

**BLOCKCHAIN TECHNOLOGY FRAMEWORK FOR SECURING AND
AUTOMATING CUSTOMER ONBOARDING PROCESS: A CASE OF EQUITY
BANK, KENYA.**

STUDENT NAME: Fredrick Otieno Owino

STUDENT ID: 18MO3DMIT019.

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DECLARATION

This document and the research it describes are my original work and have not been presented in any other university for academic work.

Name: Fredrick Otieno Owino _____

Student signature _____  _____

Date (4/6/2025).

This research was conducted under our supervision and is submitted with our approval as University Supervisors.

Supervisor name (printed): Dr Leonard Wakoli

University supervisor signature  _____

Date (6/6/2025): _____

Supervisor name (printed): _____ Dr. Emily Roche _____

University supervisor signature _____  _____

Date (7/06/2025) _____

Africa Nazarene University

Nairobi, Kenya

Dedication

To my supervisors, Dr. Leonard Wakoli and Dr. Emily A. O. Roche, my father, Mr. Martin Ombok, and my mother, Mrs. Jane Ombok, I am grateful for their key roles in supporting and encouraging me to complete this course. Indeed, much of what I did was always a constant source of motivation and support.

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ABSTRACT

The increasing prevalence of cyber threats and fraudulent activities has heightened the need for robust security measures in the financial sector, particularly in customer onboarding processes. This study investigated the implementation of a blockchain technology framework to enhance the security and efficiency of the customer onboarding process at Equity Bank, one of Kenya's leading financial institutions. The research aimed to assess the impact of decentralized ledger technology, cryptographic security, and consensus mechanisms on the onboarding process. The study is guided by four specific objectives: (1) To evaluate the current problem with Equity Bank's customer onboarding process. (2) To analyze the existing blockchain technology solutions to the customer onboarding process in other institutions. (3) To analyze the existing solutions and processes for customer onboarding and assess the use of blockchain technology at Equity Bank, Kenya. (4) To develop a blockchain framework for customer onboarding, explicitly focusing on Equity Bank Kenya. (5) To test the functionality of the developed framework for consumer onboarding at Equity bank, Kenya. Corresponding research questions were formulated to explore these objectives in detail. A mixed-methods approach was employed, combining qualitative interviews with Equity Bank staff, bank security experts, and customers and quantitative surveys to collect comprehensive data. The Technology Acceptance Model (TAM), Diffusion of Innovations Theory, Information Security Theory, Distributed Ledger Theory, and Operational Efficiency Theory provide the theoretical framework for the study. These theories helped the study understand the dynamics of blockchain technology's adoption, security enhancements, and efficiency improvements. The study's significance lies in its potential to inform Equity Bank's strategy for implementing blockchain technology, contributing to the broader body of knowledge on fintech innovations, and guiding policy development for secure and efficient customer onboarding processes. In conclusion, the research underscores the transformative potential of blockchain technology in securing the customer onboarding process, highlighting its applicability in enhancing data protection, reducing fraud, and improving operational efficiency at Equity Bank. Future research could expand the scope to include comparative studies across different banks and regions, further testing the findings and exploring additional fintech innovations.

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ABBREVIATIONS/ ACRONYMS

TAM Technology acceptance model:

FINTECH- Financial Technology.

RPA: Robotic process automation

EBK: Equity Bank of Kenya.

DOI: Diffusion of Innovation

KYC: Know-your-client.

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CHAPTER ONE

1.1 Introduction

In an increasingly digital world, the need for secure and efficient processes for onboarding customers has become paramount. The customer onboarding process is a critical phase in which new clients are introduced to a company's services or products, and it involves a series of steps designed to verify their identity, gather necessary information, and ensure compliance with regulatory standards. However, this process often faces significant challenges in data security, fraud prevention, and operational efficiency.

One promising solution to these challenges is the implementation of blockchain technology. Blockchain, a decentralized ledger system, offers robust security features, transparency, and immutability, which can potentially address many of the vulnerabilities associated with traditional onboarding systems. The core principles of blockchain technology distributed ledgers, cryptographic security, and consensus mechanisms make it an attractive option for enhancing the security of customer onboarding processes.

This research explored the impact of a blockchain technology framework on securing the customer onboarding process. The independent variable in this study is the "Blockchain Technology Framework," which refers to integrating blockchain technology into the onboarding process, which was aimed at automating and securing the entire process. This framework includes using smart contracts, decentralized identity verification, and cryptographic validation to secure and streamline the onboarding procedure. The dependent variable is the "Security of the Customer Onboarding Process," which encompasses various aspects such as data protection, fraud prevention, and the overall integrity of the onboarding process. Security concerns in this

context include protecting customer data from unauthorized access, ensuring the authenticity of customer information, and maintaining compliance with regulatory requirements.

1.2 Background of the Study

1.2.1 Global View of Blockchain Frameworks in Secure Customer Onboarding.

In the digital age, customer onboarding is crucial to global organizational operations. It involves collecting and verifying personal and financial information, which must be handled securely to prevent identity theft, fraud, and unauthorized access to sensitive data. Traditional onboarding systems often rely on centralized databases and manual verification processes, which can be vulnerable to breaches and inefficiencies (Meyer & Gupta, 2021).

Blockchain technology has emerged as a revolutionary solution for enhancing security and efficiency in various sectors. By leveraging decentralized ledger technology, blockchain offers a tamper-proof system where transactions are recorded securely, transparently, and immutably (Swan, 2020). The blockchain application in customer onboarding can provide several advantages, including enhanced data security, reduced fraud risk, and improved compliance with regulatory standards (Crosman, 2022). Studies have demonstrated that blockchain's cryptographic methods and decentralized verification processes can significantly mitigate risks associated with data breaches and fraud (Tapscott & Tapscott, 2021).

1.2.2 Regional View of Blockchain Frameworks in Secure Customer Onboarding

In Africa, the challenges associated with customer onboarding are compounded by a lack of robust digital infrastructure and high rates of financial exclusion. Many African countries face issues related to data privacy, cybersecurity, and inefficient traditional systems for customer verification (KPMG, 2022). The high prevalence of fraud and identity theft has made secure onboarding a critical concern for financial institutions and service providers across the continent.

