

# Financial Inclusion in Developing Countries: Applying Financial Technology as a Panacea

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## Authors' contributions

*This work was carried out in collaboration between both authors. Author AI designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors BT and AI managed the analyses of the study. Author AI managed the literature searches. Both authors read and approved the final manuscript.*

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## ABSTRACT

Traditional banking methods of addressing the problem of financial inclusion in developing countries is not working efficiently. As it is becoming obvious, opening operational and functional banking business offices in many developing countries is not a financially viable option. Banking offices need enormous amounts of resources, equipment and personnel to run efficiently. In most developing countries where low income is the norm rather than the exception, it is not possible to sustain a policy objective that employs the use of banking business offices to address the problem of financial inclusion. Such initiative could start out well, however the possibility of sustainability is called into question. Thus, whatever meaningful gains have been garnered from such policy will be reversed or lost overtime. This research employs the use of quantitative methods and it sets out to test whether the usage of financial technology has had any meaningful impact in improving financial inclusion in the developing countries selected in the study. The findings of the research reveal that financial technology offers the instrument, tools and mechanism for drive financial inclusion in ways traditional methods of banking cannot. Financial technology offers, cost effective

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and cheaper means of driving financial development. This research suggests that financial technology should be used as a means of driving financial development in developing countries as it offers a more sustainable and cost-effective solution to the problem of financial inclusion. Developing countries, should embrace, adopt and adapt financial technologies to address their financial development issues.

*Keywords: Financial inclusion; traditional banking; developing countries; financial technology.*

## 1. INTRODUCTION

The traditional banking business is focused on dispensing long-term loanable funds through issuance of short-term dated deposits, a process that is aptly described as borrowing short with the intention of lending long [1]. In more recent years, economic forces have weakened the traditional role played by banks as financial intermediators. Consequently, deposits have continued to decrease in importance as a source of funds for financial intermediaries [2]. Furthermore, profits of traditional banks earned from business lending have steadily declined in recent years. In developing countries, the traditional banking business tend to be out of reach for the rural poor as operating functional bank business offices is not a profitable and viable option [3]. Banking offices tend to need a significant amount of investment in capital, resources, equipment and logistics to run efficiently. All these come at a great cost, and as such banks in developing countries tend to shun rural and suburban areas. To make matters worse, the traditional banking system tend to be unfit for the men and women in developing countries who are semi-literate and poor with no resources to guarantee loans, if the need to obtain one from a bank arises [4].

The limited outreach of traditional banks in rural and suburban areas is largely as a result of inadequate infrastructure, low levels of income, and high levels of illiteracy, expanding inflationary trend, governance challenges and high transaction costs as well as limited competition amongst the banking industry ([1; Visconti, 2016). Currently, financial exclusion figures for developing countries in Africa are shocking. In total, only an estimated 25% of adults in Africa own an account in a formal financial institution. This figure is not unilateral, within Africa, there appears to be a large variation in formal account ownership ranging from 44% in South Africa to 8% in Central Africa. In Central African Republic and the Democratic republic of Congo, more than 93% of adults are unbanked (i.e., do not have a bank account at a

formal financial institution). In North Africa, a similar disparity occurs with an estimated 24% of adults having an account in a formal financial institution. With regards to the range, 40% in Morocco to 11% in Egypt. Men appear to be more likely than women to own a bank account at financial institution [5].

Policy makers in developing countries have been increasing worried about the rates of financial exclusion in developing countries and have devoted time and effort to find meaningful solutions to economic stagnation and a lack of economic growth and development, financial inclusion is seen as the panacea to resolve these problems. Ouma et al [6] maintain that financial inclusion is a key pillar of development policy in most developing countries and this is as a result of the realization that an inclusive financial system is crucial for reducing extreme poverty, promoting sustainable inclusive growth, boosting shared prosperity and enhancing economic development. An inclusive financial system will allow for the poor to save and borrow, enables them build financial assets, invest in business and entrepreneurial ventures [7]. Furthermore, the poor and less privilege can smoothen their consumptions and insure against socio-economic threats and vulnerabilities.

Financial inclusion can be described as the use of formal financial services and financial products that include but is not limited to the following deposit of cash or cheques, access to loanable funds, insurance, consumer protection, and payment systems [8]. Improvement of access to financial services is one element of financial inclusion, others include risk mitigation, fostering financial stability and developing an efficient financial structure that acts as a conduit to connects small scale businesses by ensuring they have access to capital to grow their business through greater involvement in the financial system [9]. As surprising as it may sound, despite the low penetration in rural areas by traditional banks, a significant amount of the population still finds ways to save in an informal way in developing countries. This is usually done

through the use of fairly unsophisticated methods with the sole intention of managing their finance and ensuring they plan for the future. Thus far, available evidence suggests the application of specific saving behaviour by most poor families. These include the following, keeping monies under the mattresses, in small cans, beneath the carpet, inside a hole in the grounds, accumulating savings with traditional credit associations and savings with rotating savings and credit associations and giving loans to others.

The inability of traditional banks to influence a change in informal channel saving mechanisms of poor households is attributed in part, to weak bank product designs that are not effective in targeting specific saving behaviour of a significant number of poor households. There is also the problem of a rigid or inflexible design that do not allow for clients to tailor using of bank accounts to meet their peculiar saving needs. It is only in recent times, that the use of financial technologies applications in mobile phones, lap tops, and iPads have become ubiquitous in the African market, providing a more effective method of integrating the financial excluded and unbanked population into mainstream financial infrastructure. Financial technological advances such as digital mobile transfers, savings, credit and payments and creating of new delivery channels such as the usage of banking services through third party agents are playing an important role in provision of greater financial access to developing countries in Africa.

In reality, the advances made in financial technology, more specifically smart mobile phones banking mobile applications, blockchain technology such as Bitcoin and Gemini and financial software have in no small measure have transformed and revolutionized financial service. It is estimated that about 12% of the adult population in Sub-Saharan African have a mobile phone money account compared to only 2% worldwide [10]. The financial technology application services are cheap, reliable, secure and accessible and have enabled majority of the low-income earners and poor expand their financial service platforms to include agency banking, mobile phone banking and other types of financial services. To be precise, the extensive use of mobile phone technology has aided in the opening of new markets across Sub-Saharan Africa and has enabled financial services to reach consumers in inaccessible areas where financial and banking services are lacking [11].

