research that uses the TOE framework remains scarce. Consequently, it is this particular framework that lies at the basis of the presented study

The technology, organisation, and environment framework is an organisation-level theory that elaborates on three different elements of a firm's context that explain technology adoption decisions (Tornatzky & Fleischer, 1990). These elements are the technologies currently in use and available on the market, the environment that offers new innovations and regulates them, and important characteristics of the firm. Figure 1 below shows the classic model as introduced by Tornatzky and Fleischer (1990), however, several alterations to the framework exist.

Figure 1. TOE framework. Source: Tornatzky and Fleischer (1990).



With regards to mobile money, much is known about the technology and the alternatives it replaces (Donovan, 2012; Jack & Suri, 2011; Mbiti & Weil, 2013). Additionally, the institutional environment of primarily Kenya that enabled the innovation to flourish has been extensively researched (Burns, 2018; Lepoutre & Oguntoye, 2018). Despite the considerable focus on the first two components of the TOE framework, studies on the user-characteristics

of mobile money lack. Although some research looks into the type of people and households that uses mobile money (Batista & Vicente, 2020; Murendo, Wollni, De Brauw, & Mugabi, 2018), a study that specifically addresses the type of firms currently using it, does to the knowledge of this work, not exist. This is remarkable since firm characteristics remain a crucial component that explains the diffusion process of MM (Tornatzky & Fleischer, 1990).

This paper aims to fill the identified academic gap, and tries to answer the following question:

What firm characteristics influence the decision to use mobile money services for business transactions?

According to the TOE framework, organisational characteristics have a great deal of influence on the decision to adopt technological innovations and are therefore crucial to consider (Tornatzky & Fleischer, 1990). In this research, Kenya is used for analysis because the country has the largest diffusion of the financial innovation and is seen as frontrunner in mobile money usage (Lashitew et al., 2019). In order to obtain its results, this paper uses a binary logistic regression model where the adoption of mobile money in business practices is used as dependent variable. Alongside that, several firm-level characteristics are used as predictor variables. The paper tests its hypotheses with the use of World Bank Enterprise Survey Data from 2018. This dataset provides firm-level data on matters like innovation, mobile money usage, firm characteristics, and the financial performance of 1,001 firms in Kenya.

Besides the specified theoretical relevance, identifying and describing the current users of mobile money platforms could help in spreading the financial innovation to new areas on the African continent too. This is important because adoption of mobile money services has the ability to increase financial inclusion (Donovan, 2012; Gosavi, 2018; Misati et al., 2019; Okello Candiya Bongomin et al., 2018) and household spending (Kikulwe et al., 2014; Munyegera & Matsumoto, 2016). Therefore, this paper is expected to have a great deal of practical relevance. Widespread adoption of mobile money in Africa is perceived to be a solution to some of its most prevailing issues.

Consequently, understanding the characteristics of firms that are adopting MM for the use of their business transactions can be perceived as equally important as it has the possibility to help with the technology's diffusion in several ways. Firstly and more in general, enterprise

characteristics are important in explaining behaviour when it comes to adoption of new banking options (Yousafzai & Yani-de-Soriano, 2012). If mobile money service providers understand what type of firms use their platforms, it becomes easier to improve design and service. In turn, this ultimately enhances customer experience among some of its frequent users. Current adopters have indicated that if mobile money platforms continue to meet their demands, diffusion rates will ultimately increase too (Osah & Kyobe, 2017).

Secondly and as mentioned before, mobile money seems to be dominating Kenya partly due to the favourable regulatory environment in the nation (Buku & Meredith, 2012; Burns, 2018; Lepoutre & Oguntoye, 2018). Further identifying the users of mobile money, provides policy-makers in other African nations with a great share of valuable information. If financial institutions and governments understand who is using MM platforms, rules and laws could be amended in a way that enables them to use the invention more easily. In this way, many other countries could benefit from its advantages ultimately leading to higher adoption rates.

As illustrated, a further diffusion of mobile money on the African continent is crucial for households and firms. In order to use the TOE framework to gain knowledge on this diffusion process, the rest of this paper is organised as follows. After a short introduction on the TOE-model itself, section two explains MM technology and uses Kenya's M-Pesa as a leading example. After that, the second TOE-dimension is discussed, namely the regulatory environment in Kenya and how it compares to that of fellow African nation Nigeria. In what follows, related literature on firm traits and innovation adoption in Africa is used to create a conceptual model with hypotheses aiming to explain the type of firms adopting mobile money services. Hence, covering the organisational context dimension of the framework. In section three, this study elaborates on its methodology. In order to do so, the data is presented, the method of analysis is introduced, and a thorough conceptualisation of the variables is given. After that, the previously stated hypotheses are tested with a logistic regression model. The final section of this work concludes the findings and provides its implications and a solid direction for future research in the field.

2. Literature review

2.1. *The TOE framework*

Nowadays, technology is widely recognised as an essential tool for firms to be competitive in any country or economy (Oliveira & Fraga, 2011). To measure the impact of new technologies and systems, it is crucial that these are widely adopted and used. There are several models in today's literature that aim to explain this diffusion process and elaborate on all the different factors that come into play. These models are also widely used to particularly describe the diffusion process of mobile money services.

Firstly, the technology acceptance model by Davis (1989) explains user acceptance for new technologies by studying perceived usefulness and perceived ease of use. This model is often adopted in research on mobile money to discover the factors leading to individual adoption of mobile money (Lule et al., 2012; Narteh et al., 2017; Tobbin & Kuwornu, 2011). A second theory is the theory of planned behaviour that states adoption is explained by intentions (Ajzen, 1991). Like the TAM, this theory is often used to explain MM adoption at the individual level (Baganzi & Lau, 2017; Koloseni & Mandari, 2017). Thirdly, the innovation diffusion theory by Rogers (1995) focuses on how, why, and how fast new innovations spread through societies. Previous studies use the model to explain the spread of mobile money on the African continent (Osei-Assibey, 2015; Tobbin & Kuwornu, 2011). The last model and also main focus of this work is the firm-level technology, organisation, and environment framework introduced by Tornatzky and Fleischer (1990).

The TOE framework identifies three important parts of an innovation's context that may influence a firm's decision to adopt a new innovation (Oliveira & Fraga, 2011). Firstly, the technological context that explains the internal and external technologies that could be relevant to the firm. This indicates that all technologies, so the ones currently in use and the ones not yet adopted, may influence innovation adoption decisions (Baker, 2012). At all times, it is essential that a firm carefully considers the effect a new innovation may have on its enterprise and the industry around it.

Secondly, the environmental context describes the arena in which innovation adoption takes place (Oliveira & Fraga, 2011). This arena mainly includes the providers of the service and the institutions within the regulatory environment around it. Especially the regulation imposed by

governments about an innovation can be either enabling or disadvantageous (Baker, 2012). Regulations may include safety and testing requirements but could also entail rules around privacy and general user protection.

Finally, the organisational context which includes the characteristics and resources of the firm (Baker, 2012). Some of the characteristics that may help in explaining the diffusion of technological innovations are the size of the firm and the level of centralisation within its boundaries. Nevertheless, a range of different firm characteristics are often utilised in diverse contexts and for particular innovations. As illustrated in figure 1, the classic model by Tornatzky and Fleischer (1990) uses internal linkages, structure, communication, and size as main firm characteristics. However, these may be altered to fit the type of technology discussed. On the one hand, for a complex IT system like Radio Frequency Identification Technology (RFID), Bhattacharya and Wamba (2018) added top management support and IT expertise as firm characteristics. These were suggested to be of great importance for the adoption of RFID. On the other hand, for the implementation of a simpler enterprise resource planning software, demographic composition and scope of business operations were deemed as crucial (Awa, Ukoha, & Emecheta, 2016).

The focus of this paper is on the diffusion process of mobile money services. This particular innovation has its own specific characteristics and needs special regulations when comparing it to already existing payment platforms. In the next part, the technology of mobile money and the impacts it has on its environment are explained. After that, the regulatory environment that surrounds this innovation is covered. In both cases, Kenya's M-Pesa is used for illustrative purposes since the company is acknowledged to be global leader in the MM adoption process (Lashitew et al., 2019). Although these two dimensions of the TOE framework have been extensively researched for mobile money, the organisational characteristics that are important in its adoption are not sufficiently understood. Consequently, some firm traits are considered and hypothesised to determine how these influence the likelihood of adopting mobile money.

2.2. Technological context

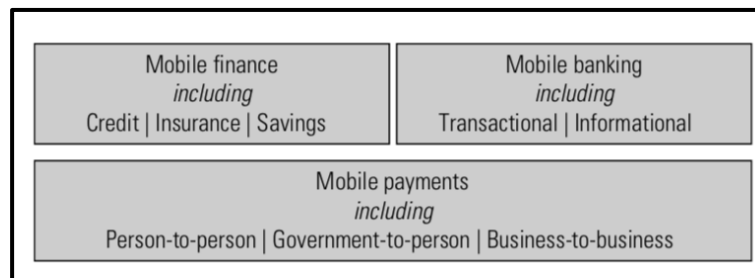
The technological context in the TOE framework describes both internal and external technologies (Baker, 2012). Internal technologies are the ones currently utilised by a firm to make payments. The external technology that could potentially replace the internal technology is mobile money. It is crucial to gain a thorough understanding of the technology and the effects

it may have on society. For MM services, both have been extensively researched. In what follows, a short introduction on mobile money and its main provider M-Pesa is given. After that, the technology behind the service is introduced and some of its effects are explained. Lastly, a description on usage in business-related settings is provided as the main focus of this work is on firm-level adoption.

2.2.1. Mobile money and its alternatives

Mobile money is a collection of financial services performed through a mobile device. The array of possibilities the technology offers can be summarised in three broad categories as indicated in figure 2. Firstly, and most general are the mobile payments. These include for instance person-to-person, government-to-person, and business-to-business payments. Users can pay for everyday goods and services at a local market or safely transfer money to family members (Jack & Suri, 2011; Misati et al., 2019). Secondly, mobile finance services include access to credit and saving plans in combination with bank partners (Bosire & Ntale, 2018; Donovan, 2012). It also allows users to access insurance for their businesses by paying a premium on each purchase (Must & Ludewig, 2010). Finally, mobile banking services allow users to make account balance inquiries remotely at any given time (Yakub, Bello, & Adenuga, 2013).

Figure 2. Types of mobile money services. Source: Donovan (2012).



Although mobile money offers many possibilities, the technique behind it is rather straightforward. Any subscriber can add credit to his or her account and save or send it to other users via SMS (Must & Ludewig, 2010). In order to deposit money in the first place, subscribers go to a mobile money agent and provide regular cash money. After subtracting a small fee, the agent sends a coded message to a MM platform which in turn puts credit in the customer's account via a text message. After the money is put into the account, users can transfer it to other users or take out the money whenever needed (Donovan, 2012; Must &

Ludewig, 2010). In this way, cell phone credit became a form of currency that people can transfer or later exchange for cash.

