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Tiwasing, P., Addae, J. A., Naab, F. Z. & Naab, G.

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# Do mobile money services enhance business performance? An empirical analysis of Kenyan businesses

**Pattanapong Tiwasing** 

Keele Business School, Keele University, Staffordshire, UK

**John Agyekum Addae** 

LUT University, Finland; Ghana Communication Technology University, Ghana

**Francis Zana Naab**

Scotland's Rural College (SRUC), Edinburgh, UK

**Gilbert Zana Naab**

School of Strategy and Leadership, Coventry University, UK

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## Abstract

This study examines the impact of mobile money services on business performance by comparing the performance between businesses that use and do not use mobile money. The analysis empirically draws on cross-sectional data of 1001 Kenyan businesses from the 2018 World Bank Enterprise Survey. Propensity Score Matching is used to control for selection bias and variations in business characteristics. The results reveal that businesses that use mobile money services are more likely to be innovative in products and processes than non-users. However, they perform as well as businesses that do not use mobile money. The results also show that differences in business-specific characteristics such as business size, sector, location, and business obstacles significantly influence the adoption of mobile money by Kenyan businesses. Therefore, these results highlight the importance of mobile money services for Kenyan businesses with effective digital tools and support. Policy recommendations to enhance the financial mobile ecosystem and financial inclusion are discussed.

## Keywords

mobile money, FinTech, business performance, empirical analysis, Kenya

## Introduction

Financial Technology (FinTech) is a synergistic coupling of finance and technological innovation (Lai and Samers, 2021), which encompasses different platforms such as mobile payment systems, Blockchain, and similar (Suri et al., 2021). The FinTech industry is a non-monolithic sector where diverse financial services are delivered remotely, with rapid successive yearly growth (Lehner and Simlinger, 2019). Global investment in the FinTech sector rose from US\$9 billion in 2010 to US\$56 billion in 2016 (Papadimitri et al., 2021) and reached US\$135.7 billion in 2019 (Pizzi et al., 2021). This huge investment contributed to a significant increase in global FinTech usage from a mere 16% in 2015 to

64% in 2019 (Papadimitri et al., 2021). Especially during the COVID-19 lockdown, FinTech has boosted the number of users globally since physical financial services have been restricted (Mansour, 2022). World Bank (2020) reveals that the world's fastest-growing FinTech markets are in developing nations, especially in Sub-Saharan Africa (SSA).

SSA has the highest number of registered mobile money accounts globally (Bai et al., 2021). Nevertheless,

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### Corresponding author:

Pattanapong Tiwasing, Keele Business School, Keele University, Denise Coates Foundation Building, Staffordshire, ST5 5NS, UK.

Email: [p.tiwasing@keele.ac.uk](mailto:p.tiwasing@keele.ac.uk)

inadequate infrastructure remains a critical issue that undermines the usage and efficiency of mobile money services in SSA (World Bank, 2020). A significant investment in digital technologies (e.g. mobile networks etc.) has enabled SSA constrained with infrastructure to make significant strides in the FinTech ecosystem, particularly in Kenya – one of the top three African countries for financial services innovation (Nejad, 2022). In 2007, Kenya introduced ‘M-PESA’, a mobile money service – an electronic money transaction model built on telecommunication networks that allows users to deposit money and make payments (Nejad, 2022). Approximately 90% of Kenya’s adult population uses M-PESA and about 75% of families have at least one FinTech user (Jack and Suri, 2014). Also, approximately 80% of small- and medium-sized enterprises (SMEs) have integrated mobile money into their operations with a greater utilisation rate for business growth and performance (Lorenz and Pommet, 2021).

Several recent studies have examined the impact of mobile money services on business performance. For example, Abbasi et al. (2021) reported that FinTech positively influences business efficiency among SMEs from 22 OECD countries. Talom and Tengeh (2020) also presented a positive relationship between adopting mobile money services and financial performance among SMEs in Cameroon. Similarly, Lorenz and Pommet (2021) find that mobile money adoption is positively associated with firm innovativeness among businesses in Kenya, Uganda and Tanzania. Gopane (2021) also reveals that mobile money uptake promotes financial inclusion and improves financial performance between Kenyan agribusinesses.

In particular, previous research has shown that factors such as firm size, business age, type of business, and access to financial services can significantly influence mobile money adoption by businesses (Lorenz and Pommet, 2021; Islam and Muzi, 2022). However, most studies primarily focus on the determinants of mobile money adoption at the individual level (Narteh et al., 2017; Akinyemi and Mushunje, 2020; Glavee-Geo et al., 2020). Consequently, it remains unclear whether these determinants differ between adopters and non-adopters at the firm level, which could provide valuable insights for understanding the barriers and motivations for adoption among Kenyan businesses. Therefore, this study aims to provide an evidence-based analysis to evaluate the impact of mobile money services on business performance between businesses that adopt and do not adopt the services and identify key factors that differentiate adopters from non-adopters at the firm level.