In this context, this research study examines the role of financial technology in resolving the problem of financial inclusion that the traditional banks failed to address in developing countries such as Kenya, Uganda, South Africa and Nigeria. More specifically, the study investigates the extent to which the adoption of these financial technologies has assisted in promoting financial inclusion in the region.

### **1.1 Financial Inclusion: A Theoretical Perspective**

In the finance and growth literature, the theory on the relationship between finance and economic growth is based on the premise that financial markets and financial institutions are capable of achieving the following economic and financial objectives: (1) increase domestic productive investments [12]; (2) strengthen the growth of capital accumulation [13]; (3) mitigate information asymmetry problems that exists in financial markets [14]; (4) improve efficiency in investment productivity [15]; (5) provide the necessary liquidity that allows for capital accumulation, economic productivity and growth [5]; and (6) reduce income inequality, improve basic infrastructure and decrease unacceptable levels of poverty in developing countries [16].

As earlier stated, the theoretical literature on finance and economic growth has argued that the financial sector development is a necessary and important mechanism for increasing economic growth and attaining economic development. Previous literature stress that financial liberalization through removal of restrictions so that market forces are allowed determine interest rates and exchange rates. These rates are essential and conducive for increasing economic growth and development as opposed to the alternative which would involve implementing policies of financial repression which involve exchange and interest rate ceilings, reduction in market competition in financial markets and institutions. The resultant effect or consequence of financial repression would be increasing levels of market inefficiencies and transaction costs and facilitation of risk ([17]; [18])

Other finance theories have maintained that a developed financial sector has the capacity to broaden and increase accessibility to funds, this can easily be done through efficiently allocating capital across various investment options including entrepreneurial innovation and production technology ([19]; [20]), pooling of

funds and mitigating risk management, as well as diversification which will lead to increased asset liquidity ([21]; and [22]). More importantly, the empirical literature on financial inclusion, financial development and economic growth suggest that there a link between financial sector development and the level of financial inclusion ([23];[24]).

A meticulous review of the literature on financial inclusion, financial development and economic growth maintains that increasing/enhancing financial inclusion at the macro and institutional level can have a positive effect on economic growth. At the macro and institutional level, weak financial infrastructure, absence of the rule of law and poor regulatory institutions are all evident in developing countries that have poor levels of financial inclusion. The opposite holds through in countries where there is an efficient financial infrastructure, strong presence of the rule of law and effective regulatory institutions; in such countries, the rate of financial inclusion are usually high.

Allen, Demirguc-Kunt, Klapper and Peria [25] examined several factors that influenced financial inclusion using data from 123 countries; the findings of the researchers reveal that there is a positive relationship between a conducive environment that enables people to access to financial services and the rate of financial inclusion. For example, lower costs in operating bank accounts and increased proximity to financial service are positively correlated to the rate of financial inclusion. In their conclusion, they recommended policies that are designed to encourage individuals to own bank accounts through elimination of unnecessary documentation requirements, removal of pointless barriers such as excessive bank charges for usage and ownership of bank accounts, and removal of administrative bottle necks that hamper individuals from owning accounts.

Also, Allen et al. [26] investigate financial development and financial inclusion gaps in developing countries and find that bank penetration continues to remain low in low income and sparsely populated areas, however advancement in financial technology such as mobile phone banking is resolving the proximity problem by enabling users of financial services to be located far distances, away from their banks, and other financial institutions. This has provided means of facilitating financial development and

financial inclusion in developing countries in rural and non-urban settlements that are sparsely populated. While the success in mobile banking has proved useful within the context of receiving money and sending money, the issue of increasing in savings products, usage of credit and other financial services have remained largely unchanged.

To address this issue, financial services providers would have to find new methods that are simple, effective and can easily be used financial services customers. Finally, Park and Mercado [27] assess country specific macro-economic factors influencing the rate of financial inclusion in 37 African countries. Their research reveals that enforcement of the rule of law, implementing financial regulation oversight, the level of per capita income and strict adherence to financial contracts tend to be positively influence financial inclusion in Asian countries. At the microeconomic level, the number of bank branch networks, banking sector penetration, automated teller machine penetration, information communication technology infrastructure, financial infrastructure and ownership of financial institutions are usually associated with better accessibility to financial services and better rates of financial inclusion.

## **1.2 Financial Technology: A Disruptive Innovative Theoretical Framework**

While a significant amount of the theory has focused on financial inclusion and economic growth, another important aspect of the research that the finance theories have failed to shed light on is the adoption of new financial technologies by financial firms and institution in developing countries. The financial inclusion story in developing countries will not be complete without a theory explaining how banks and other financial service firms in developing countries are embracing financial technologies to solve the problem of financial exclusion. Like most finance and management theories, the theory of disruptive innovation began as a series of peculiar observations that resulted in a research question ([28]; [29]). Across a broad range of industries from retail to computers to financial services, leading companies failed to remain dominant in their industry. The press and business analysts could not understand why this was happening, they lauded these well managed firms, and yet, they overlooked some-thing important that precipitated their decline. At the time, initial explanations tended to blame

organizational inertia, technological complexity and faulty managerial cognition ([30]; [31]).

Regrettably, in spite of its success in the field of finance and management, disruption innovation theory appears to be in danger of becoming a victim of its achievements. Notwithstanding its broad dispersion and dissemination, the theory's core has been collectively misunderstood and its fundamental tenets have been erroneously and frequently misapplied [32]. In its simplest description, disruption explains a process where small companies with little or no resources successfully challenge established existing businesses [32]. The norm is for existing businesses to concentrate on improving products and services for their most profitable and demanding customers, in so doing, more often than not, they exceed the needs and expectations of some segments and ignore the needs and expectations of others.