Blockchain technology presents a promising solution for addressing these issues. For instance, blockchain's decentralized nature can offer enhanced security for financial transactions and identity verification, which is particularly beneficial in regions with less established data protection frameworks (Munyoro, 2023). Several pilot projects and initiatives in African countries are exploring the potential of blockchain to secure customer onboarding processes and enhance financial inclusion (World Bank, 2021). These initiatives demonstrate a growing interest in leveraging blockchain to overcome challenges and improve operational efficiencies.

1.2.3 Local View of Blockchain Frameworks in Secure Customer Onboarding

In Kenya, the customer onboarding process is a key area of focus due to the rapid digital transformation and growth of the financial sector. With the rise of mobile banking and fintech solutions, there is an increasing demand for secure and efficient methods to onboard new customers (Omondi & Mutiso, 2022). However, the traditional systems in place often face issues related to data security, fraud, and compliance with regulatory requirements.

Blockchain technology has the potential to address these challenges effectively. For example, Kenya's embrace of blockchain in various sectors, including finance and agriculture, indicates a willingness to innovate and adopt advanced technologies for better security and efficiency (Juma & Mwangi, 2023). Kenya's government and private sector are exploring

blockchain applications to enhance security in customer onboarding, streamline processes, and ensure compliance with data protection regulations (Kenyan Ministry of ICT, 2023). Using blockchain for secure customer onboarding could improve trust and transparency and support Kenya's broader digital economy goals. While the global perspective highlights the benefits of blockchain for securing customer onboarding, the African and Kenyan contexts emphasize the relevance of these advancements in addressing local challenges related to data security and operational inefficiencies. Integrating blockchain technology could improve security and efficiency in customer onboarding processes across different regions at Equity Bank.

1.3 Statement of the Problem

The customer onboarding process in the banking sector is a critical yet challenging component of operations. At Equity Bank Kenya, onboarding new customers involves complex, time-consuming, and resource-intensive procedures, including manual Know Your Customer (KYC) checks, document verifications, and compliance with stringent regulatory requirements. These inefficiencies often result in delays, increased operational costs, a suboptimal customer experience, and, more importantly, jeopardize individual account security. Furthermore, the existing onboarding methods are prone to data security vulnerabilities, including identity theft and fraud, compromising customer trust and the bank's reputation.

Despite significant advancements in financial technology, a gap remains in leveraging innovative solutions, such as blockchain, to address these challenges effectively. With its inherent transparency, immutability, and decentralized control, blockchain technology offers a promising avenue for automating and securing customer onboarding. However, existing studies and implementations fail to provide a tailored framework that meets the unique needs of Equity

Bank and aligns with the Kenyan banking ecosystem. This leaves the bank reliant on outdated systems that cannot meet customers' evolving needs and regulatory demands.

Moreover, the Kenyan banking sector faces additional challenges due to its limited technological infrastructure, including serving a diverse customer base encompassing rural and unbanked populations. While blockchain could address these issues, its full potential remains untapped due to the absence of validated frameworks tailored to this context. This creates a significant gap between the theoretical promise of blockchain technology and its practical application in enhancing customer onboarding at Equity Bank.

To address these challenges, a blockchain-based framework tailored to Equity Bank Kenya's specific requirements needs to be developed and validated. This framework must streamline and secure the onboarding process, integrating seamlessly with the bank's existing systems while ensuring compliance with local regulations. By bridging the gap between blockchain's potential and its practical application, this research aims to transform the customer onboarding experience at Equity Bank, setting a precedent for innovation in Kenya's financial sector.

Finally, Equity Bank Kenya, a financial institution, faces numerous challenges in its existing practices and during the onboarding process for new customers. According to a study conducted by Martino in 2019, using manual procedures is a significant obstacle. Many banks continue to employ outdated banking procedures, which can include extensive paperwork, the physical submission of documents, and manual data entry. The enrollment procedure is hindered by labor-intensive, time-consuming, and manual operations, resulting in reduced efficiency and speed.

1.4 General Objective

To develop a blockchain technology framework for the security of the customer onboarding process, focusing on process automation and effectiveness in enhancing data protection, reducing fraud risk, and improving overall process efficiency.

1.4.1 Specific Objectives

- (i) To evaluate the current problems of Equity Bank, Kenya, concerning the customer onboarding process.
- (ii) To examine existing blockchain solutions for customer onboarding in other organizations.
- (iii) To analyze the existing solutions and processes for customer onboarding and assess the use of blockchain technology at Equity Bank, Kenya.
- (iv) To develop a blockchain framework for customer onboarding focusing on Equity Bank, Kenya.
- (v) To test the functionality of the developed framework for consumer onboarding at Equity Bank, Kenya.

1.5 Research Questions

- (i) What are the current problems with the current customer onboarding and security process at Equity Bank, Kenya?
- (ii) What are the existing blockchain solutions for customer onboarding in other organizations?
- (iii) What are the existing solutions to the customer onboarding process at Equity Bank Kenya?
- (iv) What are the key components and design considerations for developing a blockchain framework to improve the customer onboarding process at Equity Bank, Kenya?

- (v) How effective is the proposed blockchain-based technology framework in securing and automating the customer onboarding process at Equity Bank, Kenya?

1.6 Significance of the Study

The significance of this study lies in its potential to offer valuable insights into the application of blockchain technology in enhancing the security and efficiency of the customer onboarding process. The study is significant for several reasons: The research thoroughly evaluated how blockchain technology can strengthen data protection during customer onboarding. With increasing concerns about global data breaches and privacy violations, this study will contribute to understanding how blockchain's cryptographic features and decentralized ledger system can address these security issues. This knowledge is crucial for organizations seeking to safeguard sensitive customer information and comply with data protection regulations.

By examining the impact of blockchain technology on reducing fraud and identity theft, the study will offer insights into how blockchain's verification and validation mechanisms can enhance the integrity of the onboarding process. This is particularly important in regions with high financial fraud and identity theft rates. The findings could help financial institutions and service providers implement more secure systems, thereby reducing the incidence of fraud and increasing customer trust.

The study assessed how implementing blockchain technology affects the overall efficiency of the customer onboarding process. This includes evaluating improvements in processing times and cost reductions. Optimizing the onboarding process for businesses, particularly those in the financial sector, can lead to significant operational benefits, including cost savings and better customer experiences. The insights gained could support organizations in

making informed decisions about adopting blockchain solutions to enhance their operational efficiency.

This research contributed to knowledge of blockchain technology and its applications across various sectors. By focusing on the customer onboarding process, the study will contribute to the academic literature on blockchain's practical benefits and limitations, especially in the banking sector. This can provide a foundation for future research and innovation, guiding subsequent studies and technological advancements.