To do this, this article aims to answer two key questions on “do Kenyan businesses that adopt mobile money services perform better than non-adopters?” and “What are the main factors that differentiate businesses that adopt mobile money services from non-adopters in Kenya?” In this study, we focus on financial and non-financial

performance, using cross-sectional data from 1001 Kenyan businesses from the 2018 World Bank Enterprise Survey. To control for selection bias and differences in firm characteristics, we apply propensity score matching (PSM) to examine the effect of mobile money on firm performance by comparing performance between businesses that use and do not use mobile money. Our results reveal that businesses using mobile money are more likely to be innovative in products and processes than non-users. However, they perform as well as businesses that do not use mobile money in terms of annual sales. These results highlight the importance of mobile money use to improve business development with the requirement of effective digital tools and support for Kenyan businesses. The results also identify key business profiles that differentiate adopters from non-adopters. These empirical results should, therefore, be helpful for policymakers, practitioners and academic researchers in maximising Kenya’s FinTech ecosystem and promoting financial inclusion for business success in the digital era.

The rest of this study is organised as follows. The ‘Theoretical background’ section discusses the theoretical background. The ‘Literature review and hypothesis development’ section reviews relevant literature with the hypothesis development. The ‘Secondary data and descriptive statistics’ section describes the secondary data and key variables used in this study. The ‘Propensity score matching’ section discusses the method used for data analysis. The empirical results are discussed in the ‘Results and discussion’ section. The ‘Conclusions and policy recommendations’ section concludes with contributions. The ‘Limitations and future research directions’ section highlights limitations and future research directions.

## **Theoretical background**

Transaction cost theory (TCT) and technology acceptance model (TAM) serve as the underpinning theory for this study, illustrating how businesses can enhance competitiveness by reducing costs through innovation (Pelletier et al., 2020). TCT perceives enterprises as contractual structures with transaction costs, prompting businesses to minimise these costs by either managing resources internally or outsourcing services (Akbar and Tracogna, 2018). It provides insights into why certain economic transactions occur within firms while others are outsourced externally (Pelletier et al., 2020). The theory predicts that high transaction costs lead to internalisation within firms, while low costs incentivise outsourcing for cost efficiency (Young, 2013). In line with this, many businesses are transitioning to external payment platforms, such as mobile money services, as an alternative to traditional payment methods due to their significant economic advantages (Pfister and Lehmann, 2023). The adoption of mobile money fosters a seamless integration with internal operations, facilitates

enhanced external interactions, and adds overall value to the ecosystem (Wu et al., 2022).

Using mobile money in business operations can be viewed as an innovation tool that facilitates cost reduction and profit enhancement. Jack and Suri (2014) point out that mobile money is considered an innovative technology that significantly reduces both the fixed and variable costs associated with the transfer of money. Thus, firms would potentially prefer to use mobile money as an external tool to help lower their operational expenses and boost sales (Pfister and Lehmann, 2023; Ding et al., 2022). Using mobile money also has the potential to maximise a company's profitability, as well as increase the likelihood of new product and process innovations being implemented within the business (Young, 2013).

The fundamental components of TCT encompass transaction frequency, transaction uncertainty, and asset specificity, all playing crucial roles in understanding economic transactions (Alaghehband et al., 2011). Asset specificity refers to the degree of specialised financial investments required to maximise transaction value, whereas transaction frequency and uncertainty encompass the frequency of transactions and the range of potential future contingencies. In our context, mobile money is a specialised financial instrument for managing frequent payments and addressing client issues that may arise when businesses do not utilise mobile money. Thus, TCT helps explain how mobile money's asset specificity is seen as a key resource in managing business activities and strategies in the digital world (Lorenz and Pommet, 2021; Jalil et al., 2022). Applying TCT, therefore, allows us to understand firms' behaviour in the cumulative adoption of mobile money services over time. It helps us understand that firms vary in their willingness and ability to embrace innovation, meaning that not all businesses approach the adoption of these services in the same way or at the same pace (Ganglmair-Wooliscroft and Wooliscroft, 2016).

Recent research has shed light on the direct association between mobile money adoption and firm innovation, supported by TAM (Kim et al., 2015). TAM provides a theoretical framework for understanding users' acceptance and adoption of new technologies, highlighting the importance of perceived usefulness and ease of use. In the case of mobile money adoption, individuals perceive it as a useful and convenient technology for financial transactions, leading to increased adoption (Lorenz and Pommet, 2021). As mobile money adoption expands within a population, businesses are then motivated to innovate their products and processes to leverage the benefits of this technology (Kim et al., 2015). By integrating mobile money into their operations, businesses can enhance efficiency, streamline financial transactions, and improve customer experiences (Gopane, 2021). This positive relationship between mobile money adoption and business innovation

underscores the importance of user acceptance of technology in driving organisational innovation (Abbasi et al., 2021).

In conclusion, TCT and TAM offer valuable frameworks for examining the relationship between mobile money services and business performance, as well as for exploring factors influencing adoption and user engagement in innovation activities. Adopting mobile money services can lead to business innovation, the development of new business models, the introduction of new products/services, and cost reduction. Subsequently, this improvement in business processes can enhance business performance for mobile money users. Evidence on mobile money adoption and business performance improvement is discussed in the following section.

## Literature review and hypothesis development

FinTech, including mobile money, has reshaped the global production and financial ecosystem and supported the proliferation of local economic activities in developing countries (Lai and Samers, 2021). Also, it is considered a significant driver for the sustainable development goals (SDGs) and pivotal to the recovery efforts of countries following the COVID-19 pandemic (Bai et al., 2021). Mobile money is also a major contributor to business growth and economic development in developing economies. For example, using data from 104 developing countries between 1990 and 2019, Apeti and Edoh (2023) showed that mobile money adoption significantly increases tax revenue performance in mobile money countries relative to non-mobile money countries. Also, Jacolin et al. (2021) revealed that mobile money is an innovative tool to accelerate the economic activity of businesses in the formal sector in developing countries. Pelletier et al. (2020) also point out that mobile money usage, rather than physical cash transactions prevents robbery attacks in SSA countries. Businesses that adopt mobile money can reduce uncertainty surrounding business operations such as trading activities (Pelletier et al., 2020). Mobile money can also create social value by providing transactional security and convenience as well as enhancing consumers' skills development among those adopters in many countries in SSA (Fall et al., 2021), including Kenya.