Industry entrants that become disruptive usually begin by selectively and successfully targeting those neglected segments, gaining some measure of foothold by intentionally delivering better products and services – usually at a lower price [30]. On the other hand, existing businesses tend to focus on increase in profitability in more demanding segments, in doing so, they often fail to respond vigorously. Entrants, seize the opportunity and move into the market, delivering outstanding performance that existing businesses customers require, while maintaining the advantages that resulted in their earlier success [29]. When customers in existing business begin adopting entrants offering in large volumes, disruption has occurred.

Disruptive innovation refers to a product, service, or technology whose application affects the way a market or industry functions [33]. Examples of modern disruptive innovation is the internet, computers and mobile phones, these technologies have significantly altered the way companies do business and negatively impacted companies that have failed to adapt [34]. For developing countries, financial technology has the potential to disrupt the traditional banking business model and appeal to a broad range of low-income earners who have been financially excluded from the financial system [35]. Financial technology is capable of disrupting the financial service industry in developing countries by doing the following: forcing local banks to reconsider and modify their digital strategies, demanding that the banks develop new capabilities, reinvent

themselves and transform their culture [31]. It helps firms to redefine and broaden the customer service user experience through the usage of e-banking and online solutions. The financial technology disrupters will force existing banks in developing countries to accept lower margins, improve quality of financial services and cut costs.

### **1.3 Financial Inclusion in Developing Countries**

After a painstaking review of the literature of financial inclusion in developing countries, the following themes emerge from a detailed evaluation of the literature: determinants of financial inclusion ([36]; [27]); eliminating constraints that are hindering the growth of financial inclusion ([37]; [38]); reduction of poverty through financial inclusion [39]; the usage of financial technology to increase financial inclusion ([8]; [7]) and using financial inclusion as a means of enhancing economic growth [40].

In developing countries, it is important for both the private and public sector to create an enabling environment that supports financial inclusion. Demircuc-Kunt, Klapper and Singer [41] evaluate gender differences in the usage of financial services using data from 98 developing countries; the findings of their research reveal that in countries where women are faced with legal restrictions in their ability to work, in deciding where to live, receiving inheritance, heading households, women are less likely to own a bank account, relative to men and are less likely to save and borrow. The results also explain that manifestations of gender norms, such as the incidence of early marriage for women and the level of domestic violence against women, are contributory factors in explaining variations in the usage of financial services between women and men - after controlling for other country and individual characteristics. In concluding, they observe that the low usage of financial products and services by women may expose their vulnerability to save, invest and plan for tomorrow and they recommend that to improve women's access to financial products and services, legislative reforms need to be initiated to ensure more equitable outcomes under the law.

Guieze [42] argues that to improve access to financial products and services in developing countries, there is the need to address the

problem of a country's characteristics or structural constraints such as rising levels of poverty and inequality, increasing in surge in public debts, inadequate financial infrastructure and poor levels of financial literacy. These constraints hamper financial inclusion and there is the need to address them. Oji [43] observed that there are individual characteristics or non-structural constraints that are peculiar to a country, also have to be addressed. For example, some banks and financial institutions in developing countries have unnecessary administrative bottlenecks such as excessive documentation requirements by financial institutions, request for loan balances unnecessary fees and minimum deposit requests before an account can be officially opened [44]. These administrative bottlenecks act as an unnecessary hindrance and result in financial exclusion for many persons living in developing countries.

As previously suggested, financial inclusion is seen as a tool to address rising level income inequality and poverty in developing countries. Beck, Demircuc-Kunt and Levine [45] investigate the impact of financial development on income inequality and poverty using a cross-country study. The findings of the study show that in better developed financial systems, there is a faster increase in the income share of the poor and a faster decrease in income inequality as measured using the Gini index, over a period of 45 years. Furthermore, the research revealed that developing countries with deeper financial systems attained a faster reduction in the share of persons living on less than \$1 dollar a day. This relationship was found to be both statistically and economically significant: an estimated 35% of cross-country variation in the change in poverty rates could be explained by the changes in financial development.

Koomson, Villano and Hardley [46] reaches the same conclusion as Beck, Demircuc-Kunt and Levine [45]; in their paper on the effect of financial development on income inequality and poverty in Ghanaian households. The results of their findings are in two folds: first, an increment in financial inclusion is associated with a reduction in the household's exposure to poverty by an estimated 27%. Second, financial inclusion is instrumental in preventing a household's exposure to poverty by 29%. Moreover, female-headed households have a greater opportunity of experiencing a significant reduction in income inequality, poverty and vulnerability to poverty

through an increase in financial inclusion than do male-headed households. The increase in financial inclusivity by reducing income inequality and poverty is not the only means through which increment in financial inclusion can be attained.

An emerging area of research interest is the use of financial innovation, and financial technology to increase financial inclusion, especially in developing countries where the structural constraints have made the use of financial innovation and financial technology an important and crucial determinant of financial inclusion. Lee, Wang and Ho [47] describe financial innovation as an activity that is used with the sole purpose of creating new financial technologies and they can be classified into three distinct types: institutional, product and processes.

The benefits of financial innovation for financial inclusion are two folds: it greatly enhances the provision of financial services and also improves accessibility to financial services, especially in developing countries where traditional methods of financial inclusion have failed to reach the suburban and rural areas as a result of escalating costs of business operations [11]. In Fig. 1, an evolution of mobile phone penetration reveals that in a period of 10 years, Africa has garnered 470 million sim connections, representing 47% of the 1 billion registered mobile money account users [48].

According to the global system mobile association (GSMA), the total amount of digitalized money transactions by mobile money agents globally was \$176 billion, this is more than the total value of international remittance flow to Sub-Saharan Africa, Caribbean and Latin America combined [48]. The number of mobile money agent outlets across the globe has tripled in the past 6 years, reaching 7.8 million in 2019 [48]. The proportion of agents active on a 30 day basis also increased to 54% during this period. Mobile money agent outlets in rural and difficult to reach terrain have been instrumental in enhancing financial inclusion as they provide broader geographical coverage than traditional banking channels. A mobile money agent has 7 times the reach of automated teller machines and 20 times the reach of the traditional banking channels. Meanwhile, the density of commercial bank branches in the same market did not change substantially between 2014 and 2018, averaging 10 per 100,000 adults.