This currency is especially used in Kenya, in fact, the country could be perceived as frontrunner in MM usage (Lashitew et al., 2019). High adoption rates in the nation are attributed to the success of Safaricom's M-Pesa. In response to the fast-growing market for mobile phones and the severe struggle of financial inclusion on the African continent, British telecom company Vodafone decide to launch M-Pesa through its Kenyan subsidiary Safaricom (Burns, 2018). After its release in March 2007, mobile money soon became a nearly universally accepted way of making financial transactions. Due to the widespread usage of the platform in Kenya, this paper utilises M-Pesa and mobile money services interchangeably.

After its inception in early 2007, M-Pesa grew rapidly with an average number of daily new members of more than 5,000 in the first months (Jack & Suri, 2011). This tremendous growth can be ascribed to the perceived simplicity in registration for the platform; it was easy and very fast (Mbiti & Weil, 2015). If a person or firm wishes to use the mobile money services of M-Pesa, any official form of identification is sufficient to open an account. Therefore, use of the platform requires significantly fewer official documents than formal bank accounts do. For the first time, a payment system other than basic cash and bank payments became available for people living in the most remote areas of the nation.

However, in order for M-Pesa to function properly, Kenya needed to adopt a cash-in, cash-out infrastructure to make transactions possible (Jack & Suri, 2011). As mentioned in the previous section, this is achieved through the use of "cash merchants" or "agents" that are available virtually anywhere in the country. Registered users can make deposits or withdraw cash with these agents, who in turn receive a small commission every time they provide a service (Donovan, 2012; Must & Ludewig, 2010). Currently, the East African nation has over 120,000 agents which is around 40 times the number of registered bank ATMs available (Muthiora, 2015).

The emergence of mobile money as a new system for payments on this scale had a large impact on society, especially in Kenya. Firstly, it drastically reduced the transaction costs associated with banking activities (Aron, 2017; Demirgüç-Kunt & Klapper, 2012). In rural Africa, where families, businesses, and networks are widely-dispersed, this reduction is especially visible in

a decrease in transportation costs, travel time, and waiting time. Financial institutions are often located far away from rural areas and waiting lines at banks are long. Next to that, fewer formal documents are required to open a mobile money account (Jack & Suri, 2011; Mbiti & Weil, 2015). The reason why fewer documents are needed in comparison to some of MM's alternatives, is covered in the section on environmental context.

Secondly, mobile money reduced the problem of asymmetric information (Aron, 2017, 2018). Usage of a MM system like M-Pesa turns ordinary cash into recorded cash. Consequently, governments and financial institutions benefit from the availability of visible records on their customers' spending and saving behaviour. Lastly, the use of a mobile money platform increased the consumption of households in rural areas via for instance remittances (Kikulwe et al., 2014; Munyegera & Matsumoto, 2016) and provides them with a secure way of saving money (Aron, 2017).

Mobile money services have the potential to provide individuals and businesses with advantages over its substitutes currently on the market. In general, there are two alternative "technologies" available to make payments in emerging countries. Firstly, ordinary cash payments. Mobile money offers a safer way of making financial transactions since there is no need to bring large amounts of cash to pay for utilities or supplies, let alone, be physically present (Jack & Suri, 2011). Secondly, formal bank payments. It is oftentimes stated that MM services can be perceived as a partial substitute for formal banking accounts (Jack & Suri, 2011; Mbiti & Weil, 2015). Users can store money safely in their accounts in a convenient way due to lower transaction costs and fewer formal requirements. Despite these numerous advantages, the service is primarily used by individuals and households, usage for business-related transactions remains scarce (Mas & Ng'weno, 2012).

2.2.2. Corporate usage of mobile money

It seems to be the case that the above-mentioned advantages over its alternatives, allowed for high mobile money adoption rates in Kenya. Currently, around 70 percent of the individuals uses M-Pesa in the nation (Muthiora, 2015). Nevertheless, such a mass diffusion did not occur in Kenya's business environment (Mas & Ng'weno, 2012). For the firms that did end up adopting the service, there seems to be a large dissimilarity in adoption rates between formal and informal firms.

On the one hand, the formal business environment of Kenya primarily uses cash. In general, innovation adoption by these more established enterprises is very slow and incremental. This is not different for mobile money, the service is primarily introduced as a means to accept payments from customers that are further away (Mas & Ng'weno, 2012). The biggest problem with the payments system is the fact that transferable amounts often exceed the limit MM supports. Therefore, employees still need a bank account to receive payments and suppliers are most often paid with the use of a cheque.

On the other hand, informal businesses, the ones that are unregistered and do not pay taxes (Khavul, Bruton, & Wood, 2009), like tradesmen and street vendors seem more ready to use MM platforms (Mas & Ng'weno, 2012). Their daily transactions are smaller and fit more into the transaction-based platform MM offers. Decisions to use it are often made on a case-by-case basis where mobile payments are frequently accepted as an alternative for ordinary cash payments. Next to that, these firms use mobile money platforms to store their money safely overnight.

More generally speaking, firms in Kenya put forward various reasons to adopt mobile money for their transactions. Firstly, most Kenyan enterprises began using the financial innovation in an attempt to satisfy customers' requests (*Kenya 2018 Enterprise Survey*, 2018). Due to the widespread usage of for example M-Pesa, firms were left no choice but to adopt the platform as a payment method too. Secondly, Kenyan firms seem to acknowledge the fact that mobile money platforms are a cheaper, faster and, safer way of making business-related financial transactions (*Kenya 2018 Enterprise Survey*, 2018). Employees of firms no longer have to carry around large amounts of cash and are able to make payments over distances (Jack & Suri, 2011).

Nevertheless, it is important to note that firms experience difficulties with mobile money too. Main reason for not adopting mobile money as a firm is the fact that business transactions are oftentimes too large for MM services to process (*Kenya 2018 Enterprise Survey*, 2018). Alongside this issue, there are several other obstacles that Kenyan firms encounter when adopting a mobile money platform (Mas & Ng'weno, 2012). Firstly, MM services are closed-loop systems which implies that easy integration with other IT platforms in a business is not simple. Secondly, businesses experience trust issues when receiving money from clients they do not know personally. Fraudulent messages and transaction reversals are two ways in which

customers can commit fraud. Lastly, Kenya's biggest enabler of MM services, Safaricom, has not widely marketed M-Pesa as a corporate service. Much like research, marketing methods have primarily focussed on individuals and households.

Hence, mobile money has not been fully integrated into Kenya's business environment. Although there are differences between formal and informal firms, both experience similar problems when adopting the service. Nevertheless, the potential of corporate MM usage is clear; digital money is a safer and more convenient way of making financial transactions and should thus be widely adopted (Mas & Ng'weno, 2012; Mbiti & Weil, 2013).

As illustrated in this section, the numbers around for instance M-Pesa indicate the significant presence of a MM system in Kenya. By addressing some of the shortcomings of main alternatives cash and formal bank payments, the innovation is expected to bolster both economic and firm growth in the future (Bosire & Ntale, 2018; Osah & Kyobe, 2017). The TOE framework suggests that organisations willing to adopt a new innovation like mobile money must carefully consider the technology and the impact it may have on its business practices. For MM, in particular the limits on transferable amounts and the integration with other IT systems seem to withhold firms from using it.

To benefit from the full potential of mobile money, it is vital to obtain higher adoption rates in Kenya's business environment. In order to do so, MM service providers need to gain a general understanding of current corporate users and amend their offers to create value for them, something that has not been researched extensively before. Next to that, the regulatory arena in which the system is offered needs to be optimised to fit the needs of enterprises. The special environmental context in which main mobile money provider M-Pesa operates and managed to gain tremendous diffusion, is covered in the next part.

2.3. Environmental context

The environmental context in the TOE framework includes a discussion on the technology service providers and the regulatory environment around them (Baker, 2012). Especially the latter is often seen as main reason for the successful penetration of mobile money into Kenya's society (Lepoutre & Oguntoye, 2018). The following section provides a brief description of the type of firms offering mobile money services. After that, Kenya's enabling regulatory environment is covered.

In spite of M-Pesa's substantial economic impacts and its connectivity to actions originally performed by banks, the new financial system was not introduced by formal financial institutions but by a large telecommunication firm already active in Kenya: Safaricom (Pelletier, Khavul, & Estrin, 2020). This is not surprising since the incentives and capabilities needed to successfully develop a MM system match more with telecom firms than with formal institutions like banks.

In Kenya, local banks acknowledged that providing mobile money services contrasted with their established competences (Pelletier et al., 2020). The traditional banking business model is based on profits through interests and is therefore not ideal for the small and high-volume transfers associated with mobile money. Next to that, banks use a brick-and-mortar approach to serve local customers which is difficult in emerging countries due to the dispersed population in rural areas. Telecom firms managed to create a transaction-based system where revenues come from a fee on each transaction, making them the perfect enablers of a MM system (Donovan, 2012; Pelletier et al., 2020).

Nonetheless, it should be noted that M-Pesa's remarkable success of the past years can mainly be attributed to Kenya's enabling regulatory environment (Burns, 2018; Lepoutre & Oguntoye, 2018). In 2000, Safaricom approached the Central Bank of Kenya (CBK) with their proposal for a mobile money platform. At that moment, the CBK had the choice to either support this new initiative or refuse the new application on legal grounds. A potential reason for refusal would be based on the fact that Kenya's regulatory system does not permit non-banks to engage in financial services.

However, the nation's financial institutions commenced to witness the potential of mobile money to help overcome societal issues like financial inclusion and the lack of banking options for people in rural areas. After some time, the Central Bank of Kenya acknowledged that traditional banking did not yet have the potential to facilitate the current unbanked with a financial payment system (Pelletier et al., 2020). Therefore, it decided to issue Safaricom a "letter of no objection" in February 2007 (Burns, 2018). Vodafone's subsidiary obtained the right to develop a mobile money payment platform and could start operating in a very lightly regulated business environment.

The regulatory system in which Safaricom began to operate can be perceived as lightly monitored due to two reasons. Firstly, the Central Bank of Kenya allowed Safaricom to establish contracts with retail agents all across the country (Burns, 2018). These agents are crucial for the cash-in and cash-out infrastructure underlying mobile money services (Donovan, 2012; Jack & Suri, 2011; Must & Ludewig, 2010). Striking about the contracting procedure was the fact that these cash merchants did not have to comply with the same capital requirements as traditional financial institutions had to (Burns, 2018; Donovan, 2012). This allowed the entrance of numerous competitors all attempting to obtain a piece of market share.

Secondly, Kenyan authorities decided to relax the Know-Your-Customer and Anti-Money-Laundering (KYC-AML) requirements (Burns, 2018; Markus & Nan, 2020). In order to open an M-Pesa account, users can use any form of identification (Mbiti & Weil, 2015). This implies that significantly fewer formal documents are needed than for opening a bank account. Relaxation of the KYC-AML requirements was made possible because Safaricom imposed limits on the amount of money that could be stored and transferred via their system. Removal of the KYC-AML regulations ultimately got rid of the costliest hurdle to reaching the unbanked population of Kenya (Burns, 2018).

Despite Kenya's successful diffusion of a mobile money platform, other nations on the African continent did not achieve similar levels of adoption (Lashitew et al., 2019; Lepoutre & Oguntoye, 2018). The news of the incredible advancements of M-Pesa in Kenya quickly spread all over Africa (Markus & Nan, 2020). Emerging countries like Nigeria became interested in the financial innovation too. Although the West African nation showed similar rates of financial inclusion, mobile phone usage, and general economic development, mobile money never came off the ground (David-West, Iheanachor, & Umukoro, 2020; Lepoutre & Oguntoye, 2018). Main reason for the non-emergence of a solid MM system in Nigeria can be found in the country's regulatory environment which lacked some fundamentals for such a system to arise.