The findings of this study will have implications for policymakers and industry practitioners. Understanding how blockchain technology can enhance security and efficiency in customer onboarding may inform the development of regulatory frameworks and industry standards. Policymakers can use the insights to develop guidelines that promote the secure and effective adoption of blockchain technology, while practitioners can leverage the findings to implement best practices in their onboarding processes

1.7 Scope of the Study

The study area encompasses assessing and optimizing the key customer onboarding process at Equity Bank Kenya, utilizing blockchain technology. As previously discussed, it examines the current challenges associated with the onboarding process, including inefficiencies, security risks, and the reliance on manual onboarding processes. The study identifies areas of a blockchain application that can enhance operations, including KYC checks, data integrity, and customer experience. Additionally, it explores the potential of utilizing blockchain for storing, sharing, and ensuring the trustworthiness of customer data. It examines the feasibility of implementing smart contracts to reduce compliance verification and overhead costs. It also presents results on compliance with regulatory and security requirements, particularly

concerning the Kenyan data protection legislation and the Central Bank of Kenya (CBK) regulations. Lastly, the study aims to propose potential solutions for implementing blockchain in Equity Banks and to determine the percentage improvement in cost savings, efficiency, and customer satisfaction.

Equity Bank is an ideal choice for this study due to its leading position in Kenya's banking sector, its emphasis on digital transformation, and its large customer base. Serving over 18 million customers across Kenya and East Africa as of 2023, Equity Bank's extensive and diverse clientele provides an excellent foundation for testing scalable and robust blockchain solutions. The bank is well-known for its commitment to innovation in digital banking, offering mobile and online banking services that align with the adoption of blockchain technology. Despite its advancements, Equity Bank faces challenges in ensuring efficient and secure customer onboarding processes while maintaining compliance with anti-money laundering (AML) and KYC regulations. Blockchain technology can address these issues by streamlining workflows and automating processes prone to human error.

Equity Bank's commitment to regulatory compliance further strengthens its suitability for this study. Kenya's Data Protection Act of 2019 emphasizes data security and transparency, which align with the inherent strengths of blockchain. Equity Bank's compliance leadership makes it a strong candidate for piloting blockchain-based solutions. Additionally, as one of Kenya's most influential financial institutions, improvements in Equity Bank's onboarding process could set industry standards and encourage adoption across the sector. From an economic perspective, blockchain solutions have been shown to reduce operational costs by up to 30% for financial institutions, according to Deloitte. Such cost savings and improved return on investment could be significant for a bank of Equity's scale. In conclusion, the study's focus on

Equity Bank allows the creation of a secure, efficient, and scalable customer onboarding framework. It addresses existing challenges and reinforces the bank's reputation as a leader in innovation, setting a precedent for other financial institutions in Kenya and beyond.

1.9 Limitations

Stakeholder Perspectives:

The perspectives gathered from Equity Bank staff with a focus on customer's representatives, and IT professionals may be subjective and may not fully represent the views of all relevant stakeholders. The information provided by the equity bank professional may not be adequate for the application of other banks and, to some extent, may be outdated or too advanced to be applied to other banks.

1.10 Assumptions

The study assumed that blockchain technology can be effectively integrated within Equity Bank's existing infrastructure and will have a measurable impact on the customer onboarding process and the security of customer accounts. It is assumed that Equity Bank staff, customer representatives, and other stakeholders will provide honest and accurate feedback regarding their experiences with the onboarding process and the potential benefits of blockchain technology.

The study assumed that regulatory requirements related to data protection and financial transactions would remain consistent throughout the research period and that these regulations would align with implementing blockchain technology. Finally, it is assumed that the blockchain technology framework considered in the study will remain stable and will not undergo significant changes during the research period that could affect the outcomes.

1.11 Theoretical framework

1.11.1 Technology Acceptance Model (TAM):

The Technology Acceptance Model (TAM) guided the study, providing a framework for understanding how users accept and utilize new technologies. This model suggests that perceived ease of use and usefulness influence technology adoption (Davis, 2021). In the context of blockchain technology at Equity Bank, TAM helped analyze how the bank's staff and customers perceive the benefits and challenges of adopting blockchain for onboarding. TAM is crucial for evaluating how Equity Bank's employees and customers perceive blockchain technology. It focuses on perceived ease of use and usefulness, which can help assess whether the respondents find blockchain technology straightforward and beneficial for customer onboarding. By applying TAM, the study can predict the likelihood of successful implementation of blockchain technology based on respondents' attitudes. This helps in understanding barriers to adoption and designing strategies to enhance acceptance. TAM guided the assessment of how different stakeholders at Equity Bank perceive the technology. For instance, if employees find blockchain technology complex or not beneficial, it could impact its integration and effectiveness.

1.11.2 Information Security Theory:

Information Security Theory, which focuses on protecting information systems from unauthorized access and ensuring data integrity and confidentiality, will provide a basis for evaluating how blockchain technology enhances data protection during customer onboarding (Bertino & Sandhu, 2021). This theory helped assess the effectiveness of blockchain's cryptographic and decentralized features in securing customer data. This theory is fundamental for analyzing how blockchain's features, such as cryptographic security and decentralized ledgers, enhance the protection of customer data during the onboarding process. Addressing

Security Challenges: It provides a framework for understanding how blockchain addresses common security issues such as unauthorized access, data breaches, and fraud, making it relevant for evaluating the effectiveness of blockchain in improving data security. The study will use information security theory to measure the improvements in data protection resulting from blockchain implementation, which will help to evaluate whether blockchain's security features meet the needs of Equity Bank's customer onboarding process.

1.11.3 Distributed Ledger Theory:

The concept of distributed ledgers refers to the protocols and technical framework that enable multiple users to simultaneously access, validate, and update records in a networked database. Distributed ledger technology (DLT) is the foundational technology for blockchains, minimizing the need for audits, ensuring data reliability, and granting access to only those who require it while also allowing users to view who made changes and when. The theory is correct because it permits encryption for safe and accurate data storage. Encryption "keys" and digital signatures provide access to the data. The database becomes immutable after storing the data; the ledger is governed by the network rules encoded in the database's programming code. Distributed ledgers are more secure than centralized ones due to their encryption and decentralization, and an attack on one copy cannot succeed unless all copies throughout the network are compromised simultaneously. Further streamlining, improving, and decreasing the overall cost is the peer-to-peer sharing and updating of records. A distributed ledger network maintains a duplicate ledger on each node.

