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DIGITAL BANKING TECHNOLOGIES AND FINANCIAL INCLUSION AMONG BANKS IN NAIROBI CITY COUNTY, KENYA

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ABSTRACT

This study intended to investigate the influence of Digital Banking on financial inclusion among banks in Nairobi City County Kenya. A descriptive survey research was used where the target population was all the 42 licensed banks in Kenya that are operating within Nairobi City County. Various financial inclusion indicators were measured using different forms of technological advancements including, Banking Service Automation and Banking System Integration Technologies, these indicators were premised on influence of Digital Banking on financial inclusion within Nairobi City County. A further robustness check was conducted by computing a composite indicator of financial inclusion to determine how it is affected by digital banking. The study findings reveal significant coefficients and corresponding p-values, indicating meaningful relationships between various factors and financial inclusion outcomes among banks in Nairobi City County, Kenya. Notably banking service automation ($\beta = 0.252$, $p = 0.018$), financial systems integration technologies ($\beta = 0.598$, $p = 0.000$), exhibit substantial associations with financial inclusion. These statistical insights suggest that banking service automation, and financial systems integration technologies, play pivotal roles in influencing financial inclusion initiatives within the region. The conclusions drawn from these findings underscore the importance of technological innovations in driving financial inclusion efforts, highlighting the need for banks and policymakers to prioritize investments in cutting-edge technologies to expand access to financial services. Building upon these conclusions, the study offers recommendations to enhance financial inclusion strategies, including fostering collaborations between banks and technology providers, strengthening regulatory frameworks to support innovation, and promoting digital literacy among underserved populations. By leveraging the insights derived from the statistical analyses, stakeholders can develop targeted interventions aimed at overcoming barriers to financial access and fostering inclusive economic growth in Nairobi City County, Kenya.

Key Words: Digital Banking Technologies, Financial Inclusion, Banking Service Automation, Financial Systems Integration Technologies

Background of the Study

The Financial Sector has gone through tremendous technological morphology with Digital Banking extending the change in demand and access to financial services globally. While technological advances are not new advents in the banking sector, digital innovation has improved interconnectivity between financial systems while scaling up computing power and reducing cost of access to financial services, which has led to the collection, processing, and storage of large volumes of data that can be mined for use in diverse business cases. For instance, mobile phone usage has gone up threefold globally, social, and economic activity has shifted online and new technologies like, cryptocurrency, block chain, edge computing, cloud computing have become widely adopted giving rise to large databanks for use in in the digital banking realm.

Technological developments in Digital Banking are changing the way payments are made, ease of access to credit facilities, accumulation of savings and wealth, access to insurance products as well as improved financial literacy. Digital banking has an ecosystem made up of mobile applications, universal service short codes, internet of things (IoT) and payment platform developed and run by Banks in collaboration with FinTech companies together with a set of regulatory and security framework thus Digital Banking is a new way of thinking about how money moves around the world. It is a more democratic system that gives power back to the people, consumers can now take control of their finances and have more options when it comes to choosing a bank.

Financial inclusion can be transformative for people and businesses. Historically, people with low income, women, and other socioeconomically marginalized groups have been underserved by financial institutions. Without access to formal services and the freedom and skills to use them, they have often relied on informal, unregulated financial tools. Compared to individuals and businesses with access to formal services, this limits their potential to capture economic opportunities and makes it harder to overcome financial shocks. An expanding body of research shows that financial inclusion has a measurable impact on poverty alleviation, resilience in times of crisis, and other measures of human progress.

Digital banking is a predominant terminology which refers to all forms of financial transactions taking place with the aid of technology (World Bank, 2022). As the world moves more rapidly towards a cash-free society, digital banking is the system by which an entire online economy has been allowed to grow and thrive. Digital banking can refer to the many digital systems available to businesses to make them run more efficiently. The digital banking encompasses funds transfer, Cash withdrawal, Getting statements, Bill Payments, Investments, Mobile Banking, Cheques etc. Currently in Kenya a lot of financial services conducted regularly are through digital banking platforms, for example, paying for government services through e-citizen, booking of SGR/Airline tickets, paying for car parking within the Cities, ordering and paying for food using Digital Platforms e.g M-Pesa. Therefore, digital banking simply encompasses any transaction that can be done via mobile or computer, online or offline.

Financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their financial needs like transactions, payments, savings, credit, and insurance delivered in a responsible and sustainable way, says World Bank Group (World Bank, 2022). Financial inclusion is considered a key enabler to reduce extreme poverty and boost shared prosperity. Being able to have access to a transaction account is a first step toward broader financial inclusion since a transaction account allows people to store money and send and receive payments.

Statement of the Problem

It is generally accepted among financial experts that giving people access to banking facilities and services can uplift the economic welfare of their lives. However, despite the obvious benefits of

financial inclusion and the technological advancements that has been made so far, according to (World Economic Forum, 2020), around a billion people in the world still do not have access to basic banking services.

Based on studies which focused mainly on financial inclusion by Financial Sector Deepening (FSD) in Kenya, the results indicated that 45 percent of respondents relied on friends and family members for financial advice compared to 43.3 percent who relied on their own knowledge (FSD Kenya, 2021). It was found that lack of awareness among the study group prevented them from utilizing the right financial products and services that suited their needs.