At the time of the growth of M-Pesa in Kenya, the Nigerian telecommunication market was highly consolidated and instable. Four large mobile network providers shared the market and public trust in these corporations was low (Lepoutre & Oguntoye, 2018). This is in sharp contrast to Kenya, where Safaricom owned most of the market, allowing the company to use their power in diffusing the newly developed innovation (Jack & Suri, 2011). The Central Bank

of Nigeria (CBN), was afraid to allow a dominant monopolist like Safaricom to rise in its country and was therefore reluctant to support the development of a MM platform (Lepoutre & Oguntoye, 2018). Due to this scepticism, a similar, lightly regulated business environment like Kenya's never set foot in Nigeria, leading to highly diverging adoption rates. The East African nation obtained rates as high as 70 percent in 2015 (Muthiora, 2015), which is in sharp contrast to Nigeria, where the diffusion rate around that time stagnated at merely 1 percent (Lepoutre & Oguntoye, 2018).

To conclude and as stated in the TOE framework, these numbers indicate the vitality of a sound regulatory system for the diffusion of financial innovations like mobile money. Kenyan firms may benefit from the lightly regulated environment surrounding MM services and can also profit from the accessibility of service providers. The next section in this paper covers the last context of the TOE framework: the organisational context which has not been covered extensively in previous research.

2.4. Organisational context

Foregoing sections of this paper focused on the technology and environment contexts of the TOE framework. The aim of the remainder of this work and its overall focus, is to explore the final dimension: organisational characteristics. This context refers to the characteristics and resources of the firm that may affect adoption decisions for a financial service like mobile money (Baker, 2012).

Currently, a wide array of research already looks into the type of people and households that uses mobile money (Batista & Vicente, 2020; Murendo et al., 2018). Hence, research focusses primarily on adoption at the individual level. This makes sense, as the innovation was introduced for usage at the individual level. Nevertheless, an analysis that attempts to identify firm traits that influence the decision to implement MM does not exist. This is remarkable since it remains a crucial component explaining its diffusion process (Tornatzky & Fleischer, 1990).

Although Tornatzky and Fleischer (1990) use a distinct set of firm traits they deem essential in technology adoption, variations to the model are more of a rule than an exception. Researchers pick factors in the organisational context that are specific to the phenomenon studied (Awa et al., 2016; Bhattacharya & Wamba, 2018). In this work, several firm characteristics that play a crucial role in explaining the adoption of mobile money services in an emerging market context

are selected. These traits are the size of the firm, the gender of the manager, the level of family ownership, and firm location.

The decision to select these particular characteristics is grounded in several established theories. Firstly, the resource-based view suggests that the resources and capabilities of a firm have the ability to create a competitive advantage (Barney, 1991). Innovation is grounded in these resources and presents an important way to achieve a favourable position within a market (Robson, Haugh, & Obeng, 2009). Firm size is often perceived as a surrogate measure for several dimensions within a firm's resources that can lead to innovative behaviour (Hadjimanolis, 1999). Next to that, it is expected that different firm sizes experience different issues and may therefore make dissimilar decisions with regards to innovations (Aterido, Beck, & Iacovone, 2011; Demirgüç-Kunt & Klapper, 2012). Consequently, size is selected as first predictor variable in this paper's model.

Secondly, entrepreneurship theory places emphasis on the characteristics of the firm manager (Hadjimanolis, 1999). Especially in smaller firms, managers have a large influence on firm decisions (Orser & Riding, 2018). In Africa, these smaller type of firms make up a large part of the economy (Mahemba & Bruijn, 2003). It is generally stated that men and women in the African business environment, do not encounter the same barriers (Aterido et al., 2011; Orser & Riding, 2018). Hence, gender is expected to influence the decision to use mobile money.

Despite the importance of the manager in small businesses, it is not uncommon to see decision-making power diluted because of large levels of family ownership within the firm (Robson et al., 2009). These so-called family firms are very much present in and around African economies (Bertrand & Schoar, 2006). It is generally expected that this ownership structure has the ability to influence the way in which firms engage in business activities. Consequently, it seems important to consider the effect of firm ownership on the adoption of MM services (Robson et al., 2009).

Lastly, an environmental approach is used as it complements the previously mentioned resource-based view. Generally, the location of the firm is crucial in determining the degree of innovation that occurs within a business (Hadjimanolis, 1999). Firms have to adapt to outside forces and respond to external trends (Robson et al., 2009). Therefore, a difference between firms in densely populated areas in comparison to firms from more rural parts of the country

could be expected. The next part elaborates on each of the firm aspects considered and states a hypothesis accordingly.

2.4.1. Firm size and mobile money adoption

Research on firm size and the adoption of financial innovations is twofold. On the one hand, classic work in the innovation field suggests that larger firms are more likely to adopt and exploit new innovations (Schumpeter, 1942). This can be attributed to the fact that larger firms possess more processes and capital to engage in innovative behaviour. Wignaraja and Ikiara (1999) specify this for firms in Kenya and find that smaller firms generally lack the resources engage in innovative behaviour. Therefore, it could be concluded that particularly larger firms adopt financial innovations like mobile money since these enterprises possess the resources to do so.

On the other hand, studies in Africa find that smaller firms experience greater financing obstacles in comparison to larger firms (Aterido et al., 2011; Demirgüç-Kunt & Klapper, 2012). Fixed fees, high costs, and formal requirements impede them from accessing a registered bank account. It is oftentimes stated that mobile money services can be perceived as a partial substitute for such formal banking systems (Jack & Suri, 2011; Mbiti & Weil, 2015). Next to that, payments from larger firms tend to be of amounts that exceed the transactional limits of mobile money (Mas & Ng'weno, 2012). Hence, it may be concluded that smaller firms are more likely to use MM services due to their struggle to gain access to actual bank accounts and because their payments fit in the range that mobile money platforms support. The widespread adoption of mobile money services in Kenya, combined with these specific characteristics of small firms leads this paper to state the following hypothesis:

H1: In Kenya, there is a negative relationship between firm size and likeliness of adopting mobile money services.

2.4.2. Gender and mobile money adoption

In firms around the world, managers are central in the decision-making process. This may indicate that gender-related factors influence the decision to use an innovation like mobile money (Orser & Riding, 2018). It is generally found that women face additional barriers in adopting new technologies for their firms. Challenges include the limited access to networks

and the assumption that women are not as competent as men in adopting new innovations (Orser & Riding, 2018). Consequently, it may be expected that firms led by females are less likely to do so. Nevertheless, other recent studies on this matter conclude the contrary and state that there is no significant difference between male and female managers when it comes to innovation adoption (Damanpour & Schneider, 2009).

However, research specifically addressing the gender gap issue on the African continent is clear: access to finance seems to be a bigger problem for entrepreneurial women in comparison to their male counterparts (Aterido et al., 2011). With the use of similar reasoning as for the first hypothesis, it may therefore be expected that female managers are more likely to use mobile money for business transactions due to their lack of other banking options. The current widespread adoption (Muthiora, 2015) and ease of registration (Mbiti & Weil, 2015) may not lead to as many barriers for adoption perceived by women as previously mentioned.

Next to the problem of financial inclusion, the environment seems an important determinant too. In Ghanaian households, males were found 8.1 percent less likely to use mobile money as compared to females due to the fact that females are more environmentally aware (Amoah, Korle, & Asiama, 2020). This awareness is associated with eco-friendly behaviour and cashless transactions, ultimately leading to a higher likeliness of mobile money payments in female-led firms. This paper expects females in Kenya to engage in similar behaviour, therefore the following is proposed:

H2: In Kenya, firms with a female top manager are more likely to adopt mobile money than firms with a male top manager.

2.4.3. Family ownership and mobile money adoption

There are large numbers of family-owned businesses in all economies around the world. Firms with large levels of family-ownership are characterised by a high concentration of ownership, control, and by the fact that key positions within its boundaries are often filled by family members (Bertrand & Schoar, 2006). These types of firms seem especially present in countries with a weak formal institutional system and a national culture with high levels of collectivism and power distance (Chakrabarty, 2009). Many nations on the African continent can be

described as such, making family firms very common in its business environment (Bertrand & Schoar, 2006).

Although managers in Africa rely on strong family ties to establish their businesses (Khavul et al., 2009), it is often stated that these particular ties impede the economic development of a firm (Bertrand & Schoar, 2006). One potential reason for this hindrance is the lack of innovative behaviour that occurs within them. High levels of family-ownership may dilute the decision-making power of managers and has the ability to constrain risk-taking behaviour (Robson et al., 2009). Next to that, substantial family involvement often goes with the exchange of information that overlaps with what is already known, leading to less “novel” actions performed by a firm (Bradley, McMullen, Artz, & Simiyu, 2012).

Due to the risk-averse nature of family-owned businesses, adoption of mobile money may be less likely to take place. Older family members with high levels of authority in a firm, often wish to utilise existing technologies since these are more familiar to them (Robson et al., 2009). This may in turn lead to merely accepting cash payments in an attempt to avoid some of the problems related to mobile money payment services (Mas & Ng'weno, 2012). Consequently, it can be expected that firms with larger levels of family ownership are less likely to adopt new innovations like mobile money. Hence, the following hypothesis is stated:

H3: In Kenya, there is a negative relationship between level of family ownership and likeliness of adopting mobile money services.

2.4.4. Location and mobile money adoption

Kenya's inhabitants predominantly reside in rural areas of the country. It is estimated that in 2019, 72.5 percent of the nation's population lived in rural areas opposed to only 27.5 percent living in more urban parts (*World Development Indicators*, 2019). Although over the past decades the income gap between urban and rural population has been declining, people living in rural parts of Africa still experience tremendous obstacles to get by, leaving them particularly vulnerable (Tacoli, 1998).

One of such obstacles is the limited access to financial capital (Aron, 2017; Demirgüç-Kunt & Klapper, 2012). The transaction costs associated with engaging in financial transactions for the

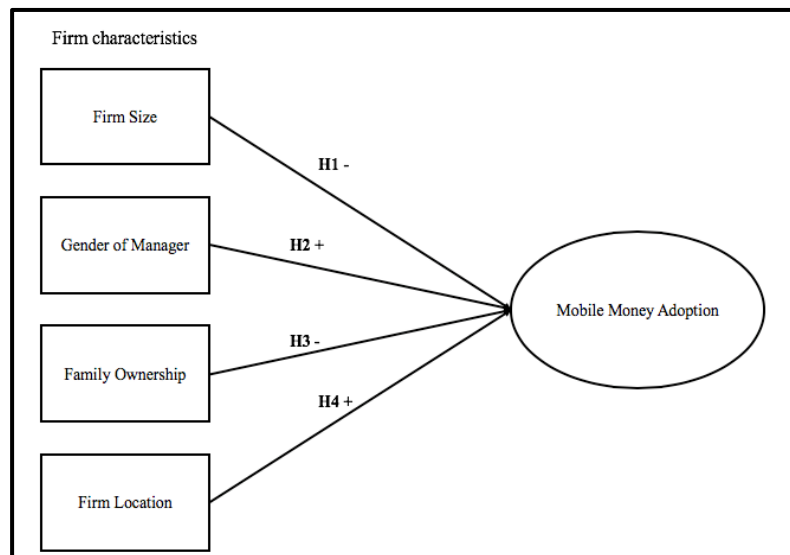
rural part of the population are enormous due to high transportation costs, lack of formal documentation, and long waiting times. Because of these issues, the share of people in rural areas of the country with a formal bank account is much lower than in urban areas Nairobi and Mombasa (Allen et al., 2020). As previously mentioned, mobile money can be perceived as a partial substitute to formal bank accounts. It might be the case that informal firms in rural areas of Kenya are capitalising on its rising importance (Mas & Ng'weno, 2012). Therefore, this paper states the following hypothesis:

H4: In Kenya, firms in rural areas are more likely to adopt mobile money than firms in urban areas.