A network can consist of an unlimited number of these devices, which are known as nodes. It is the practice for all nodes to log any modifications made to the ledger, including data transfer between blocks. Because every node stores a copy of the ledger, the most up-to-date

version is continuously updated and publicized. After the network agrees on the legitimacy of the most recent ledger, the transactions are sealed, encrypted, and used as a foundation for subsequent transactions. Blockchains work because each includes encrypted information about the block before it, making them immutable. The ability to create a distributed, unchangeable ledger of transactions is a key feature of this fundamental blockchain notion. It can provide a transparent and secure method for storing and testing consumer information among various stakeholders during the onboarding process.

1.12 Conceptual Framework

A conceptual framework is a visual or written representation illustrating a study's key concepts, variables, and relationships. It serves as a guide for the research process, helping to clarify the research questions, objectives, and hypotheses. In this study, the conceptual framework outlines the key components of blockchain technology, decentralized ledger technology, cryptographic security, smart contracts, and consensus mechanisms, as well as their impact on the security and efficiency of the customer onboarding process at Equity Bank. By mapping out these elements, the conceptual framework provides a structured approach to understanding how each aspect of blockchain technology contributes to enhancing data protection and operational performance. It also helps identify the relationships between independent variables (blockchain technology constructs) and the dependent variable (customer security during onboarding), thus facilitating a more focused and coherent investigation (Miles & Huberman, 1994; Maxwell, 2013).

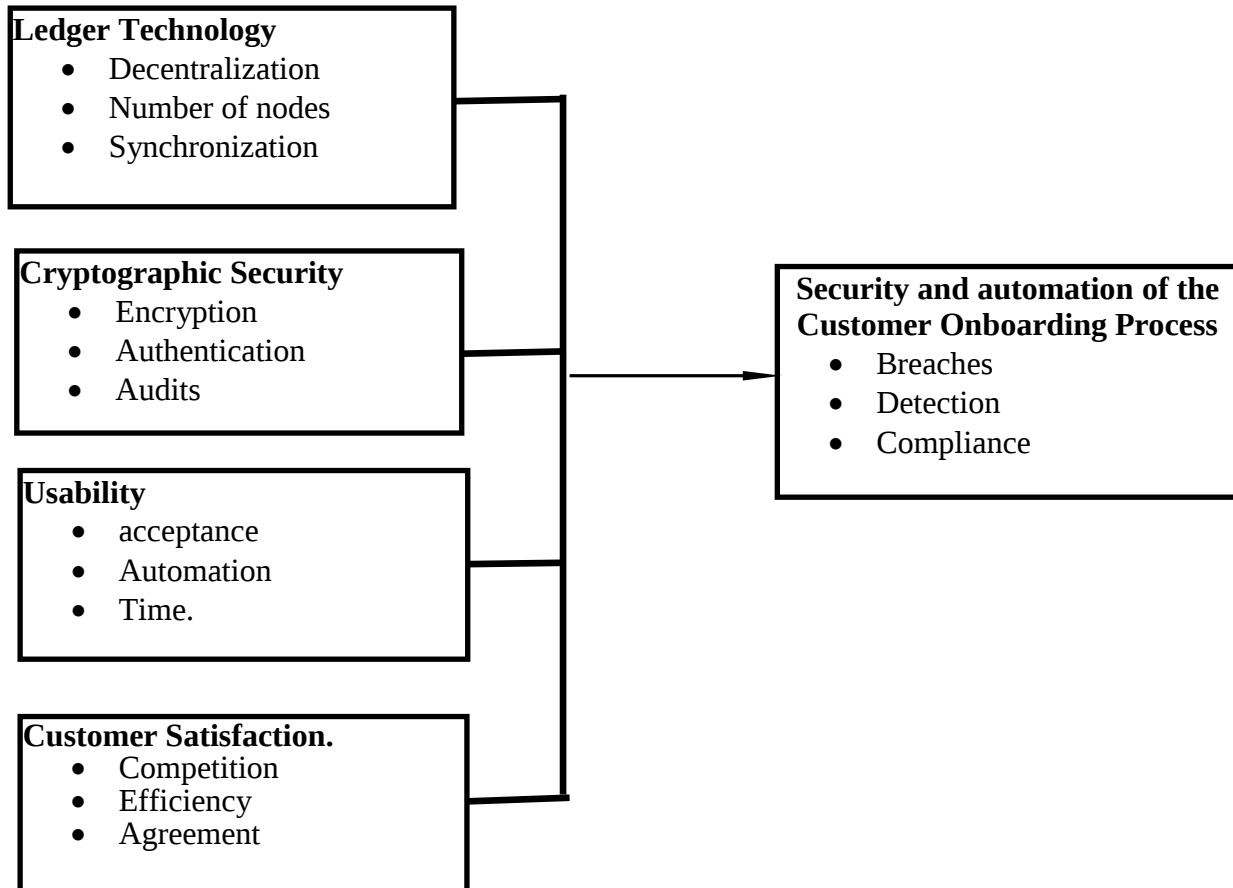
Blockchain Technology Framework**Security and Automation of the Customer****Onboarding Process****Independent Variable****Dependent Variable**

Figure 1.1: Conceptual framework.

How the variables influenced the study

In this study, the independent variable, the blockchain technology framework, significantly influenced the design and direction of the research by shaping how the customer onboarding process could be transformed through technology. The use of blockchain introduced core components such as smart contracts, data encryption, decentralized identity verification, and immutable records, which were central to evaluating the security and automation potential within Equity Bank. By focusing on blockchain as the independent variable, the study aimed to assess how this technological intervention could address existing challenges in the onboarding process, such as data breaches, delays, manual verification, and regulatory compliance inefficiencies.

The dependent variable, the customer onboarding process, was directly affected by the implementation and features of the blockchain framework. The study found that as the blockchain system was integrated into the onboarding workflow, there were measurable improvements in data security, faster processing times, reduced human error, and enhanced customer trust. These outcomes highlighted a positive correlation between the adoption of blockchain and the performance of the onboarding system. Overall, the interaction between these variables allowed the research to evaluate both the feasibility and the practical benefits of adopting blockchain technology in banking operations, using Equity Bank as a case study.