However, there are some drawbacks of financial innovation to financial inclusion. It hinders mobile payments and credit loans which are not only

closely related to financial inclusion but are also relevant to institutional and process innovations within financial innovation. The strength of institutional and process innovation lies in their ability to expand both penetration and coverage of financial services, but the downside of these types of innovation are that they not market-driven, but governance driven; and can easily be manipulated by government in developing countries [49].

Furthermore, Zhang and Guo [50] maintain that although institutional and processes financial innovation can provide business firms with high-quality modern financial services through usage of new payment tools (mobile payments and internet banking), enhanced efficiency and improved convenience, most firms in developing countries do not have the resources and so, cannot afford the huge costs of setting up mobile payment systems. Several studies confirm that there is a positive relationship between financial innovation and economic growth, but whether it has the capacity to drive firms' sale growth remains uncertain and yet to be seen ([51]; [52]).

#### 1.4 Financial Technology as a Tool to Enhance Financial Inclusion through Non-Traditional Bank Methods

The preponderance of financial exclusion in developing countries as identified by Kendall, Mylenko, and Ponce [53] who stated that despite an estimated 6.1 billion bank accounts in the world, an unequal number of the accounts 3.5 per adult are situated in the developed

economies, as compared to approximately 0.8 per adult in developing countries. To make matters worse, they also find that close to 75% of adults in the developing economies do not have bank accounts [9].

A genuine reason for this occurrence is that traditional method of banking has been unable to reduce cost of servicing small-value customers and to find solution to the problem of providing credit to those with irregular incomes living in suburban and rural areas in developing countries [11]. This enormous challenge has been resolved through the advent of the internet, computers, laptops, automated teller machines, mobile telephones and the wider accessibility has enabled the reduction in the cost of information processing.

However, it appears the application of financial technology to banking has been able to resolve some of these problem to an extent, previous studies ([54]; [55]; [56]; [57]) have examined financial technology and its effect on reduction of transaction costs of mobile money and financial inclusion in Kenya. The findings showed that the mobile phone money transfer service, micro finance service and payments users (M-PESA) were in a better position to absorb significant negative income shocks (such as job loss, severe ailment, livestock death and business or harvest failure) without any significant reduction in household consumption. However, household without access to M-PESA suffered greatly from the negative income shocks as consumption in these households on the averaged fell by 7.5%.

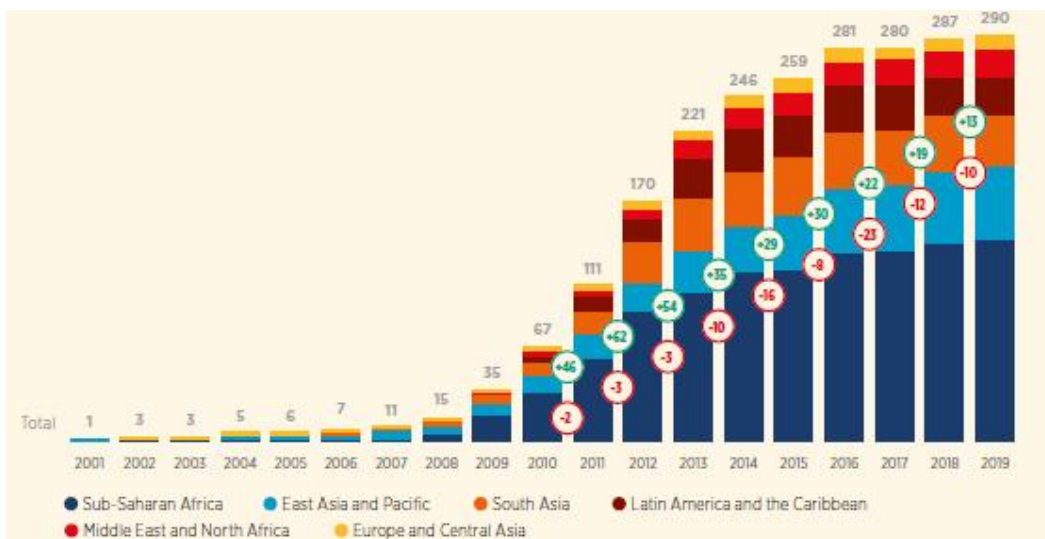


Fig. 1. Global mobile money landscape 2009 - 2019  
Source: Global Sytem Mobile Association (2019)

The combining of mobile phone and information communication technology has produced a viable solution for enhancing financial inclusion because it resolves the problem of setting up of operational business offices or branch networks by banking in suburban and rural areas. Consequently, increasing mobile phone penetration in these suburban and rural locations in developing countries increases financial access ([54]; [58]). Thus, it allows for banks and other financial institutions to improve efficiency through the usage of multiple channels that work effectively as an integrated and inter-connected system. In a nutshell, technology has facilitated branchless banking which is a banking innovation that allows for the delivery of financial services without the usage of traditional banking methods, but utilizing the services of non-bank agents and information communication technologies ([59]; [60]).

Prior studies on financial inclusion and financial technology ([61]; [62]; [63]) tend to focus on technological predisposing factors that have enhanced financial inclusion and have ignored the role of financial technology plays in improving financial accessibility to regions where traditional banks have failed to reach (Senyo et al., 2016). In part, this has been the result of the research on financial inclusion and financial technology focusing on the larger issues such as the bank concentration, economic growth and economic development. Consequently, other research in the field of financial inclusion, and financial technology which are equally important such as the role financial technology is playing in changing the financial inclusion narrative have been largely underexplored.

Thus, it is imperative that the research on financial inclusion and financial technology gives significant priority to the role financial technology is playing in mitigating some of the problems traditional banks have been unable to resolve in developing in countries [57]. Financial innovation in developing countries have enabled mobile phone users to make financial transactions such as money transfer, bill payments, savings, purchase of products, and loan acquisition [59]. However, in comparison there are significant difference between the use of mobile payments and traditional banking services.