2.4.5. Conceptual model

After elaborating on the four hypotheses that this paper aims to research, it becomes possible to construct a conceptual model. The created model guiding this research is shown in figure 3 below. As indicated, four important firm characteristics: firm size, gender of the manager, level of family ownership, and firm location are utilised to describe the type of firm currently using mobile money in Kenya for any of their financial transactions.

Figure 3. Conceptual Model.



3. Methodology

3.1. Enterprise Surveys

This paper tests its hypotheses with the use of firm-level data from the World Bank Enterprise Surveys (ES). The World Bank has conducted firm-level surveys like the ES, for over two decades now. Striking about their work is the fact that since 2005, data collection efforts have been centralised (Barasa, Knoben, Vermeulen, Kimuyu, & Kinyanjui, 2017). This allows for easy comparisons between different countries and regions. In general, the ES collect information about a country's business environment and how it is experienced by firms. The surveys cover a wide array of topics including finance, corruption, infrastructure, crime, competition, labour, obstacles to growth, and performance measures (*Enterprise Survey Documentation*, 2018).

As the frontrunner in mobile money adoption in Africa (Lashitew et al., 2019), Kenya is used for analysis in this paper. Kenya is most likely to provide this paper with valuable results since diffusion is best explained in an environment where a new innovation is widely adopted (Oliveira & Fraga, 2011). The specific dataset forming the base of this work, is the Kenya full dataset from 2018. In order to get access to this file, researchers must register with the Enterprise Analysis Unit and comply with several research conducts. The Kenya full dataset from 2018 consists of 312 indicators and questions, all categorised by a particular topic. In total, 1,001 firms located all over the nation provided data for the questionnaire. Although some of the questions asked in the survey were either open or presented in a 5-point Likert scale, most of them are simplified and require merely a "yes" or "no" answer. Consequently, analysis possibilities are perceived as rather low due to the binary nature of most of the variables.

3.1.1. Sampling method

The sample for the Kenya ES was selected with the use of stratified random sampling (*Enterprise Survey Documentation*, 2018). In this type of sampling, a sample is obtained by dividing the population into different groups (strata) based on similar values on a particular score. After this so-called stratification, a simple random sampling method is used to select a group from each stratum (Hair Jr., Black, Babin, & Anderson, 2019).

This method was used to obtain unbiased estimates for different parts of the population with a specified level of precision. With that, it also provides unbiased estimates for the population as

a whole. In the case of the Kenya full dataset from 2018, the whole population is the total non-agricultural economy in the country (*Enterprise Survey Documentation*, 2018). In order to obtain the best approximation possible, three levels of stratification were used: industry, establishment size, and region. Next to the accurate estimates that a stratified sample offers, the method is also less costly and may produce lower standard errors.

To allow for comparability over the years, the questionnaire was administered to 740 firms that also participated in the 2013 Kenya ES. The survey is almost identical which enables a researcher to identify changes over time. Next to these already participating firms, 261 suitable companies were added to the set with the use of basic data obtained from Kenya's National Bureau of Statistics. This ultimately led to a grand total of 1,001 participating firms all obtained and treated in an ethically correct way.

3.1.2. Research ethics

In general, this study ensures a fair treatment of subjects throughout the entire research process. All data obtained is used strictly for research purposes and is handled in a careful manner. In order to further assess research ethics in this paper, the following section is divided into two parts. Firstly, the World Bank's Enterprise Surveys are described extensively to see whether these were conducted in a responsible way. Secondly, the general ethical concerns for this particular paper's research methods are covered.

To be able to further determine whether the World Bank's Enterprise Surveys were conducted in a responsible way, a heuristic framework on Responsible Conduct of Research (RCR) introduced by Pimple (2002) is utilised. In his work, research ethics are divided into six domains in an attempt to bring order in the field of responsible research: scientific integrity, collegiality, protection of human subjects, animal welfare, institutional integrity, and social responsibility.

Firstly, scientific integrity is concerned about the relationship between what is researched and the truth (Pimple, 2002). It can be expected that the ES provide valid answers to its indicators since the surveys were designed in a way that is easy to interpret (Lietz, 2010). Additionally, questions are predominantly polar and a "don't know" option is provided in most of the cases. Due to the simplicity of the questions, it can be expected that scientific integrity in the survey

is obtained. Specific and straightforward questions like the ones used in the ES, lead to the best possible results and honest answers (Lietz, 2010).

Secondly, and considered vital in the presented framework by Pimple (2002) is collegiality. This domain implies that data is open for usage and reviewed by peers extensively. Collegiality is achieved in the enterprise surveys because several private contractors worked together on behalf of the World Bank (*Enterprise Survey Documentation*, 2018). All work is published on the official website of the research institution and open for anyone registered with the Enterprise Analysis Unit.

Thirdly and fourthly, the World Bank is funded by member countries and other sponsors, all striving for a reduction of world poverty. Doing research is seen as an important pillar in achieving this goal. There is no reason to believe that conducting the Enterprise Surveys led to conflicts or that they are conducted without any form of regulatory compliance. Therefore both institutional integrity and social responsibility are assumed (Pimple, 2002).

Fifthly, animal welfare does not have to be considered since no experiments were performed on animals. Lastly, in a research with a substantial number of participants, the protection of human subjects is of utmost importance. Confidentiality of the survey respondents and the sensitive information that they may provide is necessary to ensure participation in a research. In order to achieve this, the ES followed two procedures. Firstly, all participants were told the following before answering the first question of any survey: “The goal of this survey is to gather information and opinions about the business environment in Kenya. The information gathered here will help to develop new policies and programs that enhance employment and economic growth. The information obtained here will be held in the strictest confidentiality. Neither your name nor the name of your business will be used in any document based on this survey” (*Enterprise Survey Documentation*, 2018). This is crucial, since many questions include sensitive subjects like corruption and the state of the government.

Secondly, the World Bank collaborates with private contractors to conduct their surveys (*Enterprise Survey Documentation*, 2018). These are picked over national governments to ensure confidentiality of the respondents’ answers. As the above-mentioned procedures indicate, the protection of human subjects and their firms is considered and taken as an important part of the survey process. Therefore, the World Bank’s Enterprise Surveys are

expected to be conducted in an ethically correct way, meeting all standards for responsible conduct of research (Pimple, 2002).

After addressing research ethics with regards to the World Bank's Enterprise Surveys, it is also important to explain the procedures this particular research takes to act in an ethically correct way. In order to do so, the five principles that are deemed crucial for research integrity in this paper's country of publication are assessed (*Netherlands Code of Conduct for Research Integrity*, 2018). These principles are honesty, scrupulousness, transparency, independence, and responsibility.

In accordance to the first principle stated in the Netherlands Code of Conduct, this work aims to provide honest findings by offering a fair view on potential limitations and problems that may be encountered throughout the research. By all means, this paper tries to design its analysis with the best possible care. A solid academic base guides its literature review and argumentation for the selection of variables is provided. Ensuring scrupulousness is crucial to end up with a conclusion that is grounded in academic literature (*Netherlands Code of Conduct for Research Integrity*, 2018).

Alongside thoroughness throughout the research process, this work aspires to be transparent and aims not to be guided by non-scientific considerations. In its analysis, each step is carefully described and the rightful source is always provided. This indicates that a clear explanation of what particular data is, and is not used in each component is given. Next to that, tables and figures are used extensively to provide readers with all outcomes of the performed method of analysis.

Lastly, responsibility for survey participants is achieved with the careful research procedures of the World Bank. This paper intends to operate with comparable diligence. Due to the sensitive subjects that are discussed in the Enterprise Surveys, it is of utmost importance to ensure confidentiality of the survey participants in this work. Therefore, this research is strictly used for educational purposes and will be saved in the Radboud University Thesis Repository. This is a digital archive managed by the University Library. To ensure this, the research integrity and consent forms are added in appendix 1 and 2 at the end of this work. In the remainder of this chapter, the particular variables used from the ES are introduced and prepared for analysis.

3.2. *Dependent variable*

The measure for mobile money adoption is directly taken from the World Bank's Enterprise Survey of Kenya. In a series of questions on the use of mobile money to make payments for business-related transactions, the participants were asked the following: "In its current operations, does this establishment use mobile money for any of its financial transactions?". Survey respondents had the possibility to answer "yes", "no" or "don't know". Consequently, the dependent variable in this study is dichotomous or binary in nature.

The question is indicated in the Kenya 2018 full dataset as "MMs1" and uses values 1 for "yes", 2 for "no", and -9 for "don't know". All 1,001 firms that participated in the survey answered this question and the option "don't know" was not used by any of the respondents. This ultimately led to the following numbers. 68.5 percent of the respondents in this dataset uses mobile money for any of its financial transactions. 31.5 percent of the participants answered not to use mobile money for any business-related transactions. In order to prepare the data for analysis, a value of 0 is given to all firms that do not use mobile money. A value of 1 is given to firms that do use MM for firm-related transactions.

3.3. *Independent variables*

3.3.1. *Firm size*

The first independent variable that is utilised to describe the type of firms that uses mobile money in Kenya, is firm size. Several studies on the African business environment use the number of employees as a proxy for firm size (Barasa et al., 2017; Gosavi, 2018; Mahemba & Bruijn, 2003). Therefore, the variable seems to be a generally accepted way to measure the size of a firm. To give a better indication of the types of firms active in Kenya, this research uses the official World Bank classification to determine firm size. Micro firms have 1 to 4 employees, small firms have 5 to 19 employees, medium firms 20 to 99, and large firms employ 100 or more workers (*Enterprise Survey Documentation*, 2018).

In the Kenya 2018 full dataset, survey participants were asked the following question ("l1") in the section on labour: "At the end of fiscal year [2017], how many permanent, full-time individuals worked in this establishment? Please include all employees and managers". A specification was added in order to determine who classifies as permanent and full time.

Workers that are employed for one or more fiscal years, have guaranteed renewal of their contract and work a full shift fall into this group.

Firms had the possibility to provide any answer to this open question. As in many questions, the option “don’t know” was again included. Nonetheless, only one firm decided to use it, leading to a total of 1,000 Kenyan firms providing a viable answer to this question. The average number of employees among the respondents was 74. These can be classified in the predetermined firm-sizes, leading to the following numbers: 4.6 percent of the participants are micro firms, 43.3 percent of the firms are small, 36.4 percent medium, and 16.7 percent large.