CHAPTER TWO

A LITERATURE REVIEW

2.1 Introduction

In the digital age, customer onboarding processes have evolved, yet they still pose significant challenges for financial institutions, particularly regarding security, efficiency, and compliance. Traditionally, banks and financial service providers have relied on manual verification processes, centralized databases, and physical documentation to onboard customers. However, these methods have increasingly been exposed to risks, including data breaches, identity theft, fraud, and inefficiencies. Blockchain technology has emerged as a transformative solution to these challenges, offering a decentralized, transparent, and secure method for managing customer onboarding data.

This chapter provides a comprehensive review of the existing literature on blockchain technology and its potential role in enhancing the customer onboarding process in financial institutions. The review focuses on the following key areas: the security challenges in the traditional customer onboarding process, the application of blockchain technology in addressing these challenges, global and regional perspectives on blockchain adoption, and the specific implications for Kenya's financial sector. The chapter also identifies gaps in the existing research, emphasizing the need for further investigation into the implementation of blockchain frameworks in the Kenyan banking industry.

2.2 Understanding Blockchain technology and its application.

The blockchain has recently garnered significant attention. Blockchain is a distributed ledger technology that enables the transparent and secure recording of digital transactions. The blockchain, a decentralized ledger system, is independently maintained by each network node (Yli-Huumo et al., 2016). Belotti et al. (2019) conducted research highlighting the significance of decentralization in blockchain technology. This research indicated that Blockchain technology operates on a decentralized network of individual nodes, unlike traditional centralized systems. A central authority is responsible for confirming and verifying transactions in classic centralized systems. These systems encompass both governmental and corporate entities. However, according to Belotti et al. (2019), blockchain depends on peer-to-peer networks. Due to the decentralized nature of the blockchain network, it is impervious to attempts to modify or limit its data, as no central authority governs it. The ledger remains intact due to the network's consensus on testing transactions. This literature contributes to the study by explaining the meaning and utility of blockchain technology within the banking system.

According to Zheng et al. (2018), an additional crucial factor to examine is the influence of blockchain technology on user anonymity, which is critical to the banking system. Cryptographic techniques enabled the creation of blockchains by securely connecting each transaction to the preceding one. Due to the cryptographic link, it is now highly challenging, if not impossible, to clandestinely modify or influence previous transactions. Zheng et al. (2018) highlight that the decentralized nature and dependence on a consensus mechanism of the blockchain network offer additional security against intrusions and attacks.

Customer Onboarding in Financial Institutions

Customer onboarding refers to the process by which financial institutions gather, verify, and approve the necessary information to enroll new clients. According to Patil and Sharma (2021), onboarding is critical for regulatory compliance and ensuring the safety and security of financial transactions. However, the traditional methods used for customer onboarding are often inefficient and prone to security vulnerabilities. Manual verification processes, extensive paperwork, and centralized databases create opportunities for fraud, data breaches, and delays in service delivery (Martino, 2019). These inefficiencies are further exacerbated in developing countries, where digital infrastructure is often underdeveloped.

A significant challenge in the onboarding process is collecting and verifying customer data. Financial institutions typically must coordinate with multiple departments and external databases, such as identity systems, credit bureaus, and regulatory bodies. Patki and Sople (2020) note that this process can be time-consuming, labor-intensive, and prone to human error, leading to delays and compromised data security. As mobile banking and fintech services continue to expand, particularly in developing economies like Kenya, the demand for faster, more secure, and more efficient onboarding processes has intensified.

Globally, the financial sector has grappled with many cyber threats, including data breaches, identity theft, and fraud. The Ponemon Institute (2023) reports that the average cost of a data breach globally was \$4.45 million in 2022, reflecting the severe financial consequences of compromised security. The Identity Theft Resource Center (2023) documented over 1,800 data breaches in the United States alone, exposing more than 22 billion records. These breaches highlight the vulnerabilities in traditional customer onboarding processes, which rely on centralized databases susceptible to hacking and unauthorized access.

In Africa, the challenges are even more pronounced due to less advanced digital infrastructures and higher rates of financial exclusion. A report by the African Union (2023) revealed that over 60% of banks across the continent lack comprehensive data protection laws, increasing their susceptibility to cyber threats. In Kenya, the Central Bank of Kenya (2023) has reported a 15% increase in fraud and identity theft cases in the financial sector, underscoring the need to enhance customer data security. The rapid growth of mobile banking, which resulted in over 1.2 billion transactions in 2022, has further highlighted the limitations of traditional onboarding methods in protecting customer data (Central Bank of Kenya, 2023).

Blockchain technology is increasingly recognized as a viable solution to the challenges posed by traditional customer onboarding processes. Blockchain's decentralized ledger system offers a secure, transparent, and tamper-proof method for storing and verifying customer data. By eliminating the need for intermediaries and reducing the reliance on centralized databases, blockchain enhances data security and minimizes the risk of fraud (Natarajan et al., 2022). This is particularly crucial in financial institutions, where the integrity and confidentiality of customer data are paramount.

Patil and Sharma (2021) suggest that blockchain technology can streamline onboarding by enabling real-time customer information verification. Through smart contracts, customer data can be securely verified and shared across multiple departments and regulatory bodies without manual intervention. This reduces the time and costs associated with onboarding, ensuring the data is accurate and secure. Blockchain also enables financial institutions to comply with Know Your Customer (KYC) and Anti-Money Laundering (AML) regulations by providing a transparent and auditable record of all transactions (Ramachandran et al., 2020).

In Kenya, where mobile banking and fintech services are rapidly expanding, blockchain technology offers a promising solution for enhancing customer onboarding. Equity Bank Kenya, for example, has identified blockchain as a potential tool for enhancing the efficiency and security of its onboarding procedures (Martino, 2019). By adopting blockchain, the bank aims to reduce fraud, improve data protection, and accelerate onboarding, ultimately improving customer satisfaction.

Globally, financial institutions are increasingly adopting blockchain technology to improve customer onboarding processes. In India, Patki and Sople (2020) report that several banks have successfully implemented blockchain solutions to streamline data collection and verification, resulting in faster onboarding times and reduced fraud risks. Blockchain's ability to provide a decentralized and immutable record of customer data has proven particularly effective in preventing identity theft and ensuring the accuracy of customer information. In Africa, the adoption of blockchain technology is still in its early stages, but its potential to address issues of financial exclusion and data security is significant. The World Bank (2022) estimates that financial fraud and identity theft cost the African banking sector approximately \$1.2 billion annually, highlighting the critical need for secure onboarding solutions. Blockchain's ability to provide a secure, decentralized platform for managing customer data can help mitigate these risks while improving access to financial services for underserved populations (African Union, 2023).