After the popularity of Kenya's M-PESA in March 2007, the country has become the hub for innovation in mobile money technology (Gopane, 2021; Lorenz and Pommet, 2021). Kenya continues to explore the potential of mobile money services to accelerate financial inclusion and reduce poverty (Makina, 2019). Also, the mobile money ecosystem still continues to evolve throughout the country, introducing new demand-side products that are customer-centric. Businesses and consumers can use mobile money to make payments, lend, borrow, and

invest through the power of digital wallets/mobile money (Lai and Samers, 2021). In particular, during the COVID-19 crisis and aftermath, Bai et al. (2021) suggested that enterprises should integrate FinTech services into their digital transformation strategy to champion business model sustainability and enhance business development in the digital era. However, not all Kenyan businesses can be successful in adopting mobile money due to low levels of digital skills and literacy and their business obstacles (Gopane, 2021).

As a result of the digital revolution, businesses have become more competitive and efficient. Firm-level digitalisation has a wide range of benefits, including improved efficiency, cost reduction, increased customer satisfaction and increased competitive advantages (Pfister and Lehmann, 2023). Despite the many benefits of digital transformation, some Kenyan businesses are yet to fully utilise the digital potential and some firms still lack the capacity to adapt to new technology (Lorenz and Pommet, 2021). While others view the digital investment and operational costs are extremely expensive (Lehner and Simlinger, 2019). Therefore, firms with digital skills and capacity can quickly adopt mobile money and other FinTech services to improve their financial services and enhance business performance (Pfister and Lehmann, 2023).

Mobile money services greatly have a positive effect on business performance, and they can foster access to finance to drive business growth. For example, Pfister and Lehmann (2023) supported that FinTech drives higher sales, cuts operational expenditure, and lowers personnel costs. Similarly, Talom and Tengeh (2020) confirmed that mobile money adoption has a positive relationship with the financial performance of Cameroonian SMEs. Nan and Park (2022) affirmed that SMEs that have integrated mobile money with their business operations are better equipped to withstand COVID-19 economic shocks relative to non-users. They found that mobile money users are less likely to record lower sales than non-users, which are predicted to have 31% lower in sales. However, Jack and Suri (2014) reported that mobile money non-users find money mobile unattractive since they experience 10% negative shock in adverse events in Kenya. Based on the foregoing, we set our first hypothesis to particularly focus on annual sales as financial business performance since little research focuses on this measure, which is:

**H1:** Businesses that adopt mobile money are more likely to have higher annual sales than non-adopters.

Mobile money is seen as one of the modern methods to enhance innovativeness in several businesses. Bouwman et al. (2019) point out that firms that have the capacity to engage in some novel methods, including mobile money, can bring about product and process innovation to their businesses. Wonglimpiyarat (2017) also supports that

FinTech, including mobile apps, can transform business services, especially in banking industries, to the best commercial opportunities and deliver commercialised product/process innovation in a competitive market. Thus, several positive outcomes have emerged from adopting mobile financial services to improve firm innovativeness. For example, Muzanarwo et al. (2020) found that mobile financial services are the main enabler to drive product innovation in the banking industry in Zimbabwe. In Kenya, Lorenz and Pommet (2021) indicated that the adoption of mobile money can reduce financial constraints and improve financial services and firm innovativeness among Kenyan businesses as well as those in Uganda and Tanzania. Abbasi et al. (2021) also showed that SMEs using mobile money are more likely to be innovative in processes since they can significantly improve firm processes and increase firm efficiency. Additionally, Salamopsis and Mention (2018) revealed that using FinTech applications such as M-PESA in Kenya can help businesses to promote financial products and services and develop new financial processes. Therefore, businesses that have adopted mobile money can enhance their business capabilities related to product and process innovation compared with non-users. Accordingly, we postulate our second as:

**H2:** Businesses that use mobile money are more likely to be innovative than non-users.

In summary, most studies have focused on businesses that use mobile services without recourse to businesses that do not. Thus, it is still empirically unclear whether mobile money adoption impacts business performance more than non-adopters, particularly in the context of Kenya. Our study, therefore, provides new empirical evidence to address this hiatus in the literature relating to mobile money (non)adoption and venture performance.

## Secondary data and descriptive statistics

This study uses secondary data from the 2018 World Bank Enterprise Survey (WBES) for Kenya – a firm-level survey of an economy's private sector. The WBES includes different key information on the business environment and economic data, such as access to finance, business obstacles, and innovation capability. Although the WBES was conducted for Kenya in 2007, 2013 and 2018, the information on mobile money usage is only available in 2018. Therefore, we only use the 2018 data to perform cross-sectional analysis and it is the updated data for Kenya.