First, the registration process is so much easier and less cumbersome when compared with opening a traditional bank account. Any person can simply have access to a mobile money

account with a valid national identity and a registered mobile phone - these processes can be completed within 7 minutes [64]. Second, mobile phone services and technology are widely available in developing countries - this has enhanced accessibility to remote regions; enabling participation without the need for traditional banking business offices [65]. Moreover, the use of mobile phone technology platforms in banking offers the following advantages reduced transaction cost, convenience and wider accessibility [66] as transactions can be performed at anytime, from anywhere and at sensible service charge.

It is pertinent to stress that there are dissenting voices, those who hold a different position on the effect of financial technology and financial inclusion on developing countries. Mader [67] dismisses the argument that financial inclusion enables broader development outcomes, as he claims it is based on weak evidence and weak economic logic. Second, he is doubtful that financial inclusion reduces poverty and maintains that poor people do not necessarily benefit from financial inclusion as the empirical evidence suggests that impact is superficial. Third, he questions the idea the business case for financial inclusion, suggesting that the business case for financial inclusion is weak and elusive. Nothing can be further from the truth, these assertions made by Mader [67] are not only misleading, they are also factually incorrect. While research on the link between financial technology and financial inclusion can be regarded to be in the infancy stage and there are limited time series data on both financial inclusion and financial technology, there is substantial, overwhelming and consistent evidence to suggest that developments in financial technology and financial technology have been extremely beneficial to developing countries ([10], [46]; [68]).

Of course, financial technology alone is not sufficient to broaden financial inclusion in developing countries ([55], [9]). To consolidate on the gains of financial inclusion from improved financial technology - mobile phone services and the internet can only drive financial inclusion when the necessary infrastructure is available. Physical infrastructure such as mobile networks and constant electricity is key. In developing countries, people will not be encouraged to use digital payments when network outages, security issues and other technical problems undermine their efficiency. Technological infrastructure is also needed. This includes adequate physical



networks and adequate payment systems built and effectively designed to deliver payments to both urban and rural areas. More importantly, banks and other financial institution can use agent banking and build partnership with retail shops and post offices to deliver financial services to customers, since it is not cost-effective to open a traditional brick-and-mortar banking branch office in every location that has a large unbanked population.

### **1.5 Research Hypothesis**

Based on an extensive review of the literature on financial inclusion in developing countries and the literature of financial technology and its influence on improving financial inclusion in developing countries, the following null hypotheses have been designed

Ho<sup>1</sup>: There is no difference in the number of commercial banks for developing countries between 2015 and 2018.

Ho<sup>2</sup>: There is no difference in the number of registered mobile money accounts for developing countries between 2015 and 2018.

Ho<sup>3</sup>: There is no difference in the number of registered mobile money agent outlets for developing countries between 2015 and 2018

## **2. RESEARCH METHODOLOGY**

The research methodology is a very crucial element of the research process and the purpose of the research methodology is to explain the the research philosophy, the research strategy and the research methods. The choice of the research methodology used in conducting the research was determined by the following, the research question the research intended to examine, the researchers world view, and the researchers philosophical understanding of the nature reality and the nature of the data collected to address the research question.

In conducting the research, the researchers have applied a positivist methodological stance in addressing the research question. Positivism is a western philosophical school of thought that advocates for the use of scientific methods in conducting research, it maintains that scientific knowledge is easily verifiable. This is not the case with issues that bother on superstition, dogmatism and speculation which cannot objectively be verified, since they are subjective and tend to based on the experience of the individual. For positivism, the emphasis is on an

objective approach to knowing things, or an objective approach to creating knowledge based on facts. And as such, any data collected for this research would be, data that can be measured, quantified, and analyzed in such a way that conclusions can be drawn from the data (Fay, 1996).

The adoption of positivism simply implies that primary data collected with the intent of knowing an individual's experience would not be suitable for this research. For positivism tends to lend itself to the use of secondary data. It must be emphasized that the nature of the research question the researchers are intent on answering informs the nature of secondary data collected, the research methods applied and the research instruments used to analyze the data. In using secondary data, the most important benefit is; it saves enormous amount of time and money that would have been spent in collecting data, since the data can easily be downloaded from statistical websites or collected from other public sources such as government agencies [69]. Financial inclusion data can be classified into two distinct categories, demand and supply side information. Demand side data usually involves conducting of interviews with end users of financial services and products: households and firms [70]. Supply-side data is collected from providers of financial service [71]. Central banks are usually saddled with the responsibility of collecting supply-side data as part of their responsibility in supervising and regulating institutions [72]. Supply-side data includes but is not limited to the following; number of accounts and automated teller machines in a country [73]. The data employed for this research was downloaded from the international monetary fund database. A relatively short period of time was examined 2014 - 2018. The financial access survey, is a supply side dataset on access to and use of financial services aimed at supporting policymakers to measure and monitor financial inclusion benchmark progress against peers. The financial access survey is based on administrative data collected by central banks and other financial regulators.

### **2.1 Traditional Banks and Financial Inclusion**

Traditional banking businesses have struggled to cope with the increasing demand for financial services and financial products in developing countries particularly in sub-urban and rural areas where the local population have low income and earning capacity [74]. Thus, it would

not create the necessary incentives for traditional banking businesses to run profitable banking operations in such locations [75]. Consequently, traditional banking businesses tend to neglect these regions. The inability of traditional banks to provide sufficient financial services for the teeming population in developing countries is a serious concern to public policy officer holders who are wrestling with the problem and are actively thinking of sensible measures that can be taken in the long-term to resolve and address the problem.

A cursory examination of the tables on financial service access for Ghana, Kenya, Nigeria, Rwanda, South Africa and Ghana have important implications for developing countries in Africa. The results may be of genuine concern for policy makers in developing countries. All the countries in the study with the exception of Ghana recorded a reduction in the number of traditional banking business offices in the four year period of the study. For instance, Uganda, Nigeria and Kenya all saw a decline in the number of traditional banking branch offices over the period. Uganda and Nigeria reduced their banking operations by 16.2% and 30.4%. Kenya happened to be the least affected, it's traditional banking offices declined by 9.6%. On the contrary, as earlier stated, Ghana saw a surge in the number of traditional banking offices over the period by an estimated 43.7%. This is in spite of the fact that the number of depositors to commercial banks per 1,000 adults for Rwanda, Nigeria and Ghana have recorded significant improvement. For Rwanda and Nigeria the increase in the number of commercial bank depositors in the period in question was 56.4% and 55.1%.