According to research done by (UNESCAP, 2023), on impact of banking regulations on financial inclusion found out that disproportionate implementation of the anti-money Laundering regulations also has unintended consequences such as excluding individuals and legitimate businesses from the formal financial system.

Another literature on digital finance opines that there is lack of financial literacy and awareness about financial cybercrimes resulted in general mistrust among rural population which led to reduced digital banking penetration (Malladi, Soni, & Srinivasan, 2021). Moreover, according to IMF research findings done in Niger (IMF, 2023) on financial services found out that financial services and products offered appears to not respond to the specificities of the large rural population.

Whereas there is an expanding corpus of academic research and literature that relates to Digital finance and financial inclusion, none of which has specifically given a research outcome on the influence of Digital banking on financial inclusion with regards to the current technological advancements as research indicators. None of these literatures had adequate and conclusive findings on how banks that are exclusively digital (like Fingo) are leveraging technology to open up financial inclusion initiatives in Kenya.

Therefore, more empirical data is needed to detail how digital banking can be leveraged in enhancing financial inclusion penetration. Moreover, this study aimed to add to the current knowledge by investigating the influence of digital banking on financial inclusion among banks in Nairobi City County, Kenya. The general question was whether digital banking has influenced access to/use of financial products and services among Kenya's underprivileged or unbanked population.

1.3 Objectives of the study

i. To evaluate the influence of banking service automation on financial inclusion among banks in Nairobi City County, Kenya.

ii. To examine the influence of financial systems integration technologies on financial inclusion among banks in Nairobi City County, Kenya.

LITERATURE REVIEW

Theoretical Review

Diffusion of Innovations Theory (DOI)

Diffusion of innovations is a theory that seeks to explain how, why, and at what rate new ideas and technology spread. The theory was popularized by Everett Rogers in his book Diffusion of Innovations, first published in 1962. DOI has been defined as a process by which innovation is communicated through certain channels to members of the social system over time. The theory focuses on the fact that new ideas (innovations) or technologies, are being created continually and that communication becomes vital in spreading or disseminating the innovation to society or communities. Adoption of a new idea, behavior, or product does not happen simultaneously in a

social system; rather it is a process whereby some people are more apt to adopt the innovation than others (LaMorte, 2022). This theory can be applied across all the independent variables, it details the acceptance and adoption and use of latest technological developments in provision of Digital banking service by the banking service providers as well as the way through which the same technology can spread among the vulnerable groups to aid access to digital financial services. Therefore, this theory anchors all independent variables in this study since they're all innovation oriented.

Financial literacy theory of financial inclusion

Financial literacy theory of financial inclusion proposed by Peterson K. Ozili (Ozili, 2020) states that financial literacy will increase people's willingness to join the formal financial sector. It argues that financial inclusion can be achieved through education that increases the financial literacy of citizens. When people become financially literate, they will seek formal financial services wherever they can find it. This theory can be used to address challenges facing financial inclusion since it has the following benefits and merits. One, financial literacy can make people aware of formal financial services that are available to them. When they become aware of existing formal financial services that can improve their welfare, they will join the formal financial sector by owning a formal account. Secondly, through increased financial literacy, people can take advantage of other benefits in the formal financial sector such as investment and mortgage products.

Thirdly, financial literacy can also help people become self-sufficient and help them have some stability in their personal finance. Financial literacy can help people to distinguish between needs and wants, helping them to create and manage a budget, teaching them to save so that they can pay bills when due, and to plan for retirement. Finally, governments that have limited public funds, or limited tax revenue, to fund financial inclusion programs may prefer to use financial literacy as a national strategy for financial inclusion because it is relatively cheaper to educate the population about financial management and the benefits of using formal financial services.

This theory captures the dependent variables and posits that financial education is the key ingredient in a successful financial inclusion. It details advantages of achieving financial education to realize other goals of financial inclusion and what is considered as a successful financial inclusion undertaking. On this premise it will anchor the DV in this study.

Conceptual Framework

According to (Mugenda & Mugenda, 2003)) a conceptual framework is a concise description of phenomenon under the study accompanied by a graphical description of the major variables of the study. It is linked with the concepts, empirical research and important theories used in promoting and systemizing the knowledge espoused by the researcher. Below is the conceptual framework illustrating the independent variables (IV) and Dependent Variables (DV) under this study.