In WBES, 1001 Kenyan businesses were collected in 2018, of which 68.5% reported that they used mobile money for any of their financial transactions, including paying for their employees, paying for utility bills, paying for their suppliers and so on. Table 1 shows the descriptive statistics of variables used in the analysis. We apply the chi-

square ( $\chi^2$ ) statistic to consider the differences in these variables between businesses that use and do not use mobile money. If  $p$ -value  $< 0.05$ , there is a significant difference between the two groups. For example, mobile money adopters (18.3%) are less likely to be large businesses compared to non-adopters (26.1%).

### *Treatment variable*

Mobile money is used as a treatment variable in this analysis, which is a binary variable. Mobile money, which is one type of FinTech services, can help mobile money adopters to improve their business services and financial operation processes (Lorenz and Pommet, 2021). Also, mobile money is recognised as an innovative tool that can contribute to reducing firms' operational costs and enhancing sales (Pfister and Lehmann, 2023). It also increases the likelihood of implementing new product and process innovations within businesses (Young, 2013). Therefore, following the TCT and TAM theory, using mobile money can potentially help reduce transaction costs and enhance sales performance and firm innovativeness. We use this variable to evaluate the impact of mobile money services on business performance, especially in the context of comparative analysis between mobile money adopters and non-adopters.

### *Dependent (outcome) variables*

The analysis focuses on annual sales and innovation since mobile money adoption is positively associated with both types of business performance (Lorenz and Pommet, 2021; Zhang et al., 2021). For annual sales, mobile money services can increase firms' sales and mitigate financial constraints between businesses and clients (Lorenz and Pommet, 2021). In particular, financial mobile services can increase consumers' motivation to purchase goods due to a reduction in transaction costs and convenient payment services (Ding et al., 2022). In WBES, businesses were asked about the amount of total annual sales in the last fiscal year. We use Welch's  $t$ -test to check for the difference in annual sales between businesses that use and do not use mobile money since this variable is continuous and has an unequal sample size. It shows that there is no significant difference between the two groups.

We also consider both product and process innovation as business performance since mobile money services are often associated with firms' innovativeness because they provide a means to leverage new technologies in enhancing the delivery of traditional financial services and products (Zhang et al., 2021). In WBES, businesses were asked whether they have introduced new or significant products/services (product innovation) and improved processes (process innovation) during the last three years, which are the binary measures of innovation. Thus, it is important to note that our analysis cannot fully capture a specific type

of innovation from R&D-based new products and services. In Table 1, the  $\chi^2$  results show that businesses using mobile money are more likely to report that they are innovative in products/services than non-users, while there is no significant difference in process innovation between the two groups. However, to produce a robust analysis for the comparison of business performance between adopters and non-adopters, we need to control for differences in businesses' characteristics in the analysis, which is explained in the 'Propensity score matching' section.

### *Control variables*

Table 2 provides a summary of relevant empirical studies on the key factors of mobile money adoption and other digital technology. Drawing from these studies, we include three main factors in the analysis which are business characteristics, business obstacles, and business capability. These factors are included as control variables in the PSM analysis which can help identify the real effect of mobile money on business performance.

Firstly, for business characteristics, we control for differences in business sectors in the analysis since businesses that adopt and do not adopt mobile money can operate their businesses in different sectors such as manufacturing, food, retail, and other business services (Lorenz and Pommet, 2021). Also, business size (number of employees) is also included in the model since Gopane (2021) reports that business size is significantly associated with money mobile adoption. Also, locations, such as cities or urban areas, are often associated with high levels of IT adoption (Tiwasing, 2021). Therefore, we account for the impact of locations on mobile money adoption, using Nairobi, the capital city, as a variable to represent urban areas. Gender is also included in our analysis since women-led businesses are traditionally related to digital disadvantages (e.g. lower level of digital literacy and self-perceptions on digital technologies) compared to men-led businesses (Islam and Muzi, 2022). Also, we control for business age since this variable is significantly relevant to digital skills and IT knowledge (Tiwasing, 2021).

Next, for business capabilities, we control for business networks since businesses that participate in business networks can obtain new information and exchange knowledge, potentially resulting in an increase in digital adoption (Tretiakov et al., 2019; Tiwasing et al, 2023b). R&D investment is also controlled in the analysis since R&D investment can increase better opportunities for businesses to use modern digital platforms, including financial mobile services (Zhang et al., 2021). Additionally, we control for the capability to apply for new loans/lines of credit, since this variable can explain about whether firms are active in digitalisation or not (Tiwasing, 2021). Finally, for business obstacles, we consider key variables related to electricity obstacles and access to finance since

Table 1. Descriptive statistics of variables used in the analysis.