For Rwanda, a small country with a population of 12.5 million that increase in the number of depositors could easily be absorbed by the traditional banks. But surely, in the case of Nigeria with a population of more than 206 million people, an increase in the number of depositors by 55.1% would result in an increasing pressure on the existing facilities of the traditional banks whose banking infrastructure is already being stretched beyond the intended capacity. Ghana is the only country in the study that had an increment in number of commercial bank depositors and the number of commercial bank branch offices. One would have expected that the other countries would have followed the example set by Ghana. That is, to increase the number of commercial branch offices as the number of commercial bank depositors increased over the period. The decline in traditional banking operations should be offset by the introduction of financial innovation and financial technology in the financial sector in developing countries. However, some of the findings of the research are not consistent with the expectation. For instance, the introduction of the automated teller machines (ATM), were meant to be a game changer, as they enabled commercial banks introduce machines which could easily dispense cash to bank customers when commercial banks have closed for business. Again, the findings appear to be similar, Ghana is the only country that recorded a significant increase in the number of ATM within the period. South Africa saw some marginal increase in the number of automated teller machines, however Nigeria, Rwanda and Uganda all saw some decline in the number of ATM machines within the period.

**Table 1. Ghana**

	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Number of ATMs per 100,000 adults	7.98	9.99	10.92	11.29	11.51
Number of commercial banks branches per 100,000 adults	5.94	6.98	6.98	8.42	8.54
Number of depositors with commercial banks per 1,000 adults	491.93	583.91	543.57	614.09	725.21
Number of borrowers from commercial banks per 1,000 adults	45.60	46.66	43.78	48.37	40.91
Financial system deposit (% of GDP)	24.67	24.93	22.52	24.67	
Number of registered mobile money agent outlets per 1,000 adults	118.17	350.47	601.08	855.62	1742.99
Number of registered mobile money accounts per 1,000 adults	427.55	762.23	1117.19	1322.50	1752..51
Value of mobile money transactions (during this year as % of GDP	7.80	19.65	36.50	60.72	74.25

**Table 2. Kenya**

	2014	2015	2016	2017	2018
Number of ATMs per 100,000 adults	9.64	9.69	9.16	9.43	9.15
Number of commercial banks branches per 100,000 adults	5.48	5.59	5.37	5.21	5.00
Number of borrowers from commercial banks per 1,000 adults	160.39	220.48	269.48	237.41	232.03
Financial system deposit (% of GDP)	36.25	36.17	34.11	32.17	
Number of registered mobile money agent outlets per 1,000 adults	217.35	252.92	291.51	320.61	361.50
Number of registered mobile money accounts per 1,000 adults	931.10	1128.63	1205.89	1248.01	1251.12
Value of mobile money transactions (during this year as % of GDP)	43.90	44.81	47.78	44.67	44.74

**Table 3. Nigeria**

	2014	2015	2016	2017	2018
Number of ATMs per 100,000 adults	16.91	16.21	16.74	16.33	16.93
Number of commercial banks branches per 100,000 adults	5.61	4.98	4.74	4.44	4.30
Number of depositors with commercial banks per 1,000 adults	653.35	667.46	813.92	923.23	1013.71
Number of borrowers from commercial banks per 1,000 adults	31.08	29.88	23.81	21.79	18.55
Financial system deposit (% of GDP)	17.91	17.69	17.27	16.29	
Number of registered mobile money agent outlets per 1,000 adults	21.71	23.15	15.24	12.33	45.47
Number of registered mobile money accounts per 1,000 adults	71.41	106.43	51.74	39.03	77.20
Value of mobile money transactions (during this year as % of GDP)	0.38	0.46	0.74	0.96	1.53

Again, the findings appear to be similar, Ghana is the only country that recorded a significant increase in the number of ATM within the period. South Africa saw some marginal increase in the number of automated teller machines, however Kenya, Nigeria and Uganda all saw some decline in the number of ATMs within the period. Nigeria recorded a 15.4% decrease, the largest drop in the number of ATM machines. Kenya's ATM usage declined by 8.75%, Nigeria saw a decline in the number of ATM by 4.13% in 2015, and by 2018 the number of ATM had increased to its previous level in 2014.

This is surprising, as one would expect that the number of automated teller machines used in developing countries over the period would increase, as they are relatively cheaper to set up and maintain, when compared to a commercial bank. In setting up a commercial bank, operational costs, including costs of maintaining staff and payment of rent for use of building

space outweighs any costs used in maintaining and servicing an ATM. Yet, ATM did not significantly increase in number over the period in time.

However, as the results in the table 1-6 reveal, a significant number of people in the countries selected are embracing alternative financial innovative products that are at their disposal. The surge in the preference for branchless banking instead of traditional banking option has enabled millions of people who would have been financially excluded from the formal financial system to actively perform financial transaction at an affordable, reliable and secure manner.

The tremendous success story of Uganda and Rwanda in the number of mobile accounts and the number of registered mobile agent outlets between 2014 and 2018 cannot be ignored. For example, the number of mobile money accounts in Uganda and Rwanda grew by 133.5% and

307% over the 4 year period respectively. Kenya and Ghana also experienced some sensible growth of 34.3% and 51.8% in the number of mobile money account users within the period. Unfortunately, Nigeria did not have the same kind of success that Uganda and Rwanda had, it did have as many as 100 million mobile account users in 2015, and that number dipped by an estimated 50% in 2016, but the good news is, by 2018, it had returned to 77 million mobile account users, this was slightly higher than the 2014 numbers.

A similar result was attained with the number of mobile agent outlets in the countries in study. It only logical that as the number of mobile account users increased, the number of mobile agent outlets should increase to accommodate the increase in demand for branchless banking and third party financial transactions. Again, Ghana appeared to achieve impressive results in the number of mobile agent outlets in the 4 year period of study. For Ghana, a 1074% growth in

mobile agent outlet is an exceptional and outstanding result. Uganda and Rwanda also attained some commendable result in the four year period, as the growth in the number of mobile bank agent outlets increased by 133.5% and 276.2%. Sadly, Nigeria and South Africa do not achieve the kind of growth in the number of mobile money agent outlets as Uganda and Rwanda, growth in the number of mobile money outlets for Nigeria and South Africa, are modest when compared with Uganda, Rwanda and Ghana.