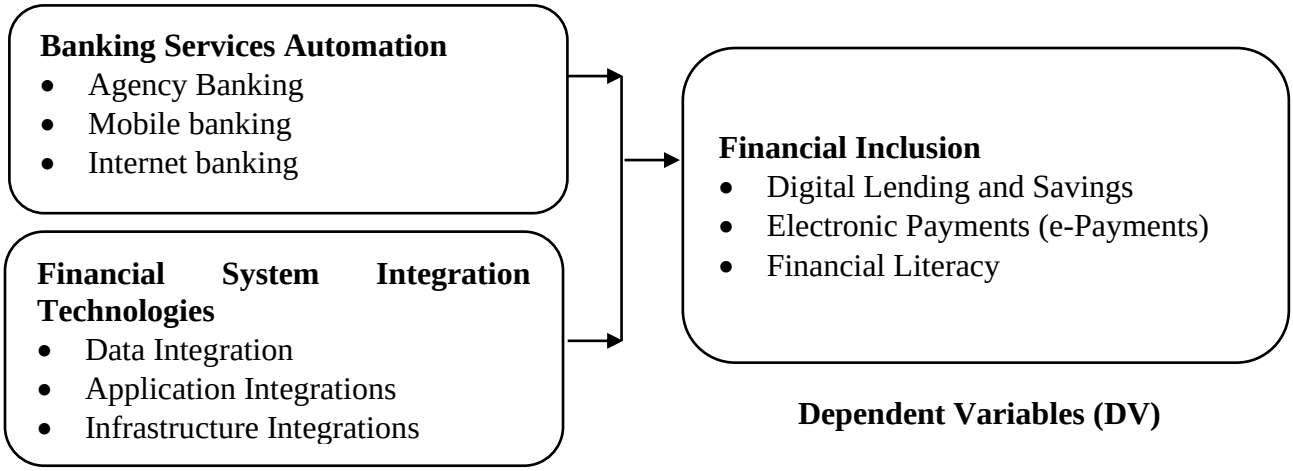

Figure 2.1: Conceptual Framework

Banking Service Automation

According to (BRAC Bank, 2023), Agent Banking means providing limited scale banking and financial services to the underserved population through engaged agents under a valid agency agreement, rather than a teller/cashier. It is the owner of an outlet who conducts banking transactions on behalf of a bank. Also known as Indirect Access/Indirect Scheme Access, the agency banking model gives financial institutions the ability to offer payment services to their customers in other locations without having to establish a physical presence in or meet direct access regulatory requirements for that jurisdiction.

Mobile banking (m-banking) refers to the provision and availability of banking and financial services through the help of mobile telecommunication devices. The scope of the offered services may include facilities to conduct bank and stock market transactions, administer accounts and to access customized information. Mobile networks in Kenya offer m-money services in the name of M-pesa by Safaricom, Orange money by Orange, and Airtel money by Airtel. Currently the mobile money market size is about 15 million users transferring Kshs. 2 billion every day. Mobile banking offers a potential solution for the millions of people in emerging markets that have access to a cell phone yet remain excluded from the financial mainstream. It can make basic financial services more accessible by minimizing time and distance to the nearest retail bank branches (CGAP 2016) as well as reducing the bank's own overheads and transaction-related costs. Mobile banking presents an opportunity for financial institutions to extend banking services to new customers (Lee et al. 2017).

Internet banking (e-banking) is the use of internet and telecommunication networks to deliver a wide range of value-added products and services to bank customers (Steven, 2002) through the use of a system that allows individuals to perform banking activities at home or from their offices or over the internet. Some online banks are traditional banks which also offer online banking, while others are online only and have no physical presence. Online banking through traditional banks enables customers to perform all routine transactions, such as account transfers, balance inquiries, bill payments, and stop-payment requests, and some even offer online loan applications. Customers can access account information at any time, day or night, and this can be done from anywhere. Internet banking has improved banking efficiency in rendering services to customers.

Financial Systems Integration technologies

The foundation of system integration lies in ensuring seamless data exchange between different systems through Data Integration. This involves ensuring that data is accurate, reliable, and can be shared and utilized effectively across different systems. Key steps of Data Integration include. Data Normalization (Standardizing and reconciling data formats to ensure consistency and compatibility across systems. Data Transformation (converting data from one format to another to facilitate smooth transfer between systems and Data Cleansing which involves identifying and correcting data inconsistencies and errors to ensure data integrity.

Connecting different applications to communicate and operate in harmony is essential for system integration. This involves establishing a unified interface that allows applications to exchange data and interact without disruptions. Key elements of application integration include application Interoperability (stablishing protocols and standards that enable applications to exchange data and interact effectively. Message Queuing -utilizing message queues to store and transmit data between applications asynchronously and Middleware -utilizing middleware components to connect and manage interactions between applications using and API interface.

Connecting and managing the underlying hardware and network infrastructure is a vital aspect of system integration. The process involves ensuring that the infrastructure is reliable, scalable, and can support the integrated system's performance and growth requirements. Key elements of infrastructure integration include Network Connectivity - establishing secure and reliable network connections between systems to facilitate data exchange, Resource Management to ensure efficient allocation and utilization of hardware resources to optimize system performance and Monitoring and Alerting tools to detect potential issues and provide timely alerts for proactive troubleshooting.

Financial inclusion

Digital lending is the service of providing loans and credit facilities with the help of Digital Banking and online platforms by assessing the creditworthiness of the borrowers with the help of data analytics. While digital savings allows customers to open and operate a digital savings account. A digital savings account is a type of savings account that can be opened, managed, and operated from anywhere at any time using mobile devices such as phones and digital devices such as the computer. Digital lending is becoming increasingly popular with the faster spread of Digital Banking culture, platforms, and infrastructure like faster net connectivity. In Kenya digital loans are loans obtained via mobile banking (for example, M-Shwari and KCB-Mpesa) or a smartphone app (for example, Branch and Tala).