Variable	Description	Number of businesses		Chi-square ( $\chi^2$ ): value (df)
		Mobile money	Non-mobile money	
Dependent				
SALE <sup>a</sup>	An establishment's total annual sales (continuous)	$1.03 \times 10^9$	$8.47 \times 10^8$	0.061 (1) <sup>a</sup>
PDINNO	I if an establishment has introduced new or improved products or services (dummy)	52.6%	33.4%	31.62 (1)**
PCINNO	I if an establishment has introduced any new or improved process (dummy)	27.8%	22.9%	2.653 (1)
Independent				
WOMEN	I if an establishment is a female-led business (dummy)	45.7%	45.8%	0.001 (1)
SMALL	I if an establishment is a small-sized business (dummy)	49.2%	36.9%	3.154 (1)**
LARGE	I if an establishment is a large business (dummy)	18.3%	26.1%	7.982 (1)**
FOOD	I if an establishment operates in the food manufacturing sector (dummy)	11.1%	26.7%	39.06 (1)**
TEXTILE	I if an establishment operates in the textiles and garment sector (dummy)	4.2%	9.8%	12.07 (1)**
CHEM	I if an establishment operates in the chemical, pharmaceutical, and plastic sectors (dummy)	11.5%	10.5%	0.284 (1)
MANU	I if an establishment operates in other manufacturing sectors (dummy)	17.8%	21.0%	1.42 (1)
RETAIL	I if an establishment operates in the retail sector (dummy)	21.6%	9.5%	21.44 (1)**
TOUR	I if an establishment operates in the tourism sector (dummy)	16.5%	7.3%	15.46 (1)**
AGE <sup>a</sup>	An establishment's age (continuous)	20.6	25.8	16.62 (1)** <sup>a</sup>
FORM	I if an establishment is a member of formal business networks (dummy)	41.7%	31.4%	9.579 (1)**
INFORM	I if an establishment is a member of informal business networks (dummy)	9.4%	6.7%	2.056 (1)
ELEC	I if an establishment has no obstacle related to electricity (dummy)	15.0%	22.9%	9.418 (1)**
ACCESS	I if an establishment has no obstacle related to access to finance (dummy)	22.1%	32.6%	12.27 (1)**
R&D	I if an establishment has spent on R&D in the last year (dummy)	21.5%	14.1%	7.498 (1)**
NAIROBI	I if an establishment is located in Nairobi (dummy)	34.4%	24.2%	10.43 (1)**
APPLY	I if an establishment applied for new loans/lines of credit in the final year (dummy)	25.9%	22.1%	1.658 (1)
Treatment				
MOBILE	I if an establishment used mobile money for any of its financial transactions (dummy)			

Note: <sup>a</sup> Welch t-test statistic is applied to test differences in annual sales and business age since these variables are continuous and their variances between the two groups are unequal.

\*\* is the significance difference at 5%, and *df* is the degree of freedom.

**Table 2.** Summary of empirical studies on the determinants of mobile money and other technology adoption.

Authors	Study area	Study level	Technology	Key determinants (control variable)
Micheni et al. (2013)	Kenya	Individual	Mobile money	Gender, level of education, types of mobile money services, and age.
Kikulwe et al. (2014)	Kenya	Household	Mobile money	Age of household head, level of education, male household head, household size, land ownership, distance to market, and distance to all-weather road.
Narteh et al. (2017)	Ghana	Individual	Mobile money	Gender, age level of education, usage experience (year), buying airtime, paying bills, transferring money, receiving money, and saving
Akinyemi and Mushunje (2020)	Rural Africa	Individual	Mobile money	Age, years of education, unemployment status, and ownership of bank accounts
Glavee-Geo et al. (2020)	Ghana	Individual	Mobile money	Level of education, usage experience, usage frequency of cell phone, income level, and age
Tiwasing (2021)	England and Wales	Firm	Social media network	Sector, business age, region, rural-urban classification, business network, business size, access to finance, business support, and digital infrastructure.
Islam and Muzi (2022)	Sub-Saharan Africa	Firm	Mobile money	Women-owned businesses, business age, business size, foreign ownership, formal training, apply for loan, purchase of fixed assets, and R&D expenditure
Avom et al. (2023)	Africa	Individual	Mobile money	Level of education, mobile phone subscription, infrastructures, urbanisation, social globalisation, rule of law, household consumption, GDP per capita, and labour force.
Tiwasing et al. (2023a)	England and Wales	Firm	Social media network	Type of businesses, sector, business age, region, rural-urban classification, business network, business size, access to finance, business support, and digital infrastructure.

these variables can be associated with mobile money services.

### Propensity score matching

This study introduces PSM to evaluate the effect of mobile money on business performance by comparing the differences in performance between mobile money users and non-users. In this context, PSM is an appropriate technique since these two events (users and non-users) cannot simultaneously occur within the same firm and at the same time period. Businesses have to choose whether they adopt mobile money or not. In fact, businesses that use mobile money may have different characteristics compared to non-users. In this case, selection bias can arise since both business groups differ in their business characteristics before comparing their performance (Tiwasing et al., 2023a). Therefore, direct comparisons between the two groups may result in bias by confounding variables (Rosenbaum and Rubin, 1983).

To address this issue, PSM produces an exact matched-pair comparison for the causal effects in observational studies, which is effective in minimising selection bias and dealing with uneven confounding variables between comparison groups (Rosenbaum and Rubin, 1983). PSM basically pairs the outcomes between two groups of observational studies: the treatment (mobile money adoption) and control (non-mobile money adoption) groups. To produce the matched-pair comparison, PSM computes a propensity score by balancing a number of observed characteristics (covariates) between the two groups and compressing them into a single score. Then, PSM compares the outcome of businesses that have similar (matched)

propensity scores between the treatment and control groups. In practice, the logit model is used to calculate the propensity score, which can be written as

$$PS(X_i) = \Pr(D_i = 1|X_i) = \beta_0 + \beta_1 X_i \quad (1)$$

where  $PS(X_i)$  is the propensity score of  $i$ th firm,  $\Pr(D_i = 1)$  is the probability of  $i$ th businesses that adopt mobile money,  $i$  is the number of individuals;  $i = 1, \dots, n$ ;  $X$  is a set of independent variables that are controlled for before comparing the outcomes (see Table 1).