More importantly, the growth in the number of mobile money accounts and the number of mobile money agent outlet also increased a crucial economic indicator that is the value of mobile money transaction as a percentage of GDP. It turns out that the increase in both the number of mobile money accounts and the number of mobile money agent outlets also translated into significant source revenues for the selected countries examined in this study.

**Table 4. Rwanda**

	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Number of ATMs per 100,000 adults	5.62	5.63	5.74	5.66	5.19
Number of commercial banks branches per 100,000 adults	5.94	6.22	6.28	6.18	5.77
Number of depositors with commercial banks per 1,000 adults	169.75	148.02	191.87	206.57	266.29
Number of borrowers from commercial banks per 1,000 adults	34.80	35.83	29.65	19.92	27.53
Financial system deposit (% of GDP)	16.46	17.73	17.82	17.44	
Number of registered mobile money agent outlets per 1,000 adults	1161.90	1640.33	2430.16	3385.93	4372.03
Number of registered mobile money accounts per 1,000 adults	987.18	1134.58	1398.10	1265.99	1498.76
Value of mobile money transactions (during this year as % of GDP)	12.65	18.32	15.59	18.23	22.09

**Table 5. South Africa**

	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Number of ATMs per 100,000 adults	65.50	68.79	68.96	67.75	66.95
Number of commercial banks branches per 100,000 adults	10.83	10.42	10.13	10.40	10.16
Outstanding deposits with commercial banks (% GDP)	41.62	43.95	43.76	44.13	44.81
Financial system deposit (% of GDP)	58.32	59.52	59.25	57.92	
Number of registered mobile money agent outlets per 1,000 adults	9.75	5.58	0.56	NA	NA
Number of registered mobile money accounts per 1,000 adults	112.56	172.59	127.17	NA	NA
Value of mobile money transactions (during this year as % of GDP)	0.05	0.05	0.03	NA	0.06

**Table 6. Uganda**

	2014	2015	2016	2017	2018
Number of ATMs per 100,000 adults	4.46	4.64	4.54	4.20	4.15
Number of commercial banks branches per 100,000 adults	3.05	3.03	2.88	2.67	2.58
Number of depositors with commercial banks per 1,000 adults	201.22	210.23	252.86	364.29	292.30
Number of borrowers from commercial banks per 1,000 adults	20.78	25.04	32.62	30.95	69.35
Financial system deposit (% of GDP)	16.45	16.48	17.09	17.35	
Number of registered mobile money agent outlets per 1,000 adults	393.99	545.87	662.96	796.88	920.25
Number of registered mobile money accounts per 1,000 adults	984.34	1061.40	1040.48	1049.39	1079.08
Value of mobile money transactions (during this year as % of GDP)	34.72	42.79	52.75	61.62	71.02

Uganda and Nigeria seem to have benefited immensely in from revenues and earnings that have accrued in terms of the value of mobile transactions as a percentage of GDP. In just a short period of four years, the value of mobile transaction as a percentage of GDP had increased from 38% in 2014 to 153% of GDP in 2018. In the case of Uganda, the growth in value of mobile phone as a percentage of GDP was more modest, the increase from 34.72% in 2014 to 71% in 2018. South Africa had the worst earnings with regards to value of mobile transaction as a percentage of GDP. In 2014 the value stood at 0.03% and in 2016, it marginally increased to 0.05% and for the year 2017 and 2018 there are no available figures.

As earlier stated, the traditional banking businesses did not enjoy the same amount of success and tremendous growth that mobile telephone operators achieved over the 4 year period. As the table reveals, a comparative analysis of the growth, in terms of density of traditional bank branches pales in comparison to the growth in registered mobile money account. And the reason is obvious, establishing of a bank branch requires significant amount of resources that the bank shareholders have to put together, but more importantly, the establishment of a new branch can only be done when the shareholders are certain it would make profit. This is not to say, that telecommunication investors do not have significant operational costs. Yes, there is the need for the telecommunication investors to build the infrastructure, which they do; but the costs of maintenance of telecommunication mast and other equipment is far cheaper than running a traditional bank branch outlet.

In Table 8 and Table 9, the results of the t-test of the hypothesis tested in the study at 5 percent level are displayed. The hypothesis tested for difference in three specific areas in financial inclusion, the null hypothesis tested for significance in the number of commercial banks per 1000 that have been built over the four-year period to see if the number of banks has had a significant effect on improving financial inclusivity. The second hypothesis tested the effect in the increase in the registered mobile accounts, to assess if the increase in mobile phone technology has had an effect on financial inclusion. The third hypothesis tested the effect of mobile money agents in enhancing financial inclusion at the 5% of significance.

For the first hypothesis, we accept the null hypothesis, which is consistent with the literature that traditional banking is having considerable issues in enhancing levels of financial inclusion in developing countries. The literature clearly states that traditional banks need significant infrastructures, buildings, man-power and the need to ensure profitability. In rural areas, traditional banks cannot operate in such a harsh environment and make enough profits to keep in business. In the second hypothesis, we reject the null hypothesis – which is also consistent with the literature. Mobile phone technology has had a significant influence in improving financial inclusion in developing countries. The T value is greater than the critical value suggesting that there is more signal than noise and the difference is significant. Finally, the third hypothesis, we accept the null hypothesis, which states that the introduction of mobile money agents has not improved financial inclusion. This result is not consistent with the findings in the