Electronic payments (e-payment) are payments made through digital or online modes, with no exchange of hard cash being involved. Such a payment sometimes also called digital payment, which as the transfer of value from one payment account to another where both the payer and the payee use a digital device such as a mobile phone, computer, or a credit, debit, or prepaid card.

The payer and payee could be either a business or an individual (Forbes, 2023). This means that for digital payments to take place, the payer and payee both must have a bank account, an online banking method, a device from which they can make the payment, and a medium of transmission, meaning that either they should have signed up to a payment provider or an intermediary such as a bank or a service provider.

Mobile-based digital payments also provide the payee with the ability to collect customer data for analytics and market segmentation. This enables retailers and issuer banks to use digital payments,

along with loyalty and reward programs, to drive customer acquisition and retention through targeted marketing and customized offers.

According to (Corporate Finance Institute, 2023) Financial literacy is the cognitive understanding of financial components and skills such as budgeting, investing, borrowing, taxation, and personal financial management. The absence of such skills is referred to as being financially illiterate. Being financially literate allows an individual to be better prepared for specific financial roadblocks, which, in turn, decreases the chances of personal economic distress. Achieving financial literacy is crucial today due to everyday facets of life, such as student loans, mortgages, credit cards, investments, and health insurance.

Financial literacy consists of several financial components and skills that allow an individual to gain knowledge regarding the effective management of money and debt. These components are Budgeting, Investing, Borrowing, Taxation and Personal Financial Management. Achieving an in-depth knowledge of the financial components mentioned guarantees an increase in an individual's financial literacy. Obtaining financial literacy is one of the most important things an individual can do to ensure prolonged financial stability, and this plays a key role in the success of financial inclusion initiatives.

Empirical Review

Mulwa (2017) investigated the effect of internet banking on financial performance of commercial banks in Kenya. The study acknowledged that internet banking has the potential to transform financial services and banking industry. The study adopted a descriptive 15 research design and descriptive statistics for analysis. The findings revealed that ROI in commercial banks in Kenya was on an upward trajectory due to increase in online customer deposits through internet banking. In addition, internet expenses fees and commissions increased to total asset ratio increased.

Byegon, Cheboi and Bonuke (2019) examined the intervening role of financial innovations on the link between behavioral factors and utilization of formal financial services among Micro enterprises in Kenya. The study adopted a descriptive survey where a sample of 486 managers of micro-enterprises in Nairobi was studied. The study was based on regression analysis where results showed that financial innovations have an intervening effect on the link between behavioral factors and financial inclusion. Hence financial innovations like agency banking and mobile money enhanced the relationship between behavioral factors and financial inclusion.

Durai and Stella (2019) evaluated the contribution of Digital Banking to financial inclusion. The study used primary data where multivariate regression was adopted. Research showed that financial inclusion was affected by Digital Banking through their convenience, accuracy, usability, convenience, and easy interbank. Hence, Digital Banking in the form of mobile banking, credit cards, Internet banking, mobile wallets (apps) have a major influence on financial inclusion.

RESEARCH METHODOLOGY

In this study, the research problem was solved using a descriptive survey design. Survey research design is the collection of information from a sample of individuals through their responses to questions (Check & Schutt, 2011). The study involved 42 licensed Banks in Kenya that are operating within the Nairobi City County. The study adopted a census of all the commercial banks in Kenya from a population of 42 Commercial banks (Central Bank of Kenya, 2022). The researcher targets staff members from both ICT and Banking Operations Departments from the 42 banks. Respondents were purposively picked from ICT and Banking operations departments

because of their knowledge and experience in technological advancements and banking respectively.

The sample frame was therefore made up of 10 staff members from ICT and banking operations department of each of the 42 banks which are currently headquartered within Nairobi City Country, allowing a total of 420 respondents from all participating banks. Taro Yamane's formula was used to arrive at the sample size. Therefore, the sample size consisted of 204 participants. Since the population is heterogeneous, stratified random sampling technique was more appropriate for the study. The study used a questionnaire for collecting primary data from the selected respondents.

The researcher self-administered the questionnaires to all the 204 respondents at their own convenient time through email or online tools like survey Monkey and Kobo Collection tools. The researcher conducted a pilot on the research instruments first with 10% of the respondents from an anticipated sample size of 204 giving a total of 20 respondents randomly drawn from the target banks within Nairobi City County.

The data was then coded and checked for any errors and omissions. The data collected were both quantitative and qualitative. This data was analyzed by means of descriptive and inferential statistics. The data analysis was done with help of Statistical Package for Social Sciences (SPSS) program; this generates quantitative reports through tabulations, percentages, and measure of central tendency. The data was subjected to a regression analysis to measure the relationship between the various digital banking technology and financial inclusion among banks in Nairobi City County.

RESEARCH FINDINGS AND DISCUSSION

The sample size of this study was 204 ICT and Banking Operations Departments staff from 42 licensed Banks in Kenya. All selected respondents were issued with questionnaires for data collection. Out of the 204 questionnaires distributed, 176 were completed and returned, representing a response rate of 86.3%. As indicated by Metsamuuronen (2017), a response rate that is above 50% is considered adequate for data analysis and reporting while a response rate that is above 70% is classified as excellent. Hence, the response rate of this study was within the acceptable limits for drawing conclusions and making recommendations.