3.3.2. Gender

Next to firm size, gender of the manager may influence the choice of adopting mobile money too. In the Enterprise Surveys, top manager gender is measured by the following question (b7a): “Is the top manager female?”. Respondents had the possibility to answer “yes”, “no” or “don’t know” to this question. Again, only one respondent decided to use the “don’t know” option and is therefore excluded from the dataset. In total, 15.4 percent of the firms have female managers and 84.6 percent of the participating firms have male managers. A value of 1 is given to firms with a female manager whereas a value of 0 is given to firms with a male manager.

3.3.3. Family ownership

The 2018 Enterprise Survey of Kenya asks multiple questions on firm ownership. To identify the extent to which a firm is owned by one single family, the following indicator is used (KENb1): “What percentage of this firm is owned by the same family? (If more than one family, refer to the one with the largest ownership)”. Survey respondents had the possibility to answer any percentage they perceived adequate. Next to that, the option “don’t know” was again included.

In total, 22 firms did not know the percentage of ownership by a single family and decided to utilise the “don’t know” option in the question. The remainder of firms is classified in the following five subgroups to gain a better understanding of firm ownership in Kenya: corporations with very little family ownership (0-20%), firms with little family ownership (21-40%), firms with moderate family ownership (41-60%), firms with high family ownership (61-80%), and firms with very high family ownership (81-100%).

This division leads to the following distribution of participating firms. 16 percent can be perceived as having very little family ownership. 3.4 percent had little family ownership. Moderate levels of family ownership were found in 8.6 percent of the respondents. Percentages of 5.9 and 66.2 in the dataset had high and very high levels of family ownership respectively. Through this classification, the indicator for family ownership is transformed into a metric Likert scale which can be added into this paper's model. Firms with very little family ownership receive a value of 1, firms with little family ownership 2, moderate family ownership is labelled with 3, high and very high levels of family ownership are indicated with values 4 and 5 respectively.

3.3.4. Firm location

The final predictor variable in this research is the location of the firm (a3a). The Enterprise Survey divides Kenya in the following ten separate regions: Mombasa, Kilifi, Machakos, Kirinyaga, Kiambu, Trans Nzoia, Uasin Gishu, Nakuru, Kisumu, and the capital Nairobi. Each region received a number ranging from one to ten starting with Mombasa (1) and ending with Nairobi (10). This division leads to the distribution shown in table 1. Again, all firms that provided a valid answer to the above-mentioned question are included in this table.

Table 1. Region of Establishment.

Region	Frequency	Percentage
1. Mombasa	94	9.39
2. Kilifi	70	6.99
3. Machakos	69	6.89
4. Kirinyaga	74	7.39
5. Kiambu	106	10.59
6. Trans Nzoia	40	4.00
7. Uasin Gishu	70	6.99
8. Nakuru	100	9.99
9. Kisumu	73	7.29
10. Nairobi	305	30.47
Total	1,001	100.00

With this division it becomes possible to divide the country into a rural and an urban part. In 2019, 72.5 percent of Kenya's population lived in rural areas opposed to only 27.5 percent living in more urban environments (*World Development Indicators*, 2019). Generally, the urban part of Kenya is described as the two major cities Nairobi and Mombasa (Allen et al., 2020). The rest of the East African country is primarily rural. This classification leads to the

following numbers: 399 responding firms (39.9%) are from urban areas of Kenya whereas 602 firms (60.1%) are from rural parts of the country.

To be able to fit this categorical measure in the model it is crucial to create a new variable. If a firm is located in the rural parts of Kenya a value of 0 is assigned whereas an urban firm receives a value of 1. This indicates that Kilifi, Machakos, Kirinyaga, Kiambu, Trans Nzoia, Uasin Gishu, Nakuru, and Kisumu are replaced with a 0, representing their rural nature. Opposing to Nairobi and Mombasa receiving a 1, indicating the particular respondent is located in urban Kenya.

3.4. Control variables

Two control variables are included in the model to enhance this study's internal validity. It is presumed that these two variables influence the study's dependent variable. Including them in the model, helps in establishing the causal relationship between the variables of interest and the dependent variable.

3.4.1. Export

Firms in Kenya may have varying levels of international presence. Export is oftentimes seen as an important way of accessing new channels in an attempt to gain technical advice or support (Robson et al., 2009). Therefore, firms that are internationally active through exporting can have different perceptions on the usefulness of mobile money ultimately influencing their adoption decision.

In the dataset that is used in this research the following question is asked (d8): "In which year did this establishment first export directly or indirectly?". Firms had the possibility to provide any year or could opt for the "don't know" option. Participants that decided to utilise this option are excluded from the dataset leaving 951 viable firms. From them, 27.2 percent are internationally active through exporting and 72.8 percent are not internationally active.

In order to add this control variable into the model, the variable needs to be changed. A value of 0 is given to all firms that did not provide an answer to question d8. A firm not providing the year in which it started exporting indicates that this firm is only domestically active. Consequently, a value of 1 is assigned to all firms that did indicate in what year exports were

started. These firms are labelled as exporters and may thus have gained international experience that could influence their mobile money adoption decision.

3.4.2. Type of industry

In the ES, firms from different industries are all combined into one dataset. These particular industries can be divided into manufacturing, retail, and other services (a0). From all 1,001 participating firms, 45.5 percent are active in the manufacturing industry, 19.8 percent are active in the retail industry, and the remaining 34.8 percent of the participants provide other services. Sector specific effects have the ability to influence decisions around innovation (Barasa et al., 2017). Therefore, the type of industry a firm is active in, is included as a dummy-coded control variable into this paper's model. A value of 1 is assigned when a firm belongs to the manufacturing or retail sectors and a value of 0 when otherwise. Consequently, firms in the service sector are taken as reference category.

3.5. Method

This research uses a logistic regression to test its hypotheses. In general, regression analyses are of great use in predicting outcomes with the use of several predictor variables. Especially, linear regressions have been widely used in a broad range of research fields. Nevertheless, and in spite of its extensive usage, a linear regression is not fitted to analyse all types of data. When a dependent variable is presented in a binary way, a logistic regression is most efficient and the usual method of choice (Hair Jr. et al., 2019; Stoltzfus, 2011). Next to the dichotomous nature of the dependent variable, a logistic regression can include both metric and nonmetric predictor variables, making it a solid method for this paper's analysis (Hair Jr. et al., 2019).

A logistic regression retains numerous features of an ordinary linear regression. However, the dependent variable: \hat{Y}_i , is dichotomous in nature and its value must fall between 0 and 1. This ultimately represents the probability of being in one outcome category, versus the other (Stoltzfus, 2011). In order to achieve that, a logit scale transformation of the model is needed, a multiple linear regression is expressed in logarithmic terms (Field, 2013). It transforms the original linear regression equation to get the logit of the chance of belonging to one outcome category (\hat{Y}) or the alternative ($1-\hat{Y}$). Consequently, the following general logistic regression model is created:

$$\ln(\hat{Y} / 1 - \hat{Y}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_i X_i$$

Before performing any test, it is crucial to ensure that the provided data meets some predetermined assumptions. Stoltzfus (2011) in her work, states four basic assumptions for conducting logistic regressions. Firstly, independence of errors, where each predicted value is independent. This implies that predicted values are not grouped by variables in the dataset (Hair Jr. et al., 2019). When data includes correlated outcomes and thus correlated errors, the assumption is violated (Stoltzfus, 2011).

A second assumption is linearity in the logit for any independent variable. There should be a linear relationship between the predictor variable and their transformed outcomes. This assumption is deemed as crucial since it forms the basis for the logistic model (Hair Jr. et al., 2019). Graphically, it is often perceived challenging to portray nonlinearity. Therefore, the Box Tidwell test is a widely used alternative approach for testing linearity in the logit.

Thirdly, the absence of multicollinearity is important too. When independent variables are correlated, some of them could be perceived as redundant and should thus be excluded from the model (Stoltzfus, 2011). As a final assumption, it is crucial to consider potential influential outliers. Outliers may disproportionately affect the results of an analysis (Hair Jr. et al., 2019). It is therefore vital that outliers are detected and potentially deleted from the data if deemed necessary.

3.5.1. Justification of methodological choices

A logistic regression is a form of regression that aims to predict a binary or dichotomous dependent variable. In other words, it aims to predict with a number of independent variables the likeliness of belonging to one of two groups (Hair Jr. et al., 2019). In the case of this research, it is the suited method of analysis because this paper aims to find the type of firm belonging to the group that uses mobile money for firm-related transactions. The following section justifies the choice of using a logistic regression further.

Several studies on the diffusion and the effects of mobile money take an identical approach. In a research on mobile money adoption in Ugandan householders, Murendo et al. (2018) use a logistic regression with a binary indicator for mobile money usage. The indicator equals one if

a household uses mobile money and zero if not. Similarly, Osei-Assibey (2015) tests whether an ancient savings operation in Ghana is willing to adopt a mobile money platform in their practices. A logistic regression with a dichotomous dependent variable indicating whether a firm adopts or rejects MM transfer technology in their operations is utilised. Lastly, in an attempt to identify country characteristics affecting the adoption of mobile money in West Africa, Senou, Ouattara, and Acclassato Houensou (2019) use a logistic regression model with a similar binary dependent variable. These studies indicate that several researches around the phenomenon mobile money on the African continent use a logistic regression in its analysis.

So, due to the binary nature of the dependent variable, a logistic regression is the preferred method of analysis. Next to the dependent variable, some of the predictor variables taken from the ES are presented in a similarly simple way. These register a simple “yes” or “no” answer. Studies on questionnaire design oftentimes illustrate that simplicity in the question asked, reduces the cognitive load on respondents (Lietz, 2010). In largescale research-initiatives like the World Bank’s Enterprise Surveys, this is valuable for participating firms. Specific and straightforward questions, like the ones used in the ES, without any ambiguous terms, lead to insightful results and provide the researcher with honest answers (Lietz, 2010). Therefore, through a logistic regression, the obtained dataset has the ability to identify what type of firm uses mobile money.

3.5.2. Limitations of the method

Despite the widespread usage and advantages of a logistic regression, the method presents some limitations too. Firstly, sample size must be accurately analysed (Hair Jr. et al., 2019). This work uses some nonmetric independent variables that are used to predict the dependent variable. When variables like these are included, the sample is further subdivided by the combination of dependent and nonmetric independent variables. It is crucial that all combinations of variables have a large enough sample size. For the ES dataset of Kenya, it is not expected that sample size may be problematic. With a total of 1,001 firms, each combination of variables is sufficiently represented and the sample size is deemed large enough for a logistic regression (Hair Jr. et al., 2019).

Secondly, it is of utmost importance to pick the correct variables into the model (Ranganathan, Pramesh, & Aggarwal, 2017). As is the case for linear regressions, it may be tempting to

include as many predictor variables as possible into the model. For a logistic regression, this may lead to insignificant results with large standard errors, wide confidence intervals, and potential spurious associations. Next to that, highly correlated variables should be avoided, since these lower the effect of each predictor individually.