For the robustness check, we use different matching techniques to pair the propensity scores including one-to-one, nearest-neighbour and calliper matching since this analysis considers both continuous and dichotomous dependent variables (Caliendo and Kopeinig, 2008). Then, we perform the balancing test to assess the matching quality and to ensure that the variance ratios are close to 1.0 and there are no significant differences in covariate means between the treatment and control (Dehejia and Wahba, 2002). Once the balancing tests are acceptable, the average treatment effect for the treated (ATET) on business performance between mobile money users and non-users is then calculated:

$$PS(X_i) = \Pr(D_i = 1|X_i) = \beta_0 + \beta_1 X_i \\ = E\{E[Y_{1i} - Y_{0i}|D_i = 1, \Pr(X_i)]\} \quad (2)$$

where  $Y_{1i}$  and  $Y_{0i}$  represent the business performance for  $i$ th businesses that use and do not use mobile money, respectively. Here, we measure business performance in terms of annual sales, process innovation and product innovation.



In this context, PSM is preferable to conventional binary regressions because it is effective in diminishing selection bias (Phillipson et al., 2019), and it is more robust than the logit/probit model when comparing two groups in observational studies (Cepeda et al., 2003). This technique is adequate and one of the most widely used methods for comparative analysis, which addresses the selection bias relating to non-random group assignments and provides better predictions (Tiwasang, 2021). Also, PSM is more flexible than regression analysis since it does not require any specific linearity assumptions for the treatment effects (Wellalage and Fernandez, 2019). PSM can also help identify key characteristics of mobile money adopters and address the heterogeneity in business characteristics before comparing outcomes (Tiwasang, 2021).

## Results and discussion

Table 3 reports the results of the logit model concerning the probability of businesses that choose to adopt mobile money. Model I (logit model) performs reasonably well with over 70% correct classification, which is relatively high. The likelihood ratio and the Wald test are applied to evaluate the parameters of the covariates, which are highly statistically significant. Multicollinearity is checked using the Pearson correlation, revealing no significant impact on predictive determinants, with the highest

correlation being 0.43 between SMALL and LARGE. Durbin-Wu-Hausman (DWH) test is also employed to check for endogeneity since businesses that use mobile money may be associated with high annual sales and being innovative and vice versa. The null hypothesis ( $H_0$ : mobile money is exogenous) is rejected, as evidenced by  $p$ -values higher than 0.05 in three performance equations (see Table 3). This leads to the conclusion that endogeneity is not problematic<sup>1</sup> (Tiwasang et al., 2023a).

In Table 3, the results show that large businesses (LARGE) are less likely to use mobile money. Gopane (2021) supports that mobile money uptake and usage are common among microenterprise businesses in Kenya, including agribusinesses. The finding also shows that businesses in the food (FOOD), textile and garment (TEXT), and other manufacturing (MANU) sectors (MANU is significant at 10%) are less likely to use mobile money services. In Kenya, these businesses are basically large businesses that are more likely to transact business using the bank, especially when they have huge transactional volumes (Matambalya and Wolf, 2001). This could explain why these enterprises are less likely to use financial mobile services. Firms that operate their businesses in tourism (TOUR) and retail (RETAIL) sectors are more likely to adopt mobile money. Kim et al. (2015) supported that Korean tourism companies increasingly adopt mobile services for transaction services since their customers often use mobile devices to plan and purchase tourism products. Also, Baptista and Heitmann (2010) highlighted the increasing prevalence of mobile services, including mobile payments, for electronic transactions in the retail market.

We also find that older businesses (AGE) are less likely to use mobile money. Tiwasang (2021) asserts that older firms are often associated with a lack of digital skills and literacy, which leads to a low level of mobile money adoption. Also, older firms may not be willing to adopt new technology due to the uncertainty of learning processes (Tiwasang, 2021) and the lack of trust and awareness associated with mobile money (Tiwasang et al., 2023a).

However, businesses that are members of formal business networks (FORM) are more likely to use mobile money. Formal business networks are considered as key enablers of innovation, mutual learning and business support services (Acheampong et al., 2017). Therefore, participating in these networks can help firms access external knowledge and improve business capacities related to digital and technological adoption (Tiwasang, 2021), including mobile financial services. We also found that businesses that spent on R&D investment (R&D) tend to use mobile money compared to non-users. Zhang et al. (2021) found that businesses using financial mobile services frequently incorporate technologies to develop new products and services. Therefore, they tend to spend their R&D budget on investments that increase their competitive advantages in the market. Similarly, businesses located in

**Table 3.** Results of logit model.

Variable (DV = mobile money)	Model I Coefficient (SE)
Constant	0.810*** (0.259)
WOMEN	0.032 (0.234)
SMALL	0.122 (0.182)
LARGE	-0.458** (0.209)
FOOD	-0.803*** (0.261)
TEXTILE	-0.973*** (0.334)
CHEM	-0.446 (0.310)
MANU	-0.450* (0.251)
RETAIL	0.661** (0.288)
TOUR	0.743** (0.309)
AGE	-0.008** (0.004)
FORM	0.449*** (0.167)
INFORM	0.211 (0.307)
ELEC	-0.560*** (0.196)
ACCESS	-0.412** (0.173)
R&D	0.613*** (0.210)
NAIROBI	0.689*** (0.202)
APPLY	0.129 (0.180)
<b>Number of observations</b>	<b>925</b>
<b>Correctly classified</b>	<b>73.19%</b>
<b>Probability (LR-statistic)</b>	<b>0.000</b>
<b>Model Wald statistic (<math>\chi^2_{16}</math>)</b>	<b>103.47</b>

Note: \*, \*\*, \*\*\* denote significance at 10%, 5% and 1%, respectively, and standard errors in parentheses.