Descriptive Data Analysis

In this section, the study presents descriptive statistics analysis based on the data collected for the study. The analysis includes measures such as mean, and standard deviation to describe the data comprehensively. The study requested respondents to indicate the extent to which they agreed or disagreed with various statements that examine how Digital Banking technologies have influenced financial inclusion among banks in Nairobi City County, Kenya. They used the scale of 1-5 where 1= Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree. The means and standard deviations were used to interpret the findings where a mean value of 1-1.4 was strongly disagree, 1.5-2.4 disagree, 2.5-3.4 neutral, 3.5-4.4 agree and 4.5-5 strongly agree. Standard deviation greater than 2 was considered large meaning responses were widely spread out and not tightly clustered around the mean.

Banking Service Automation

The first objective of the study was to evaluate the influence of banking service automation on financial inclusion among banks in Nairobi City County, Kenya. Respondents were asked to rate the influence of Banking Service Automation technologies on financial inclusion outcomes (1 being the least and 5 the most). Table 1 presents summary of the finding obtained.

Table 1: Descriptive Analysis for Banking Service Automation

Banking Service Automation	Mean	Std. Dev.
The uptake of Electronic Payments (e-Payments) services within Nairobi city county has improved due to introduction of Internet banking as a service/product	4.018	0.689
Internet banking has improved the Digital Lending and Savings services within Nairobi City County	4.007	0.809
The introduction of Agency Banking services by the bank has improved the uptake and use of Electronic Payments (e-Payments) within Nairobi City County.	3.974	0.623
Agency Banking technology used by the bank within Nairobi City County has influenced Financial Literacy among customers of the bank	3.912	0.635
Mobile banking services has improved the uptake and provision of Digital Lending and Savings products within Nairobi City County	3.873	0.749
The uptake of Electronic Payments (e-Payments) services within Nairobi city county has improved due to introduction of Mobile banking as a service/product	3.692	0.688
The adoption and use of Internet banking has improved Financial Literacy among customers of the bank within Nairobi City County	3.626	0.87
The adoption of Mobile banking technology has influenced Financial Literacy initiatives carried out by the bank within Nairobi City County.	3.578	0.848
Agency Banking services has influenced Digital Lending and Savings products being offer by the bank within Nairobi City County?	3.574	0.77
Aggregate Score	**3.806**	**0.742**

The findings show that the respondents agreed on average that the uptake of Electronic Payments (e-Payments) services within Nairobi city county has improved due to introduction of Internet banking as a service/product (M= 4.018, SD= 0.689); that internet banking has improved the Digital Lending and Savings services within Nairobi City County (M= 4.007, SD= 0.809); and that the introduction of Agency Banking services by the bank has improved the uptake and use of Electronic Payments (e-Payments) within Nairobi City County (M= 3.974, SD= 0.623). Respondents also agreed that agency banking technology used by the bank within Nairobi City County has influenced Financial Literacy among customers of the bank (M= 3.912, SD= 0.635); that mobile banking services has improved the uptake and provision of Digital Lending and Savings products within Nairobi City County (M= 3.873, SD= 0.749); and that the uptake of Electronic Payments (e-Payments) services within Nairobi city county has improved due to introduction of Mobile banking as a service/product (M= 3.692, SD= 0.688). They were also in agreement that the adoption and use of Internet banking has improved Financial Literacy among customers of the bank within Nairobi City County (M= 3.626, SD= 0.87); that the adoption of Mobile banking technology has influenced Financial Literacy initiatives carried out by the bank within Nairobi City County (M= 3.578, SD= 0.848); and that agency Banking services has influenced Digital Lending and Savings products being offer by the bank within Nairobi City County (M= 3.574, SD= 0.77).

The findings, indicating that respondents agree on average that banking service automation influences financial inclusion among banks in Nairobi City County, Kenya, as evidenced by an aggregate mean of 3.806 (SD= 0.742), align with the insights provided by Byegon, Cheboi, and Bonuke (2019). Their study emphasizes the pivotal role of financial innovations, including banking service automation, in enhancing the utilization of formal financial services among micro-enterprises. Additionally, the findings resonate with the research conducted by Mulwa (2017), which investigates the effect of internet banking on the financial performance of commercial banks in Kenya. Mulwa's study underscores the transformative potential of automation in financial services, particularly in terms of improving operational efficiency and expanding access to banking services. Together, these perspectives highlight the importance of banking service automation in

driving financial inclusion initiatives within Nairobi City County, Kenya, by streamlining processes and increasing accessibility to financial services for various stakeholders.

Financial System Integration Technologies

The second objective of the study was to examine the influence of financial systems integration technologies on financial inclusion among banks in Nairobi City County, Kenya. Respondents were asked to indicate the extent to which they agree or disagree with various statements on financial systems integration technologies.