For this research, each selected independent variable is expected to have a significant impact on a firm's decision to use mobile money or not. All stated hypotheses are grounded in academic literature and recent trends are taken into consideration. Therefore, the above-mentioned limitations are adequately assessed and are not expected to make the results of this research less viable.

4. Analysis

4.1. Data assumptions and cleaning

In order to test the assumptions of the dataset, it is crucial to clean the obtained data first. This is done in two steps. Firstly, it is important to delete the respondents that used the “don’t know” option in any of the questions that this research uses in its model. One firm chose this option instead of indicating the number of employees, one firm used the option instead of providing top manager gender, 22 firms in the dataset were not able to provide the percentage of family ownership, and from the firms that are left, 47 respondents did not know when or whether their firm started exporting. Hence, a total of 71 firms are deleted, indicating that there are 930 firms for further inspection. Secondly, it is crucial to check for missing data. Fortunately, the five indicators that are used in this research do not have any missing values. Therefore, all 930 firms are used in this paper’s analysis and will be tested for the basic assumptions of a logistic regression in the following part.

Before performing any analysis, it is vital to check the basic assumptions of the method used (Hair Jr. et al., 2019). This research tests the four main assumptions in a logistic regression introduced by Stoltzfus (2011). These are the independence of errors, linearity in the logit, absence of multicollinearity, and the identification of potential outliers. In the following, all four of these assumptions are tested with the use of the 930 firms selected from the ES Kenya dataset.

Firstly, it is crucial to consider potential outliers in the data. If some respondents have values that substantially differentiate from other respondents, it might be best to exclude them. Since all variables have been cleaned and are either dummy coded, transformed into a Likert scale, or were dichotomous in nature from the start, only firm size requires further inspection. In order to do so, the variable is standardised indicating it has a mean of 0 and a standard deviation of 1. Generally for datasets with large sample sizes, cases with standardised values of +4 or -4 could be perceived as potential outliers (Hair Jr. et al., 2019). With this classification, several outliers can be identified for the predictor variable firm size.

On the lower bound of this variable, no standardised value scores lower than -4. For the upper bound, a total of 7 firms have a standardised value above the +4 threshold. Among them is one influential value that lies more than 23 standard deviations away from the mean value. Since

this particular respondent changes the mean value of firm size significantly, it is left out of the analysis process. Consequently, a final number of 929 firms are taken into consideration for further analysis of the assumptions.

The second assumption that is tested is the independence of errors. The data in the Enterprise Surveys does not include repeated measures. This indicates that all sample group outcomes in the Kenya 2018 dataset are separate from each other (Stoltzfus, 2011). One firm stating it uses mobile money for any business transactions does not make another firm more or less likely to adopt mobile money for their enterprise. There are no correlated outcomes assumed and therefore the assumption is met.

Thirdly and crucial in any logistic regression is linearity in the logit. An underlying linear relationship between the logit and the continuous predictor variables is assumed for the model to provide valuable outcomes (Hair Jr. et al., 2019). To determine whether these relationships are in fact linear, the Box Tidwell test is performed. An interaction term that is the product of the predictor and its log value is created and added to the logistic regression model with all other independent and control variables. After performing the analysis, it is crucial that the tests for significance of the interaction terms turn out insignificant. This ultimately indicates that there is a linear relationship between the predictor and its logit. For both continuous predictor variables in the model, the Box Tidwell test gives insignificant results at the 5 percent level (table 2) indicating the linearity assumption is met.

Table 2. Box Tidwell Test.

Variable	<i>df</i>	<i>Sig.</i>
Ln(Firm Size) * Firm Size	1	.273
Ln(Family Ownership) * Family Ownership	1	.142

Lastly, the absence of multicollinearity is tested. This assumption is important because large levels of multicollinearity may indicate redundancy among the independent variables in the model (Stoltzfus, 2011). The Variance Inflation Factor (VIF) and the Tolerance as typical measures of multicollinearity are used to determine whether the degree of multicollinearity may be harmful. As showed in table 3 below, the levels of tolerance are high which implies a small degree of multicollinearity in the model. Generally, tolerance values lower than 0.1 could be problematic (Field, 2013). As illustrated in table 3, none of the variables in the model go

below this predetermined threshold. The VIF, as the inverse of tolerance is oftentimes given a cut-off value of 10, however a more conservative value of 3 or 5 can also be utilised (Hair Jr. et al., 2019). Again, the predictors in this paper's model do not seem to cause any issues. In short, the low levels of correlation between this model's predictors present no violations of any of the presented cut-off values. Therefore, all variables are taken into the development of the model.

Table 3. Collinearity Diagnostics.

Variable	<i>Tolerance</i>	<i>VIF</i>
Firm Size	.921	1.086
Man. Gender	.986	1.014
Fam. Ownership	.894	1.118
Firm Location	.967	1.034
Manufacturing	.688	1.453
Retail	.792	1.263
Exporter	.811	1.233

4.2. Descriptive results

As indicated in the foregoing section, the predictors that are used to determine the likeliness of adopting mobile money meet all specified assumptions. After deletion, a total number of 929 firms are taken into consideration. In what follows, the logistic regression model is created in an attempt to find out if the introduced firm characteristics have the hypothesised effect on the decision whether or not to adopt mobile money services. However, before the model is analysed, the descriptive results are checked to gain a better understanding of the distribution of the variables

Overall, 68 percent of the firms in the dataset use mobile money. This is shown in table 4 below. In the final sample that is used for the analysis, the mean number of employees is around 64. This indicates that on average, most firms are medium-sized. Next to that, the sample includes high levels of family ownership and only 15 percent of the firms have a female top manager. As for the location of the firms, a slight minority of the firms is located in urban areas Nairobi and Mombasa. Lastly, the control variables show that most firms in the sample are domestically active and operate in the manufacturing sector. Table 4 briefly summarises each variable and shows its mean and standard deviation. Alongside that, the way in which the variables are transformed and measured is illustrated in the table too.

Table 4. Descriptive Statistics.

Variable	Definition	Mean	SD
<i>Dependent variable</i>			
Mobile Money Adoption	Firm adopted mobile money for any of its financial transactions (1 = Yes, 0 = No)	.68	.467
<i>Independent variables</i>			
Firm Size	Firm size measured as number of employees in 2017	64.24	167.127
Man. Gender	Gender of the manager (1 = Female, 0 = Male)	.15	.358
Fam. Ownership	Level of family ownership in the firm (5 = Very high family ownership, 1 = Very little family ownership)	4.03	1.520
Firm Location	The location of the firm (1 = Urban, 0 = Rural)	.39	.488
<i>Control variables</i>			
Manufacturing	Dummy variable for sector (1 = Manufacturing sector, 0 = Other)	.45	.498
Retail	Dummy variable for sector (1 = Retail sector, 0 = Other)	.20	.401
Service	Dummy variable for sector (1 = Service sector, 0 = Other)	.35	.476
Exporter	Is the firm currently exporting (1 = Yes, 0 = No)	.27	.443

Next to these general descriptive statistics, there are some notable differences between the two groups in this paper's binary dependent variable. Table 5 below shows the mean differences between adopters of mobile money versus non-adopter of the service. The results of the t-tests of the mean differences are also provided in this table. There seems to be a significant difference in means at the 5 percent level for most of the predictors. In concordance with the first stated hypothesis, the firms deciding to adopt mobile money are smaller than their counterparts that decide not to adopt. Surprisingly, most of the adopting firms actually present higher levels of family ownership and are moving towards urban parts of the nation. Although these comparisons show some significant differences between adopters and non-adopters, they do not account for potential confounding effects. The logistic regression as an econometric analysis does consider these effects and its results are discussed in the next section.

Table 5. Independent Samples t-test.

Variables	Adopters versus non-adopters			Sig.
	<i>Adopters (Means)</i>	<i>Non-adopters (Means)</i>	<i>Difference in means</i>	
Firm Size	56.63	80.33	-23.698	.044
Man. Gender	.16	.13	.034	.175
Fam. Ownership	4.24	3.60	.637	.000
Firm Location	.41	.34	.070	.042
Manufacturing	.38	.60	-.225	.000
Retail	.23	.14	.089	.002
Service	.39	.26	.136	.000
Exporter	.23	.36	-.131	.000

4.3. Econometric results

A logistic regression method is used to find out how the predetermined predictors influence the decision whether or not to adopt mobile money services. Unlike multiple regression models, logistic regressions predict the probability of adoption occurring given the known values of the predictors (Field, 2013). A maximum-likelihood estimation is used to select the right coefficients from the data. In other words, with a certain set of firm characteristics, this paper's model aims to predict the likeliness of that particular firm adopting mobile money. This will in turn provide answers to the stated hypotheses.

To construct the most valuable model, a hierarchical method is used. A hierarchical regression method uses a sequential process that involves adding the predictors in blocks (Field, 2013). In this way, it becomes possible to analyse the effect of a particular predictor after controlling for other variables (Lewis, 2007). In other words, what are the effects of the main predictors, taking into account the industry in which the firm is active and whether or not the firm is currently exporting.

For this analysis, the predictors are added to the model in three different blocks. Firstly, the base model with only the intercept is created (model 0). Secondly, the control variables exporter and industry are added (model 1). Here, non-exporters and firms in the service sector are taken as reference category. Thirdly, the four main predictors: firm size, manager gender, family ownership, and firm location are added to the model (model 2). For manager gender, males are taken as reference category and for firm location, rural firms form the base line. The three models and their coefficients and statistics are shown in table 6 below. For all models

created, this paper will elaborate on the odds ratios (exponentiated coefficients) for each predictor. These ratios can be interpreted as the estimated odds of change in MM adoption for a unit change in one the model's predictors (Hair Jr. et al., 2019).

Table 6. Binary Logistic Regression Coefficients.

Model	Variable	<i>B</i>	<i>SE</i>	<i>Wald</i>	<i>df</i>	<i>Sig.</i>	<i>Exp(B)</i>	95% CI for <i>Exp(B)</i>	
								<i>Lower</i>	<i>Upper</i>
0	(Constant)	0.750	.070	113.920	1	.000	2.117		
1	(Constant)	1.226	.134	84.287	1	.000	3.408		
	Manufacturing	-.790	.172	21.145	1	.000	.454	.324	.636
	Retail	.063	.219	.083	1	.773	1.065	.693	1.637
	Exporter	-.347	.165	4.431	1	.035	.706	.511	.976
2	(Constant)	.245	.251	.949	1	.330	1.277		
	Manufacturing	-.746	.177	17.736	1	.000	.474	.335	.671
	Retail	.028	.221	.016	1	.898	1.029	.667	1.587
	Exporter	-.205	.177	1.336	1	.248	.815	.576	1.153
	Firm Size	.000	.000	.300	1	.584	1.000	.999	1.001
	Man. Gender	.198	.214	.854	1	.355	1.219	.801	1.856
	Fam. Ownership	.191	.048	15.580	1	.000	1.210	1.101	1.331
	Firm Location	.416	.155	7.250	1	.007	1.517	1.120	2.053

Model 1 includes only the control variables of the model. As shown in table 7 below, the chi-square statistics for -2LL change (46.000) and the corresponding p-values for this model turn out significant at the 1 percent level. This indicates that adding control variables to the base model, improved the overall performance significantly. Furthermore, model 1 shows that both manufacturing and exporter are significant predictors of mobile money usage (at the 1% and 5% alpha levels respectively). The odds that a firm adopts mobile money decreases by 54.6 percent if that particular firm operates in the manufacturing industry and by 29.4 percent if the firm engages in exporting activities.