Nairobi (NAIROBI) are more likely to use mobile money, indicating a significant association between mobile money adoption and location. Phillipson et al. (2019) noted that cities and urban areas offer more advantages for stimulating innovation activities and provide better digital facilities than rural areas. This explains why businesses in Nairobi, where digital access and networks are superior compared to other locations in the country, are more inclined to use mobile money.

Interestingly, we found that businesses that report that they have no obstacles related to electricity (ELEC) and no obstacles related to access to finance (ACCESS) are less likely to use mobile money compared to businesses that have experienced these obstacles. Although the non-occurrence of these obstacles could have motivated the efficient use of financial mobile services, our results suggest that Kenyan businesses do not seem to use mobile money for business activities and to seek financial support.

Considering the business performance (Table 4), for Model II (sales equation) our result reveals that there is no statistically significant difference in annual sales (SALE) between adopters and non-adopters. This indicates that businesses using mobile money perform as good as non-users. This result can be explained by various characteristics of Kenyan businesses. For example, business size may play a role in this outcome. Large businesses, as indicated in Table 2, are less likely to adopt mobile money compared to small businesses. These large businesses often have well-established systems and processes in place, including traditional banking arrangements, which may contribute to their comparable sales performance regardless of mobile money adoption. On the other hand, as shown in Table 1, small businesses tend to adopt mobile money services. Their adoption of mobile money may signify their efforts to access financial services, enhance liquidity management, and facilitate transactions in a more convenient and cost-effective manner (Talom and Tengeh, 2020). In

this context, the adoption of mobile money services can effectively help small firms in addressing financial inclusion challenges and, consequently, lead to enhanced sales performance among the users.

In addition, the sector-specific variations observed in mobile money adoption can also help explain the similar level of sales between adopters and non-adopters. Businesses in sectors such as food, textile and garment, and other manufacturing are less likely to use mobile money. These sectors often consist of larger businesses that rely on conventional banking methods, potentially contributing to the lack of significant differences in sales performance between adopters and non-adopters. However, businesses in the retail and tourism sectors, which are often operated by small-scale businesses, tend to use mobile money as a means to provide their services and access financial products. Therefore, the absence of a significant difference in sales between adopters and non-adopters can be attributed to the diverse motivations and goals behind mobile money adoption among Kenyan businesses. These motivations encompass not only operational efficiency but also the pursuit of financial inclusion and access to formal financial services.

However, for Model III (process innovation equation) and Model IV (process innovation equation), we found that businesses using mobile money are more likely to have introduced new or significant products/services (PDINNO) and improved processes (PCINNO) in the last three years compared to non-adopters. In the digital world, many businesses, especially those in the retail and tourism sectors, adopt mobile money to improve their financial operations (e.g. online payment) and innovative financial products (e.g. online hotel booking, sightseeing trips) due to its faster and more secure services than traditional transactions (Kim et al., 2015; Pelletier et al., 2020). Mention (2019) also supports that mobile money applications are innovative technology-enabled financial services

**Table 4.** Results of comparative analysis of business performance between adopters and non-adopters using PSM.

Matching technique	Model II (SALE) ATET (SE)	Model III (PDINNO) ATET (SE)	Model IV (PCINNO) ATET (SE)
PSM (1-to-1)	$6.68 \times 10^8$ ( $7.39 \times 10^8$ )	0.121** (0.056)	0.094** (0.040)
Nearest neighbour (5)	$5.54 \times 10^8$ ( $7.52 \times 10^8$ )	0.115*** (0.042)	0.079** (0.035)
Caliper (0.022) <sup>a</sup>	$6.05 \times 10^8$ ( $7.45 \times 10^8$ )	0.124*** (0.052)	0.090** (0.039)
<b>Observations</b>			
<b>Raw</b>	<b>829</b>	<b>925</b>	<b>925</b>
<b>Matched</b>	<b>580</b>	<b>639</b>	<b>639</b>
<b>Variance ratio<sup>b</sup></b>	<b>No significant difference</b>	<b>No significant difference</b>	<b>No significant difference</b>
<b>Durbin-Wu-Hausman chi-square (1) (p-value)</b>	<b>0.933 (p = 0.3341)</b>	<b>2.589 (p = 0.1076)</b>	<b>0.043 (p = 0.8359)</b>

Note: SE is the robust standard error, and ATET is the average treatment effect on the treated.

<sup>a</sup>The width of the caliper equals 0.2 of the standard deviation of the logit of the propensity score.

<sup>b</sup>The results of the variance ratio are available upon request.

\*\* and \*\*\* are significant at 5% and 1%, respectively.

that businesses can use to improve financial processes and develop their goods or services. Although mobile money adoption may not yield significant differences in annual sales, our findings highlight the positive association between mobile money usage and innovation in product development and process improvement. Therefore, mobile money presents opportunities for businesses to enhance their financial operations, offer innovative products and services, and stay competitive in the digital marketplace.