Table 2: Descriptive Analysis of Financial System Integration Technologies

Financial System Integration Technologies	Mean	Std. Dev.
Infrastructure Integration among various financial institutions to offer Electronic Payments (e-Payments) services within Nairobi City County ensures seamless transaction processing and reliability.	3.952	0.726
Effective Data Integration among various financial institutions offering Digital Lending and Savings services improves accessibility for customers.	3.949	0.828
Data Integration between different financial and non-financial entities plays a crucial role in promoting Financial Literacy among customers of the bank.	3.798	0.647
The utilization of Application Programming Interfaces (API) Technology greatly enhances the connectivity between entities providing Digital Lending and Savings services.	3.746	0.967
Infrastructure Integration between different financial institutions significantly contributes to championing Financial Literacy among customers within Nairobi City County.	3.662	0.933
Seamless Infrastructure Integration among financial institutions offering Digital Lending and Savings functions enhances operational efficiency.	3.57	0.76
Data Integration between different financial and non-financial entities in delivering Electronic Payments (e-Payments) services promotes accessibility and convenience for users.	3.548	0.802
Application Programming Interfaces (API) Technology aids in effectively disseminating Financial Literacy among customers within this bank by fostering collaboration among relevant entities.	3.542	0.691
The implementation of Application Programming Interfaces (API) Technology facilitates smooth collaboration among relevant entities in providing Electronic Payments (e-Payments) services.	3.525	0.606
Aggregate Score	**3.699**	**0.773**

The findings show that the respondents agreed on average that infrastructure Integration among various financial institutions to offer Electronic Payments (e-Payments) services within Nairobi City County ensures seamless transaction processing and reliability (M= 3.952, SD= 0.726); that effective Data Integration among various financial institutions offering Digital Lending and Savings services improves accessibility for customers (M= 3.949, SD= 0.828); and that data Integration between different financial and non-financial entities plays a crucial role in promoting Financial Literacy among customers of the bank (M= 3.798, SD= 0.647). Respondents also agreed that the utilization of Application Programming Interfaces (API) Technology greatly enhances the connectivity between entities providing Digital Lending and Savings services (M= 3.746, SD= 0.967); that infrastructure Integration between different financial institutions significantly contributes to championing Financial Literacy among customers within Nairobi City County (M= 3.662, SD= 0.933); and that seamless Infrastructure Integration among financial institutions offering Digital Lending and Savings functions enhances operational efficiency (M= 3.57, SD= 0.76). Respondents were further in agreement that data Integration between different financial and non-financial entities in delivering Electronic Payments (e-Payments) services promotes

accessibility and convenience for users (M= 3.548, SD= 0.802); that application Programming Interfaces (API) Technology aids in effectively disseminating Financial Literacy among customers within this bank by fostering collaboration among relevant entities (M= 3.542, SD= 0.691); and that the implementation of Application Programming Interfaces (API) Technology facilitates smooth collaboration among relevant entities in providing Electronic Payments (e-Payments) services (M= 3.525, SD= 0.606).

The findings, indicating that respondents agree on average that financial systems integration technologies influence financial inclusion among banks in Nairobi City County, Kenya, with an aggregate mean of 3.699 (SD= 0.773), resonate with the insights provided by Kithinji (2017). Kithinji's evaluation of the causal effect link between digital finance strategy and financial inclusion among commercial banks in Kenya emphasizes the importance of integrating financial systems to enhance access to banking services. Additionally, the findings are consistent with the research conducted by Sindani, Muturi, and Ngumi (2019), which examines the causal effect link between financial inclusion and financial distribution channels in Kenya. Their study underscores the significance of financial distribution channels, including internet banking, in expanding access to financial services and fostering financial inclusion. Together, these perspectives underscore the critical role of financial systems integration technologies in driving financial inclusion initiatives within Nairobi City County, Kenya, by facilitating seamless access to banking services and enhancing the overall efficiency of financial systems.

Financial inclusion

The main focus of the study was to examine how Digital Banking technologies have influenced financial inclusion among banks in Nairobi City County, Kenya. Respondents were therefore asked to indicate the extent to which they agreed or disagreed with statements on financial inclusion among banks in Nairobi City County, Kenya. Table 3 presents summary of the findings obtained.

Table 3: Descriptive Analysis for Financial Inclusion

Financial inclusion	Mean	Std. Dev.
Access to Digital Lending and Savings services has positively impacted ability to save and invest.	4.039	0.593
Participation in Financial Literacy programs has contributed to financial well-being within the bank.	3.982	0.715
Engaging in Financial Literacy initiatives has empowered customers to make more informed financial decisions.	3.84	0.725
Digital Lending and Savings options have provided customers with greater flexibility in managing finances.	3.801	0.633
The utilization of Electronic Payments (e-Payments) services has increased access to various financial products and services.	3.677	0.777
Participation in Financial Literacy programs has enhanced understanding of financial concepts and services.	3.634	0.896
The availability of Electronic Payments (e-Payments) services has improved overall banking experience.	3.608	0.888
Access to Digital Lending and Savings services has significantly improved financial inclusion.	3.601	0.746
The availability of Electronic Payments (e-Payments) services has made it easier for customers to conduct financial transactions.	3.571	0.667
Aggregate Score	**3.750**	**0.738**