Table 7. Chi-square Statistics.

Model		<i>Chi-square</i>	<i>df</i>	<i>Sig.</i>
1	Step	46.000	3	.000
	Block	46.000	3	.000
	Model	46.000	3	.000
2	Step	25.836	4	.000
	Block	25.836	4	.000
	Model	71.836	7	.000

When the main predictors of the model are added (model 2), the chi-square statistic remains high (71.836). This implies that by adding the set of independent variables firm size, manager gender, family ownership, and firm location, the model upgraded significantly. In model 2, the coefficient for manufacturing, although becoming less strong (52.6%), remains highly significant. Unfortunately, the control variable exporter becomes insignificant when the new predictors are added. When controlling for firm industry and international activities, the outcomes of model 2 provide this paper with valuable insights. These are discussed in detail and used to potentially confirm the stated hypotheses.

The first variable firm size, turns out to be an insignificant predictor for a firm's decision whether or not to use mobile money. This is due to its low Wald statistic. An odds ratio of 1.000 indicates that the adoption of mobile money services is equally likely to occur for all firm sizes. This is surprising because an independent samples t-test (table 5), did illustrate a significant difference in firm size between the two groups. Non-adopters of a MM platform seemed to be larger in size than adopters. Nonetheless, when controlled for the other predictors in the model, the presented result is insignificant. Therefore, the data is not sufficient to form a conclusion and hypothesis 1 is neither supported nor rejected for this sample.

The predictor manager gender also came back insignificant. Although the odds ratio indicates that women are 21.9 percent more likely to adopt mobile money, the model fails to obtain statistical significance with its sample. This is not striking since no significant difference in means could be detected in the first place (table 5). Hence, this paper fails to confirm hypothesis 2. No evidence is found that female managers are more likely to adopt mobile money than their male counterparts.

Thirdly, the level of family ownership is a statistically significant predictor (at the 1% level) for mobile money adoption. An odds ratio of 1.210 indicates that a unit increase in level of family ownership increases the odds of adopting mobile money by 21 percent. This is in accordance with the independent samples t-test which showed that adopters on average have higher levels of family ownership (4.24) than non-adopters (3.60). Hypothesis 3 of this paper expected a negative relationship between family ownership and likeliness of adopting mobile money. Yet, the results of the logistic regression model illustrate the opposite. For this paper's sample, higher levels of family ownership actually increased the chance of a firm deciding to adopt mobile money. Therefore, hypothesis 3 is not supported.

Lastly, significant results were found for the predictor location (at the 1% level). For this predictor, the odds ratio of 1.517 shows that the odds of firms in urban areas adopting MM services are 51.7 percent higher than those of firms in rural parts of Kenya. In the previously conducted t-test, a similar pattern was visible. A statistically significant difference between adopters and non-adopters was observed, however, only confirmed with an alpha level of 10 percent. Hypothesis 4 states that firms in rural areas are more likely to adopt mobile money than firms in urban area. This paper's logistic regression analysis shows the opposite and actually finds that urban firms are more likely to adopt mobile money, ultimately leading to a rejection of hypothesis 4.

Despite the fact that the presented model did not manage to confirm any of this paper's hypotheses, it is important to assess it further. With further assessment, it becomes possible to find out whether the model has some predictive accuracy and if it can be used to predict group membership from a certain set of firm traits.

4.4. Assessing the model fit

To assess overall fit of the logistic regression model in this paper, three approaches are used (Hair Jr. et al., 2019). Firstly, there is the previously addressed chi-square test for change in -2LL values. Model 1 with only control variables was a significant improvement over base-model 0 without any predictors. Model 2, with all predictors included, in turn presented a significantly improvement over preceding model 1. In short, this measure of overall model fit indicates that both model 1 and model 2 are statistically significant improvements from the baseline model with only an intercept.

Secondly and seen as equivalent of the R square value in multiple regression, the Nagelkerke (1991) R square (R_N^2) is used to indicate the variance in the dependent variable explained by the model's main predictors (Hair Jr. et al., 2019). This measure is a direct alteration of Cox and Snell's R square (R_{CS}^2) and makes sure the obtained statistic ranges from 0 to 1. As shown in table 8, model 2 illustrates strongly improved measures and thus explains more variance between adopters and non-adopters. Based on Nagelkerke's R square measure, it is possible to state that this paper's predictors explain around 10.4 percent of variation in the dependent variable.

Table 8. R Square Measures.

Model	<i>Cox & Snell R Square</i>	<i>Nagelkerke R Square</i>
1	.048	.068
2	.074	.104

Final method to assess the overall model fit involves the predictive accuracy of the model. This method focusses more on the practical significance of the logistic regression model (Hair Jr. et al., 2019). Table 9 presents the classification table illustrating the observed versus the predicted cases. The table uses the default cut-off value of 0.5 due to a fairly equal distribution of adopters and non-adopters in the total dataset (68.5% and 31.5% respectively). The overall predictive accuracy, as the percentage of total cases correctly classified can be calculated with this classification table. It shows that model 2 predicted 70.8 percent of the cases in this paper's dataset correctly.

Table 9. Classification Table.

		Predicted		
		No	Yes	Percentage correct
Observed	No	71	227	23.8
	Yes	44	587	93.0
Overall percentage				70.8

In short, the model used in this paper has some predictive accuracy and managed to predict more than 70 percent of cases within its sample correctly. Next to that, it explains around 10 percent of the variation between adopters and non-adopters. This indicates that there is still a large amount of variation explained by other variables not included into the model. This is not a surprise, as a wide array of other independent variables could potentially predict the likelihood of adopting mobile money for firm-related transactions.

5. Discussion and conclusion

5.1. Discussion

Mobile money presents an exciting possibility for firms on the African continent to overcome issues related to for instance financial inclusion. Widespread usage of a MM platform provides firms with a safe and easy way of making financial transactions for their businesses. However, the adoption process of this particular innovation does not go without any difficulties. Some nations managed to obtain adoption throughout all layers of society whereas others fail to get a successful MM system off the ground.

In an attempt to better understand the diffusion of such an innovation, research oftentimes relies on existing theories like the technology, organisation, and environment framework. This particular framework states that the technological context, environmental context and certain firm characteristics play an important role in the diffusion process of a technological innovation. In its analysis, this research focussed on the last context and found some noticeable results.

For a specific set of firm characteristics, several hypotheses were stated in chapter two. As for hypothesis 1 on the predictor firm size, it was expected that smaller firms were more likely to adopt mobile money services than larger firms. Especially the struggle of smaller firms to obtain formal bank accounts and the fact that transactions from larger firms could potentially exceed the limit that MM supports, led to the formulation of this hypothesis (Aterido et al., 2011; Demirgüç-Kunt & Klapper, 2012; Mas & Ng'weno, 2012). Nonetheless, the sample from Kenya, with widespread adoption, did not manage to form a conclusion.

Although on average, firms adopting mobile money were in fact smaller, an analysis with other predictors included, fails to find such a result. A potential reason for this could be the limited number of micro firms within this paper's sample. As previously indicated, especially these smaller and informal firms seem to be most ready to use MM services for firm transactions. From all micro firms included, more than 75 percent indicated that mobile money was used within their business. This is higher than for smaller firms (68%), medium-sized firms (68%), and large firms (62%). Possibly, an analysis with a higher number of micro-sized firms included does find size to be a significant predictor of likeliness to adopt mobile money services.

Secondly, hypothesis 2 stated that firms with female top managers are more likely to adopt mobile money than firms with male managers. In particular, the ongoing struggle of women to access financial resources and their rising awareness on societal issues related to cash transactions led this paper to think so (Amoah et al., 2020; Aterido et al., 2011). Nonetheless, significant results failed to materialise, in fact, hardly any difference was found between adopters and non-adopters. For a decision to adopt a financial innovation like mobile money, the gender of the firm's manager is negligible. Therefore, for this sample and model, neither male nor female top managers are more likely to adopt mobile money.

As for third predictor family ownership, hypothesis 3 states that larger levels of family involvement lead to firms being less likely to adopt MM services. This is mainly due the fact that family ownership often goes hand in hand with lower levels of innovative behaviour and reluctance to adopt new technologies (Robson et al., 2009). Nevertheless, no support for this hypothesis was found; large levels of family ownership actually indicated a significantly higher likelihood of adopting mobile money for firm transactions.

The answer as to why high levels of family ownership seem to lead to higher MM adoption rates may lay in the importance of both family ties and community ties in the East African business environment. It is true that strong family involvement creates obligations for emerging market firms that can sometimes impede innovative behaviour (Robson et al., 2009). However, these obligations are often offset by strong ties within local communities (Khavul et al., 2009). The reliance on community ties is a vital way of addressing the limited scope that family members may have in considering new alternatives for their business. Therefore, it can be expected that firms with high levels of family ownership heavily rely on community ties that in turn provide them with the sources to adopt an innovation like mobile money.

Finally, hypothesis 4 on the predictor firm location, states that firms in rural areas are more likely to adopt mobile money than firms in urban parts. The proximity to banks and the high transaction costs that come with formal banking in rural areas of Africa, led this paper to expect firms located there to be more likely to look into alternatives (Aron, 2017). Mobile money services, as one of these alternatives is therefore expected to be widely used in rural areas. The logistic regression model utilised in this paper finds the opposite and concludes that firms in urban areas are more likely to adopt MM services than their rural counterparts.

A potential explanation for this could be in the way in which mobile money was introduced in the first place. Safaricom presented M-Pesa with a focus on urban-to-rural remittances (Morawczynski, 2009). For decades, rural-urban relationships have had several interactions in Kenya. Changes in cities like Nairobi and Mombasa have immediate effects on the countryside in terms of movement of people and the availability of economic resources (Ross & Weisner, 1977). With regards to MM usage, this shows in the fact that senders are mostly men working in urban areas while receivers of funds tend to be women from rural parts of the nation (Morawczynski & Pickens, 2009). Perhaps, the severe struggle of rural firms to access financial capital does not offset the substantial amount of usage by urban firms to remit money back to more rural areas of the nation.

5.2. Implications

5.2.1. Theoretical implications

The discussed results have several theoretical contributions. Firstly, this work provides a starting point for further exploration of the diffusion of mobile money with the TOE framework. As of today, research that uses this highly influential and firm-level framework remains scarce. Although some aspects of the model have been extensively covered, an investigation of the effect of characteristics within the organisational context has not been presented yet. Despite the limited significant results of this paper, it may lead to a further examination of organisational characteristics that are important in the MM adoption process.

Secondly, this work has demonstrated that existing theories on innovation adoption in Africa may not be accurate for the adoption of mobile money services. For instance, the struggle of women to innovate in Africa may not be as severe for mobile money adoption as previous research describes. MM has become an everyday technology and gender does not seem to make a difference in adopting it.

Next to manager gender, the effects of for instance family ownership are not sufficiently understood. The western logic of the constraining effects of family involvement may not apply to the context in which mobile money adoption happens. In short, it is crucial that the process of mobile money adoption is further researched. Existing theories on the phenomenon fail to describe its adoption process. Consequently, approaching the concept through different perspectives could potentially bring up interesting results.