## **Conclusions and policy recommendations**

This paper aims to evaluate the impact of mobile money on both financial and non-financial business performance using data from 1001 Kenyan businesses from the 2018 WBES. Using PSM, our evidence-based analysis highlights the importance of mobile money usage for firm innovation, both process and product innovation, among Kenyan businesses. Our findings reveal that businesses using mobile money are more likely to be innovative in products and processes than non-users, which support H2. However, businesses adopting mobile money perform as well as non-adopters in terms of annual sales. In other words, there is no difference in annual sales between mobile money users and non-users, which does not support H1. Our analysis reveals that while businesses perform similarly on annual sales regardless of their usage of mobile money, mobile money users display a greater inclination towards innovation, particularly in terms of developing new products and processes. Thus, to enhance sales performance, mobile money users still require support from the government to help remove barriers related to the effective delivery of financial mobile services such as digital infrastructure investment, FinTech-related training/advice, and so on. Also, support needs to fill the large existing infrastructure gap in different locations, starting with electricity and internet services for businesses located in underserved areas.

In particular, the Kenyan government has currently established policies aimed at regulating and taxing financial mobile services and proceeds. They have progressively increased taxes from 10% in 2013 to 12% in 2018 on mobile phone transactions, significantly raising the cost of sales operations for many businesses using mobile money for transactions (Ndung'u, 2019). This increase in costs could act as a disincentive to mobile money adoption, particularly among small businesses, which are a predominant user group. Moreover, it may deter businesses that have not yet used or are less likely to use mobile money services, such as large businesses, and manufacturing firms. To potentially enhance sales performance and support the growth of the FinTech ecosystem, the government should reconsider its taxation regime for mobile money-related services and making these services more attractive and business-friendly for various types of businesses. Mobile money is particularly beneficial for small firms, mainly

informal businesses, offering access to financial services and overcoming entry barriers into the formal economy. Therefore, the government should provide effective digital tools, support, and training for small businesses to enable them to use mobile money as a long-term financial channel. This initiative can drive sales growth and foster innovativeness among Kenyan businesses.

Our results highlight key managerial implications. Firstly, our findings reveal that mobile money has a positive impact on product and process innovation. Thus, business managers and/or owners are encouraged to leverage these services to improve disruptive technology and innovative capability. This strategic use can elevate their competitiveness and enable thriving in the digital era. Secondly, our results emphasize that business characteristics significantly influence the differences in the use of mobile money between users and non-users. Older businesses, food manufacturing businesses, textile and garment businesses, large businesses, businesses having obstacles with access to finance, and businesses having obstacles with electricity are less likely to use mobile money. Therefore, these businesses require business support and/or advice from the government to help set up their financial mobile systems to obtain the full potential benefits of mobile money adoption. Also, business support should cover managing risks and vulnerabilities related to mobile money services. Finally, businesses that are members of formal business networks tend to adopt mobile money. Thus, business managers/owners should participate in business networks to gain and exchange knowledge, including financial mobile services, and to build relevant business relationships (Tretiakov et al., 2019).

This study makes significant contributions to the field by addressing gaps in mobile money and FinTech literature. Firstly, using recent WBES data for Kenya, this study conducts a comparative analysis between mobile money adopters and non-adopters, examining firm performance in terms of annual sales, product innovation, and process innovation. Secondly, we introduce PSM to mitigate selection bias and offer a more precise assessment of mobile money adoption's impact on firm outcomes. Moreover, our study diverges from the prevailing literature that mainly focuses on individual-level mobile money adoption, contributing valuable empirical evidence to the limited body of research on its adoption at the firm level. Finally, our empirical evidence is also important in responding to the Kenyan government's policy of regulating and taxing FinTech-related services.

This study contributes to the theoretical understanding of mobile money adoption in the business context, particularly in Kenya. Drawing on TCT and TAM, our findings deepen the understanding of the factors influencing mobile money adoption in businesses and underscore the value proposition and potential benefits of adopting mobile money in different sectors. Particularly, businesses in food, textile, and manufacturing sectors are less likely to adopt mobile money due

to their reliance on established banking methods and associated transaction costs. In contrast, businesses in the tourism and retail sectors are more inclined to adopt mobile money, aligning with their value proposition of offering faster and more secure financial transactions to customers. Additionally, our results demonstrate that mobile money adoption positively influences business innovation, both in terms of product development and process improvement. This highlights the significant role of financial technologies, including mobile money services, in driving firm innovation and facilitating business development.

### Limitations and future research directions

This study suggests some avenues for future research. Firstly, since our analysis only focuses on mobile money, future research should consider the impact of different types of FinTech services (e.g. Blockchain, etc.) on business performance. Secondly, future research should explore the impact of mobile money adoption on business growth during the COVID-19 lockdown and aftermath, since this survey was conducted before the COVID-19 pandemic. Next, it would be interesting for future research to examine the comparative analysis of mobile money adoption between SSA countries, since our study only focuses on Kenya. Moreover, it would be interesting for future research to explore the indirect relationships between mobile money, innovation and sales performance, since innovation can be an intermediate outcome that leads to higher financial performance. Lastly, future research would benefit from a longitudinal data analysis to better understand the benefits of mobile money services on firm performance over time.

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### ORCID iDs

Pattanapong Tiwasing  <https://orcid.org/0000-0001-9604-1656>  
John Agyekum Addae  <https://orcid.org/0000-0002-6374-5195>

### Supplemental material

Supplemental material for this article is available online.

### Note

1. The results of the robustness check are available upon request.

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