The findings show that the respondents agreed on average that access to digital lending and savings services has positively impacted ability to save and invest (M= 4.039, SD= 0.593); that

participation in Financial Literacy programs has contributed to financial well-being within the bank (M= 3.982, SD= 0.715); and that engaging in financial literacy initiatives has empowered customers to make more informed financial decisions (M= 3.84, SD= 0.725). They were also in agreement that digital Lending and Savings options have provided customers with greater flexibility in managing finances (M= 3.801, SD= 0.633); that the utilization of Electronic Payments (e-Payments) services has increased access to various financial products and services (M= 3.677, SD= 0.777); and that participation in Financial Literacy programs has enhanced understanding of financial concepts and services (M= 3.634, SD= 0.896); and that the availability of Electronic Payments (e-Payments) services has improved overall banking experience (M= 3.608, SD= 0.888). Respondents were further in agreement that access to Digital Lending and Savings services has significantly improved financial inclusion (M= 3.601, SD= 0.746); that the availability of Electronic Payments (e-Payments) services has made it easier for customers to conduct financial transactions (M= 3.571, SD= 0.667).

The findings, supported by an aggregate mean of 3.750 (SD= 0.738), suggest that respondents generally agree on the influence of digital banking technologies on financial inclusion among banks in Nairobi City County, Kenya. This aligns with the insights provided by Kithinji (2017), who evaluated the causal effect link between Digital Finance strategy and financial inclusion among commercial banks in Kenya. Kithinji's study emphasized the pivotal role of digital banking technologies in enhancing access to financial services and promoting financial inclusion. Additionally, the findings resonate with the research conducted by Durai and Stella (2019), which evaluated the contribution of Digital Banking to financial inclusion. Their study underscored the importance of digital banking technologies, such as mobile banking, internet banking, and digital payment solutions, in expanding access to financial services and fostering financial inclusion initiatives. Together, these perspectives highlight the significant influence of digital banking technologies in driving financial inclusion efforts within Nairobi City County, Kenya, by leveraging innovative digital solutions to overcome barriers to financial access and inclusion.

Correlation Analysis

The study computed correlation analysis to test the strength and the direction of the relationship that exists between digital banking technologies and financial inclusion among banks in Nairobi City County, Kenya. The correlation values range from 0 to 1; if the correlation values are r = ±0.1 to ±0.29 then the relationship between the two variables is small, if it is r = ±0.3 to ±0.49 the relationship is medium, and when r= ±0.5 and above there is a strong relationship between the two variables under consideration. Table 4 presents correlation analysis findings for this study.

Table 4: Correlations

		Financial Inclusion	Banking Service Automation	Financial Systems Integration Technologies
Financial Inclusion	Pearson Correlation	1		
	Sig. (1-tailed)			
	N	227		
Banking Service Automation	Pearson Correlation	.695**	1	
	Sig. (1-tailed)	.000		
	N	227	227	
Financial Systems Integration Technologies	Pearson Correlation	.773**	.264	1
	Sig. (1-tailed)	.000	.211	
	N	227	227	227

There is a significant positive correlation between banking service automation and financial inclusion, with a correlation coefficient of 0.695. This implies that increased automation in banking services is associated with higher levels of financial inclusion. The p-value of 0.000 indicates that this correlation is statistically significant at the 0.05. The findings align with Mulwa's (2017) research on the effect of internet banking on financial performance of commercial banks in Kenya which acknowledged the transformative potential of internet banking in enhancing financial services and banking industry. The significant positive correlation observed in this study supports Mulwa's argument that automation, particularly through internet banking, positively influences financial performance, which in turn contributes to financial inclusion initiatives.

The correlation analysis reveals a strong positive correlation between financial systems integration technologies and financial inclusion, with a correlation coefficient of 0.773. This suggests that enhanced integration of financial systems is positively associated with greater financial inclusion. The p-value of 0.000 indicates that this correlation is statistically significant at the 0.05. The findings resonate with the research conducted by Sindani, Muturi, and Ngumi (2019) who examined the causal effect link between financial inclusion and financial distribution channels in Kenya, including internet banking and ATM banking. The significant positive correlation observed in this study supports Sindani et al.'s argument that improved financial distribution channels, facilitated by technologies such as financial systems integration, contribute to enhancing financial inclusion.

Regression Analysis

Multivariate regression analysis was used to assess the relationship between independent variables and the dependent variable. This study examined how digital banking technologies have influenced financial inclusion among banks in Nairobi City County, Kenya.

Model Summary

Model summary was used to determine the amount of variation in financial inclusion among banks in Nairobi City County, Kenya as a result of changes in banking service automation, financial systems integration technologies. Table 5 presents the findings.

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.888[a]	.789	.784	.47142

a. Predictors: (Constant), Financial Systems Integration Technologies, Banking Service Automation

The regression model demonstrates a strong overall fit, as indicated by an R-squared value of 0.789, suggesting that approximately 78.9% of the variance in the dependent variable (financial inclusion) can be explained by the independent variables included in the model. The adjusted R-squared value of 0.784 accounts for the number of predictors in the model and adjusts the R-squared value accordingly, providing a more accurate representation of the model's explanatory power. Therefore, the model's high R-squared value and low standard error suggest that the included predictors - financial systems integration technologies, and banking service automation - collectively contribute significantly to explaining variations in financial inclusion. Therefore, the model appears to be a robust predictor of financial inclusion within the context of the study.