Kenya's financial sector has experienced rapid growth, particularly in mobile banking and fintech services. However, this growth has also exposed the sector to significant security challenges. The Kenyan Financial Sector Deepening (FSD) report (2023) notes that 40% of financial institutions in Kenya face challenges related to data security and customer verification

during the onboarding process. Blockchain technology has been identified as a potential solution to these challenges by providing a secure, decentralized method for managing customer data. Equity Bank Kenya is among the financial institutions exploring blockchain technology to improve its customer onboarding process. According to Martino (2019), Equity Bank aims to use blockchain to reduce fraud, improve data protection, and enhance the overall efficiency of its onboarding procedures. Blockchain's ability to securely store and verify customer data without intermediaries can help banks overcome the inefficiencies and security vulnerabilities associated with traditional onboarding methods.

Despite its potential, implementing blockchain technology in customer onboarding is not without challenges. Natarajan et al. (2022) highlight the lack of regulatory frameworks and standardization as major barriers to blockchain adoption in the financial sector. Additionally, the high costs associated with implementing blockchain solutions can be prohibitive for smaller financial institutions (Ramachandran et al., 2020). These challenges are particularly pronounced in Kenya, where the digital infrastructure is still developing. However, as more financial institutions explore blockchain technology, there is potential for overcoming these barriers. The development of clear regulatory frameworks and the increasing availability of blockchain solutions tailored to the needs of financial institutions in developing economies could facilitate broader adoption in the coming years (Patil & Sharma, 2021).

2.2.1 Evaluating current Onboarding Challenges at Equity Bank

In economically disadvantaged countries such as Kenya, where blockchain technology is still limited, there is a growing inclination to leverage this technology to foster innovation and address socioeconomic challenges. The use of blockchain technology in Kenya is currently in its nascent stage; however, recent advancements suggest that the country's banking sector is on the

verge of embracing it. Kenya's government has shown a keen interest in exploring the potential and applications of blockchain technology through its various programs and projects. Currently, no legal structure is in place to regulate blockchain technology. Nevertheless, the administration has explicitly expressed its openness to embracing the digital revolution brought about by new technologies. The Kenya Innovation Hub has established the Blockchain Challenge as part of its efforts to promote innovation and collaboration in the blockchain sector (IASP, 2019). Kenyan banks and fintech startups are exploring the possible applications of blockchain technology. Equity Bank Kenya distinguishes itself among Kenya's major financial institutions due to its notable interest in blockchain technology and its active efforts to explore its practical uses. Several local fintech startups are now developing blockchain-based solutions for various financial services, such as payment processing, identity management, and money transfers.

Mosweu et al. (2021) assert that most blockchain applications in Kenya's banking industry are focused on managing digital identities, facilitating international payments, processing remittances, and supporting trade financing. The rationale for this is that with blockchain technology, Kenyan banks get enhanced transparency, efficiency, and security. Blockchain technology can enhance the traceability of transactions, expedite their processing, and reduce the associated costs in international payments. Blockchain-based digital identification systems can offer safe and decentralized identity verification, minimizing fraud and enhancing trust.

Blockchain-based solutions might be advantageous for underserved and unbanked groups as they enable their integration into the current financial system, as emphasized by Alam et al. (2021). This has the capacity to enhance economic growth, foster entrepreneurship, and reduce poverty rates. To successfully adopt blockchain technology, it is crucial to possess expertise and

understanding in this domain. Seminars, educational efforts, and corporate partnerships can enhance the utilization of blockchain technology in Kenya. Collaboration among government agencies, enterprises, and academic institutions can facilitate the advancement of blockchain research and development, as well as streamline the recruitment of highly skilled workers. Mosweu et al. (2021) argue that Kenya faces several regulatory obstacles that hinder the complete adoption of blockchain technology despite its potential advantages. Businesses and investors are perplexed due to the absence of a definitive legal framework governing blockchain technology and cryptocurrencies. The Bank of Kenya and other regulatory agencies are closely monitoring the progress of blockchain technology as they evaluate its advantages and disadvantages.

To overcome the regulatory constraints they face, the financial institutions in Kenya must adopt a proactive approach. Engaging in dialogue with authorities, participating in industry forums, and fostering collaboration with technology suppliers are all methods to create an environment that encourages the implementation of blockchain technology, addresses regulatory issues, and establishes compliance frameworks. Regulatory organizations and financial businesses must maintain ongoing interaction to adapt to the dynamic blockchain technological landscape, safeguard consumers, and ensure the financial system's stability.

When it comes to onboarding, banks in developing countries such as Kenya have numerous considerations. The Anti-Money Laundering (AML) law of Africa is an instance of a set of regulations created to deter financial offenses such as fraud and the illegal concealment of illicit funds. As part of the onboarding process, banks in a developing country must authenticate every customer's integrity and reliability. When it comes to creating a bank account, businesses consistently follow the same steps every

time. In 2018, organizations expressed the highest level of apprehension around the General Data Protection Regulation (GDPR). In order to comply with GDPR requirements, it is imperative that no data that could potentially identify an individual, directly or indirectly, is stored on the blockchain.

Buitenhek (2016) states that to enable network sharing, a secure connection must be established. This method will ensure the protection of your client's "right to be forgotten." Customers have the option to exclude themselves from the external database and, consequently, the blockchain if they do not want to disclose their data. Schuetz et al. (2020) argue that integrating additional services and technologies, such as a fraud management module, can improve the functionality of the blockchain network. Thus, the network that first holds data on companies' onboarding processes will ultimately transform into a database that stores information on organizations' identities. Furthermore, it envisions the capability to communicate this information to other enterprises directly. This corporate identity will enable organizations to collaborate with unprecedented speed and complete transparency. Blockchain technology enables organizations to optimize efficiency and reduce costs by facilitating the publication of data in a single instance. The users have complete control over their data and have the authority to determine with whom they wish to share it.

The revolutionary potential of blockchain technology to disrupt established financial processes has generated significant interest, particularly within the banking industry. Shah et al. (2018) conducted a study that found that one of the main advantages of blockchain technology in the banking sector is its ability to improve efficiency by facilitating faster and more effective payments and transactions. Blockchain technology eliminates intermediaries, reducing transactions and operations costs for consumers and enterprises (Shah et al. 2018).