**Table 7. Comparative analysis of demographic mobile phone usage for five African Countries**

	<b>Mobile money account (% age 15+)</b>	<b>Mobile money account, male (% age 15+)</b>	<b>Mobile money account, in labor force (% age 15+)</b>	<b>Mobile money account, out of labor force (% age 15+)</b>	<b>Mobile money account, female (% age 15+)</b>	<b>Mobile money account, young adults (% age 15-24)</b>	<b>Mobile money account, older adults (% age 25+)</b>	<b>Mobile money account, primary education or less (% age 15+)</b>	<b>Mobile money account, secondary education or less (% age 15+)</b>	<b>Mobile money account, income, poorest 40% (% age 15+)</b>	<b>Mobile money account, income, richest 60% (% age 15+)</b>	<b>Mobile money account, rural (% age 15+)</b>
Ghana 2014	13%	14%	12%	15%	12%	16%	12%	7%	18%	10%	15%	12%
Ghana 2017	39%	44%	42%	33%	34%	37%	40%	33%	46%	32%	44%	35%
Kenya 2014	58%	62%	62%	44%	55%	52%	62%	51%	67%	52%	63%	57%
Kenya 2017	73%	77%	78%	52%	69%	70%	74%	57%	84%	59%	82%	73%
Nigeria 2014	2%	3%	2%	3%	2%	2%	3%	2%	2%	2%	3%	2%
Nigeria 2017	6%	7%	6%	4%	4%	5%	6%	1%	9%	3%	7%	3%
Rwanda 2014	18%	20%	21%	10%	16%	12%	21%	16%	30%	7%	26%	17%
Rwanda 2017	31%	37%	32%	26%	26%	32%	31%	27%	58%	15%	42%	30%
South Africa 2014	14%	15%	18%	9%	14%	10%	16%	6%	18%	9%	18%	14%
South Africa 2017	19%	19%	25%	9%	19%	17%	20%	12%	22%	12%	24%	19%
Uganda 2014	35%	41%	39%	23%	29%	27%	41%	28%	46%	21%	44%	34%
Uganda 2017	51%	59%	55%	35%	43%	51%	50%	39%	66%	40%	58%	50%

**Table 8. Critical value tests for number of commercial banks, mobile money accounts and mobile money agents for 2015**

	Variance	Standard deviation	Standard errors	T Values	Critical values 0.05@40DF	Results of the hypothesis
1	5.59	2.36	0.515	0.27	2.02	Accept
2	145912.3	381.9	83.3	2.14	2.02	Accept
3	130913.5	361.8	78.9	1.43	2.02	Accept

**Table 9. Critical value tests for number of commercial banks, mobile money accounts and mobile money agents for 2019**

	Variance	Standard deviation	Standard errors	T Values	Critical Values 0.05@40DF	Results of the hypothesis
1	5.82	2.41	0.52	0.27	2.02	Accept
2	459482.4	677.85	147.9	2.14	2.02	Reject
3	952297	975.8	212.94	1.43	2.02	Accept

**Table 10. Descriptive statistics of the number of commercial banks, mobile money accounts and mobile money agents**

	2015	2019	2015	2019	2015	2019
Mean	4.65619	4.3719	494.023	990.865	181.872	600.746
Standard Error	0.516	0.52673	83.3559	147.919	78.9555	212.949
Median	4.92	3.94	417.6	989.07	53.82	315.65
Mode	2.06	#N/A	#N/A	#N/A	#N/A	#N/A
Standard Deviation	2.3646	2.41378	381.985	677.851	361.82	975.857
Sample Variance	5.59134	5.82633	145912	459482	130914	952297
Kurtosis	0.48839	0.26323	-1.1153	-1.507	14.4269	11.7554
Skewness	0.66845	0.90099	0.52425	0.06811	3.62418	3.19511
Range	9.46	8.62	1134.44	1995.18	1640.22	4371.96
Minimum	0.98	0.83	0.14	12.26	0.11	0.14
Maximum	10.44	9.45	1134.58	2007.44	1640.33	4372.1
Sum	97.78	91.81	10374.5	20808.2	3819.32	12615.7
Count	21	21	21	21	21	21

literature, however, the data in Table 10 does reveal that there is large variabilities in the number money mobile agents in the countries selected in the study. This might be as a result of regulatory issues, with some countries offering better regulation that allows money mobile agents to operate more efficiently than others. For example, countries like Nigeria and Angola appear to have inefficient mobile money agent operations with 12.26 and 77.7 per 1000 in 2015. This pales in significance to Rwanda and Kenya which have 1128.6 and 1134.5 per 1000 in 2015. This differentials is likely to distort the data and the results.

### 3. CONCLUSION

The study sought to investigate how financial technology and financial innovations are used as tools to solve the problem of financial inclusion in developing countries that the traditional banking

businesses have found immensely difficult to address. The findings of this research are consistent with the works of Andrianaivo and Kpodar, 2012; Honohan and King, 2012; Jack and Suri, 2014; Fanta and Makina, 2019a; Oskarsdottir, Bravo, Sarraute, Baesens and Vanthienen, 2020). Traditional banking has not been effective in resolving the problem of financial exclusion in the 6 countries in the study. More importantly, there appears to be some decline in the number of traditional branch offices for most of the countries in the study, with the exception of Ghana. The introduction of financial technology and innovation in developing countries landscape has been a game changer, however the introduction of ATM's did not record the kind successes the registered mobile money account and the mobile money agent outlets attained. However, countries like South Africa which had sound financial system did not achieve the kind of growth in mobile market

penetration in terms of number of registered mobile money accounts and mobile money agent outlets.

The success of branchless banking in developing countries has enabled for banking penetration to access satellite towns, rural areas and difficult locations. This enabled millions of financially excluded persons to gain access to financial platforms that allowed them to perform financial transaction at an affordable and convenient manner. The findings of this research paper have serious policy implications for developing countries, but more importantly it brings to the fore the importance of financial innovation and financial innovation as important tools for improving and strengthening financial inclusion in developing countries.

Therefore, it is crucial for policy makers in developing countries to focus on removal of administrative bottlenecks that could hamper the use of financial technology to improve financial exclusion rates in developing countries. Also, it is important for the research on financial inclusion to examine the different models applied by various countries to broaden financial inclusion through technology. A lot of attention should be paid to what has worked, why countries like Kenya and Ghana have been so successful in adoption of financial innovation and financial technology in the banking sectors and why countries like South Africa appear not to have benefited immensely from the financial innovation and financial technology revolution in Africa.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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