Analysis of Variance

The ANOVA table provides information about the overall fit of the regression model and whether the predictors included in the model significantly contribute to explaining the variance in the

dependent variable. In this study, the significance of the model was tested at 5% confidence interval.

Table 6: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	80.757	4	20.189	90.846	.000[b]
	Residual	49.337	222	.222		
	Total	130.094	226			

a. Dependent Variable: Financial Inclusion

b. Predictors: (Constant),Financial Systems Integration Technologies, Banking Service Automation

The analysis of variance (ANOVA) table indicates a significant regression model for predicting financial inclusion, as evidenced by the highly significant F-statistic of 90.846 ($p < .05$). This implies that the variation in the dependent variable (financial inclusion) is not due to random chance but is instead explained by the predictors included in the model. The significant F-statistic suggests that at least one of the predictors in the model has a non-zero effect on financial inclusion. Therefore, the findings support the notion that the combined influence of financial systems integration technologies, and banking service automation significantly impacts financial inclusion within the context of the study.

Beta Coefficients

Table 7: Beta Coefficients of Study Variables

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.391	.211		1.853	.065
	Banking Service Automation	.252	.106	.199	2.381	.018
	Financial Systems Integration Technologies	.598	.084	.557	7.129	.000

a. Dependent Variable: Financial Inclusion

The fitted regression model was as follows:

$$Y = 0.391 + 00.252\ X_1 + 0.598\ X_2$$

The beta coefficient for banking service automation is 0.252, with a p-value of 0.018, indicating a statistically significant positive influence on financial inclusion among banks in Nairobi City County, Kenya. This finding is consistent with the research conducted by Mulwa (2017), which highlighted the transformative impact of automation technologies on financial service delivery and accessibility. Automated banking services such as mobile banking and online banking facilitate convenience, accessibility, and efficiency, thereby removing barriers to financial inclusion and promoting broader access to banking services among diverse populations.

The beta coefficient for financial systems integration technologies is 0.598, with a p-value of 0.000, suggesting a highly significant positive effect on financial inclusion among banks in Nairobi City County, Kenya. This aligns with the findings of Sindani, Muturi, and Ngumi (2019), who emphasized the importance of integrated financial systems in enhancing access to financial services. Integrated systems enable seamless transactions, interoperability among financial

institutions, and expanded service delivery channels, ultimately fostering greater financial inclusion within the banking sector.

Conclusions

The study findings highlight the significant impact of banking service automation on financial inclusion initiatives within Nairobi City County, Kenya. Respondents' favorable views of internet banking, mobile banking, and agency banking technologies underscore the importance of automated services in improving accessibility and convenience for customers. Correlation and regression analyses confirm a strong positive relationship between banking service automation and financial inclusion. Thus, the study concludes that the adoption of automated banking services positively influences financial inclusion outcomes, facilitating greater participation in formal financial systems and expanding access to banking services for individuals and businesses in Nairobi City County.

Financial system integration technologies emerge as key drivers of financial inclusion efforts within Nairobi City County, Kenya, according to the study findings. Respondents' perceptions of the role of integrated financial systems in promoting accessibility and efficiency align with the positive correlation and regression results, indicating a significant association between financial system integration technologies and financial inclusion. Therefore, the study conclude that the seamless integration of financial entities and systems contributes to the advancement of financial inclusion objectives, facilitating smoother transactions, improving access to services, and fostering greater economic participation among diverse populations within Nairobi City County.

Recommendations

In light of the positive impact of banking service automation on financial inclusion efforts within Nairobi City County, Kenya, it is recommended that financial institutions continue to innovate and expand their automated banking services. Institutions should invest in enhancing internet banking, mobile banking, and agency banking platforms to improve accessibility and convenience for customers, particularly in underserved areas. Collaborations with telecommunications companies and fintech firms can further accelerate the adoption of automated banking solutions. Moreover, efforts should be made to promote digital literacy among customers to ensure widespread adoption and usage of these technologies. By implementing these recommendations, banks can effectively leverage automation to drive financial inclusion and expand access to formal financial services across Nairobi City County.

To capitalize on the potential of financial system integration technologies in advancing financial inclusion objectives within Nairobi City County, Kenya, it is recommended that stakeholders work towards developing interoperable financial infrastructure and systems. Regulatory bodies should promote policies that encourage collaboration and interoperability among financial institutions and service providers. Moreover, investments should be made in upgrading existing financial infrastructure to support seamless integration and transaction processing. Public-private partnerships can facilitate the development and implementation of standardized protocols and frameworks for financial system integration. By embracing these recommendations, stakeholders can create an ecosystem conducive to innovation and collaboration, ultimately enhancing financial inclusion outcomes for individuals and businesses in Nairobi City County.

Suggestions for Further Studies

Future studies should conduct comparative studies across different regions could provide valuable insights into the contextual factors that influence the effectiveness of technology-driven financial inclusion initiatives. Furthermore, qualitative research methods, such as interviews and focus groups, could complement the quantitative findings of this study by offering deeper insights into the perceptions and experiences of key stakeholders, including customers and policymakers.

Exploring the role of regulatory frameworks and policy interventions in shaping the adoption and impact of financial technology (fintech) solutions on financial inclusion could also be a fruitful area for future research.

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