2.2.2 Analysis of Onboarding Solutions and Blockchain Use at Equity Bank

Onboarding at equity involves integrating new users into the bank's system and verifying their legitimacy to prevent financial fraud. This involves the collection of personal data (such as name, address, and age), together with procedures for verifying identity and adhering to KYC (know your customer) requirements, all done to ensure compliance with regulations.

During the onboarding process, users are provided with information and instructions to facilitate communication with the bank in the event of any inquiries regarding their accounts. This entails providing users with access to a self-service repository of information, employing product tours as a means of instruction, and receiving payments via credit or debit cards. Although this technique seems to be of high quality, it still relies significantly on human involvement and lacks strong security safeguards. Furthermore, a comprehensive and seamless onboarding procedure ensures adherence to all regulatory verifications and security protocols for customer accounts while reducing the time it takes to achieve value and enhance customer satisfaction. Several difficulties are now affecting the procedure in Kenyan banking institutions, which include:

Disorganization

According to the Deloitte report 2023, almost 38% of clients discontinue their relationship during the onboarding period. The bank's services are hindered by a slow and disorganized process that lacks clear security safeguards, undermining customer confidence. A significant challenge in achieving a smooth onboarding and security process is the lengthy duration required for customers to complete each stage. Customers may experience frustration with this process when they are consistently requested to supply the same information to several entities. The Deloitte analysis predicts that customers are likely to churn if they are dissatisfied

with the onboarding process. Utilizing blockchain technology to oversee the process is essential due to the consolidation of data in a central area, which simplifies the adoption of security measures.

Challenges pertaining to the validation and quality of data

The bank faces the second significant difficulty of data quality and verification in its onboarding process. According to Yadav et al. (2019), banks must adhere to many laws and regulations, including the Know Your Customer (KYC) guidelines. Although these rules have noble objectives in addressing money laundering and fraud, they may introduce additional intricacy and prolong the onboarding process, which can, therefore, affect the client experience. Moreover, digital customer onboarding emphasizes the importance of accurate and reliable data.

Verification of Compliance and Know Your Customer (KYC) process:

Compliance and KYC checks are essential for verifying consumer authenticity and ensuring adherence to regulatory requirements. Gathering Documentation: To verify the client's identity, it is necessary to collect and authenticate key identification documents, such as passports, driver's licenses, or government-issued IDs. AML Screening: To effectively detect and prevent money laundering, it is imperative to conduct comprehensive anti-money laundering (AML) inspections. In order to stay abreast of the constantly evolving demands, it is imperative that you continually revise and update your AML policies and procedures.

Customer Consent and Participation:

Respecting clients' choices and legal obligations is of utmost importance, as it requires explicit approval and management of opt-ins. Legal documents: Provide your clients with uncomplicated authorization documents that clearly outline the details of data exchange and utilization. Provide

customers with the choice to receive specific communications or services by selecting a checkbox. Offer precise management of consumer preferences at a detailed level.

Client profiling: Equity Bank has a strategy of inquiring about clients' banking history, personal preferences, and financial ambitions to accomplish this. Utilize this information to categorize customers into several groups based on their specific needs and levels of risk. Offer personalized product recommendations to customers based on an analysis of their profile information. For risk-averse individuals nearing retirement, offering retirement planning services or low-risk investment options is advisable. Regardless of whether the connection is conducted online or in person, it is essential to consistently address the client by their name to provide a personalized experience. Establish effective communication with each individual by customizing your welcome message and advice to cater to their unique requirements.

Before opening an account, clients must know your bank's banking services and products. Individuals need to ascertain the reliability of their bank in safeguarding their funds. The degree of customer motivation to engage in onboarding is closely correlated with the effectiveness of the onboarding process execution. During this stage, clients must provide basic demographic information, including their name, address, and identification. The bank can utilize this data to substantiate its authenticity and fulfill all regulatory requirements.

Implementing a streamlined onboarding process for your customers is currently the opportune moment. Install automated teller machines (ATMs) at the designated site. Customers can independently access and complete many onboarding stages without the assistance of bank personnel by utilizing kiosks for repetitive tasks. Customers may have extended waiting times if they rely on a bank employee to address their inquiries or do menial tasks. Kiosks offer the convenience of modern document scanners and biometric authentication technology.

Verifying the customer's details is the last step in officially opening a bank account. Customers can choose from various accounts, such as savings, checking, and credit card accounts, to fulfill their individual financial needs. To authenticate your identification, the bank requires specific documentation. Forms such as knowledge-based authentication, real-time government ID verification, or in-person verification can all be included within this category.

Customers must thoroughly review the terms and conditions to understand the account's operation and any associated fees or charges.

A customer of excellent reputation and high regard has been successfully registered with the bank! For banks to establish a durable bond with their new customers, they must excel during this particular period. Banks create a welcoming atmosphere for their clients by offering friendly greetings and providing a clear description of the services they provide. This can manifest as a customized salutation, a clarification of the things, or a presentation of the accessible digital resources.

Disseminate brochures and instructional videos or facilitate a guided visit to digital platforms and mobile banking applications to help clients develop a sense of ease in using them. Ensure that your customers know the importance of using robust passwords and implementing multi-factor authentication as integral components of their security protocols. Ensure that you provide your clients with comprehensive information regarding the various support channels available and the methods by which they can seek assistance. Establish a foundation for ongoing contact between the consumer and the bank. Banks facilitate upselling and the introduction of additional products or services to clients.

During the onboarding process, banks must prioritize establishing trust with consumers. Being candid and unambiguous about the account opening process and its associated terms and

conditions can help achieve this goal. Consumers are irritated when they encounter unforeseen charges. Customer satisfaction increases when their inquiries or issues are promptly addressed. Banks can establish trust, a crucial element for enduring partnerships, by demonstrating their dependability, security, and unwavering dedication to client contentment.

Customers particularly appreciate the inclusion of a personalized element in the onboarding process. Banks can achieve this by appointing dedicated staff to manage client relationships or customer service. By adopting this approach, banks can enhance their ability to fulfill their clients' needs and provide comprehensive support. Proactive communication and individualized interactions ensure that customers feel appreciated and understood. Customers will experience an enhanced sense of value and loyalty, increasing the probability of their future patronage of your bank.