5.2.2. Practical implications

Next to these theoretical contributions, the paper has some practical implications too. As put forward in the presented work, mobile money can be seen as an excellent opportunity to solve some of the most prevailing issues on the African continent. However, a wider adoption of the service is needed for these solutions to show. The results that are obtained in this research may be helpful in its diffusion process and could potentially be used by policy makers and service providers. In the following part, the practical implications for both of these two actors are discussed.

For service providers, adoption at the corporate level seems to be an issue. Companies have not reached as many business clients as they have individuals and households. Potential reasons for these lower adoption rates are the imposed limits on money transfers and the fact that the service has been mainly marketed for individual usage. Nonetheless and as mentioned before, the use of mobile money has the potential to be highly beneficial for firms in Africa. If providers like M-Pesa decide to focus on corporate usage of their services, the results of this paper could be useful in several ways.

Firstly, the fact that mobile money services are widely used in firms with high levels of family ownership may indicate that the innovation is not seen as very radical. Next to that, the potential negative effects that family ownership is presumed to have on innovation adoption may be offset by strong ties within local communities. Therefore, if providers like M-Pesa or any future provider in another African country wishes to market their products for business-related transactions, it is wise to emphasise the simplicity of the technology and explain how the company plans to strengthen local communities and families. Firms that value these ties seem to be the main adopters.

Secondly, the likeliness of adopting mobile money is higher for firms in urban areas. Nevertheless, issues like a lack of formal banking options and the struggle for financial inclusion in general seem especially prevailing in rural areas. These widely dispersed parts of the nation present an excellent opportunity for further expansion of mobile money's corporate services. In short, service providers should aim to make their offerings more attractive for rural firms.

For policy makers, the findings around firm size as potential predictor seem practical. Although firm size was not a significant predictor of mobile money adoption, users of the service seem to be smaller in average size than non-users. The imposed limits on transfers due to relaxation of the Know-Your-Customer and Anti-Money-Laundering requirements could be a possible explanation for this. Next to that, MM platforms are closed-loop and do not support usage with other IT systems. Larger firms may therefore be less inclined to use the services as these do not work in congruence with their existing systems. If the limits on transferable amounts are erased for firm-related transactions and integration with other platforms is manageable, MM providers may reach an entirely untouched section of market share which has the potential to increase adoption rates tremendously.

Though, it is worth noting that putting in place less stringent limits on money transfers presents a paradox. On the one hand, relaxation of the KYC-AML requirements by imposing strict bounds on transferable amounts was one of the main reasons for mobile money's success in the first place. Cutting these limits may require users to present more formal documents to ensure safe usage of the system which may lower usage rates. On the other hand, these limits seem to prohibit larger firms from using MM. A less severe set of rules and laws, especially created for firms, may drastically increase corporate usage of mobile money services. For policy makers, it thus seems important to find a solution to this issue. Increased transparency and decrease in information asymmetry that comes with corporate MM usage, are merely some of the advantages widespread adoption can offer.

In short, instead of studying mobile money adoption from an individual point of view, a shift towards focussing on firm-level usage of MM with the TOE framework is valuable. If more is known about the type of firms using mobile money, the problems they encounter while using it, and about the process of diffusion, providers of the service can potentially amend their offerings to better fit users' needs. Next to that, policy makers on the continent may alter the regulatory environment that surrounds the innovation to benefit from all advantages it has to offer. This paper is a merely a starting point for extensive future research addressing the issue.

5.3. Limitations

Despite these important contributions to both academic literature and local actors, there are some limitations to this study's results too. Firstly, the categorical nature of most of the used indicators severely limits the amount of analysis possibilities. Although the simple binary

questions in the ES are advantageous, potential valuable information like the reason why, is lost when data is presented in such form. Secondly, due to time constraints it was not possible to elaborate on all probable predictors that may affect adoption decisions. It can be expected that a wide array of other independent variables in the organisational context has an effect on the diffusion process of mobile money. Lastly, adoption of MM services on the firm-level has not been widely researched yet. Consequently, the hypotheses in this work are based on general innovation literature and these theories were not adequate to describe mobile money adoption decisions since none of the hypotheses were confirmed.

5.4. Suggestions for future research

Due to limitations and the insignificant or non-supporting results of the paper, several directions for future research can be provided. First of all, it is crucial that the trend of researching firm-level adoption of MM is continued. A full analysis with the technology, organisation, and environment framework may be valuable to obtain results from which other researchers, service providers, and regulatory institutions can benefit. Other characteristics that influence innovation behaviour of firms are levels of growth, age, expenditures on training, internationalisation, and industry (Robson et al., 2009). If providers and regulatory institutions know for instance the industry in which adoption is especially happening, they could shift their focus towards industries that seem to lack behind in their adoption process.

Next to these general characteristics, Tornatzky and Fleischer (1990) focus in their original work on internal linkages and communication within firms. These factors within the organisational context are crucial according to the originally introduced framework. However, it is important to note that further exploration will require a more in-depth analysis. Communication that happens within a firm is not easily measurable and quantified.

Therefore, research with a qualitative approach should be conducted. Qualitative research can establish the relationship between specific traits that are present within a firm and the decision to adopt mobile money. Next to that, more specific knowledge about the problems that current users encounter can be found, ultimately meaning more can be done to find a possible solution. Work conducted by Uwamariya and Loebbecke (2020) presents a first attempt to use the TOE framework in combination with qualitative data. Their research provides Kenya's neighbouring countries with advice on how to successfully launch a mobile money platform. Since the main focus of the organisational context in their work is on the characteristics of the service providers

themselves, and not on those of the adopters, the study suggests further exploration of the end-users and their concerns. Although this is partly done with a quantitative approach in the presented paper, qualitative data has the potential to provide a more in-depth analysis.

Lastly, the contradictory effects that this paper finds in its analysis are interesting starting points for potential future research. For instance, the positive effect that a large level of family ownership has on the likelihood of adopting mobile money presents a remarkable conclusion; it opposes with previously established findings. Therefore, further research should assess in what way the negative effects of family ownership are offset. With that, the fact that mobile money adopters reside in primarily urban parts of the country opposes to what was originally expected. Perhaps other aspects of the environment, like regional institutional differences or conflicting social factors play a role in determining the adoption of MM services.

5.5. Conclusion

Mobile money has the potential to open new doors for businesses on the African continent. Yet, adoption on the firm-level is not sufficiently understood. This paper has shown how the highly influential technology, organisation, and environment framework can help in explaining the diffusion process of the service. The stated hypotheses that focus on the organisational context of this framework are based on established innovation literature and have presented several interesting findings. These findings were used to answer the stated research question:

What firm characteristics influence the decision to use mobile money services for business transactions?

There are numerous firm characteristics that could potentially influence a firm's decision whether or not to adopt mobile money services. However, according to the analysis performed in this paper, three main conclusions can be formed. On average, adopters of a MM platform tend to be smaller in size. Next to that, high levels of family ownership and being urban-based, increase the likelihood of adopting mobile money for firm-related transactions. Some of these findings were surprising and offer future potential research areas in the field. New work should aim to fully comprehend firm-level adoption of mobile money services as it will provide local actors with crucial knowledge in their attempts to spread this novel technology on the continent.

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7. Appendices

7.1. Appendix 1: Research integrity form

Name: Floris Julian Rovers	Student number: s1063928
RU e-mail address: floris.rovers@ru.nl	Master specialisation: International Business

Thesis title: Mobile Money and its Users: A Firm-level Analysis with the TOE Framework

Brief description of the study:


Mobile money (MM) is a promising innovation on the African continent. This paper aims to research the diffusion process of mobile money services and uses the firm-level technology, organisation, and environment (TOE) framework to structure its findings. Kenya is used for analysis because the country is perceived frontrunner in MM usage. Main focus within the framework is on the organisational context as prior studies have overlooked its importance. Four firm characteristics: size, manager gender, family ownership, and firm location are hypothesised to have an effect on the likeliness to adopt a MM platform for firm usage.

It is my responsibility to follow the university's code of academic integrity and any relevant academic or professional guidelines in the conduct of my study. This includes:

- providing original work or proper use of references;
- providing appropriate information to all involved in my study;
- requesting informed consent from participants;
- transparency in the way data is processed and represented;
- ensuring confidentiality in the storage and use of data;

If there is any significant change in the question, design or conduct over the course of the research, I will complete another Research Integrity Form.

Breaches of the code of conduct with respect to academic integrity (as described / referred to in the thesis handbook) should and will be forwarded to the examination board. Acting contrary to the code of conduct can result in declaring the thesis invalid



To be signed by supervisor

I have instructed the student about ethical issues related to their specific study. I hereby declare that I will challenge him / her on ethical aspects through their investigation and to act on any violations that I may encounter.

Supervisor's Signature: _____ Date: _____

7.2. Appendix 2: Consent form

Radboud University Nijmegen (hereafter Radboud University) has set up a thesis repository. The purpose of this repository is twofold:

1. To archive theses for a minimum period of seven years, in accordance with legal requirements (Wet versterking kwaliteitswaarborgen hoger onderwijs, Art. 7.3, lid 5).
2. Wherever possible and allowed, make theses available to potential users inside and outside Radboud University.

This supports the process of creation, acquisition and sharing of knowledge in the educational setting.

The repository serves as an archive in which all theses will be included. This consent form serves to also enable the publication of those theses.

By submission and publication in the theses repository copyright is not transferred. Therefore, students can at any time revoke their consent for publication.

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If the student grants permission to Radboud University to make his/her thesis available within the thesis repository to users inside and outside Radboud University, the student states that:

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- Neither the organization offering internship nor the client of the thesis has any objections against making the thesis publicly available in the thesis repository.
- The student has obtained permission from the copyright holder of any material used in the thesis to incorporate this material as part of the thesis in the theses repository and make it available to others inside and outside Radboud University.
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- The student grants Radboud University the right to change the accessibility of the thesis and limit it if compelling reasons exist.

Rights and obligations of Radboud University

- The student's non-exclusive license grants Radboud University the right to make the thesis available to users inside and outside Radboud University.

- Radboud University is allowed to include the thesis, in accordance with legal requirements, in the theses repository for a minimum period of seven years.
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- Radboud University will ensure that the author of the thesis is listed and make clear that if the thesis is used, the origin must be clearly stated.
- Radboud University will make clear that for any commercial use of the thesis the student's explicit consent is required. In relevant cases, explicit consent of the organization offering internship or the client of the thesis is required as well.
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As a consequence of this consent form a user of the theses repository may use the thesis for private study and/or educational and research purposes, in accordance with the provisions of the Copyright Act (Auteurswet), with full mention of the name of the student and the location of the thesis.

Student number: s1063928

Student name: Floris Julian Rovers

Thesis title: Mobile Money and its Users: A Firm-level Analysis with the TOE Framework

- Yes, I grant permission to make available my thesis with the above title in the Radboud thesis Repository.
- No, I do not grant permission to make available my thesis with the above title in the Radboud thesis Repository, but the thesis is allowed to make available with effect from (temporary embargo).
- No, I do not grant permission to make available my thesis with the above title in the Radboud thesis Repository (permanent embargo).