Customers want proactive assistance and guidance to understand the available services, primarily due to the complex nature of bank onboarding. Part of this is providing clients with information regarding the bank's online services. Assist clients in navigating the login process for their accounts, familiarizing themselves with the online banking system, and optimizing its functionalities. Customers can acquire proficiency in financial services independently by utilizing educational materials, tutorials, and frequently asked questions. During the onboarding process, you may encounter several challenges, including implementing security measures, preventing fraud, and acquiring realistic financial management practices. Banks streamline the process of bringing new clients on board and empower them by offering prompt and pertinent assistance.

Collecting customer feedback at various stages of the onboarding process was crucial. Doing this helps the bank improve its overall experience by identifying areas for improvement.

Banks should facilitate the process for clients to express their ideas and concerns, whether it be through surveys or customer service hotlines. Demonstrating a commitment to customer satisfaction involves consistently enhancing the onboarding process by attending to client feedback and promptly implementing necessary adjustments.

Financial institutions prioritizing onboarding ensure the process is streamlined and enjoyable for new clients. Banks provide their customers with value and assistance by promptly addressing their inquiries, guiding them through necessary procedures, and offering immediate help. As a result of this enhanced experience, customers are more likely to experience satisfaction and establish lasting relationships. The banks must establish effective onboarding processes to engage consumers and foster relationships actively. Banks may enhance client engagement by establishing personal connections, understanding consumer preferences, and providing customized recommendations. Consequently, clients are more inclined to experience satisfaction with the service they receive and exhibit long-term loyalty towards the bank.

Efficient onboarding operations save processing time, paperwork, and physical labor by implementing automation, digital technology, and established procedures. Enhancing operational efficiency is achieved by allowing personnel to focus on higher-level projects. Although a significant effort may be involved in investing in automation technology and developing digital onboarding routines, the long-term benefits make it worthwhile. To enhance overall efficiency, it is imperative to eliminate processing delays, redundant data entry, and human error.

To assess the current state and potential reach of blockchain technology at equity banks, it is essential to evaluate its level of maturity. Recently, Studies have examined the extent to which several businesses, including banking, have used blockchain technology. Several studies, such as the one conducted by Wang et al. (2016), aim to assess the level of preparedness of

blockchain technology in terms of its alignment with the market, companies, and general technological landscape, as well as its overall level of maturity. Their primary concerns are security, interoperability, scalability, and compliance with legislation.

An effective method for evaluating the present condition of blockchain technology is to examine maturity models. Van et al. (2018) argue that these models offer a structure for analyzing various characteristics associated with maturity that can be quantified and for describing the current level of adoption. Development can typically be divided into six phases: embryonic, emergent, developing, established, and mature. Voort et al. (2018) have identified many maturity models that are highly effective in the context of blockchain technology. These models assess the maturity, governance, ecosystem expansion, and commercial models of blockchain technology. They offer a thorough assessment by dissecting the development of blockchain technology into different elements and elucidating their discoveries.

Challenges faced by banks in the onboarding and security process

Equity Bank Kenya, a financial institution, has numerous existing challenges when it comes to onboarding new customers. According to a study conducted by Martino in 2019, the utilization of manual procedures is a significant obstacle. Many banks continue to employ outdated banking procedures, sometimes including extensive paperwork, physical submission of papers, and manual data entry. The enrollment procedure is hindered by labor-intensive, time-consuming, and manual operations, resulting in reduced efficiency and speed.

Patki et al. (2020) found that collecting client data is a significant obstacle in the onboarding procedures of the Indian banking industry. During the onboarding process, it is necessary to collect customers' personal information as well as data from other databases such as identity systems and credit bureaus. According to Patki & Sople (2020), gathering information

may include coordination and verification, which can be difficult and time-consuming. The process requires the participation of multiple bank departments, which may result in delays and complicate the task of ensuring the accuracy and completeness of customer information.

Kawamura (2022) contends that an additional obstacle lies in rigorously conforming to standards when onboarding new clients. Banks must adhere to stringent regulations on client identification in areas such as anti-money laundering (AML) and know-your-customer (KYC). To meet these legal requirements, it is crucial to conduct comprehensive screening procedures and diligently verify the identity of individuals. Kawamura (2022) contends that registration processes often exceed anticipated durations due to the substantial time and effort banks allocate toward fulfilling compliance requirements. Ensuring data security and privacy is imperative during the onboarding process and adhering to standards. Financial institutions must safeguard and oversee confidential customer information, financial documentation, and identification records. Kawamura (2022) highlights that ensuring data security and privacy is crucial in order to protect customer data from unauthorized access, data breaches, and identity theft. Research conducted by Patki & Sople (2020) and Alam et al. (2021) demonstrates that banks encounter ongoing demands and obstacles in implementing stringent security protocols and adhering to data privacy laws.

Customer experience is a crucial component of the registration process. According to Patki et al. (2020), the onboarding process might result in a negative customer experience due to lengthy procedures, the need to provide many papers, and repetitive information requests. In addition, customers may grow restless and abandon the registration procedure if they are subjected to excessive waiting periods caused by delays. This underscores the significance of offering a smooth and expeditious onboarding procedure. One additional obstacle that banks

encounter throughout the onboarding process is the need to coordinate effectively among the various divisions inside the bank (Kołodziej, 2021). The presence of several teams, such as those responsible for operations, compliance, risk management, and customer support, needs efficient coordination and clear communication. Inconsistency across these divisions can lead to inefficiencies, operational delays, and a fragmented client onboarding experience. According to Shah & Jani (2018), optimizing processes and ensuring effective collaboration among all stakeholders is necessary to provide a smooth onboarding experience.

According to Alam et al. (2021), banks with a large influx of new clients throughout the onboarding process also encounter difficulties scaling their operations. According to Alam et al. (2021), a high volume of onboarding requests might pose challenges for traditional manual operations, leading to backlogs and delays. Equity Bank Kenya must solve these issues and modify their current customer enrollment procedures to enhance efficiency and provide excellent customer service. Blockchain, a contemporary technology, may automate procedures, enhance data security and compliance controls, and simplify information collecting and verification. These capabilities can effectively address the problems mentioned above. Various instances and empirical analyses examine the integration of blockchain technology into consumer registration protocols. The examples offered illustrate the potential of blockchain technology to change and enhance the customer onboarding process for banks and other firms.

2.2.3 Examining Blockchain Onboarding Solutions in Other Organizations.

HSBC has integrated blockchain technology into its KYC processes to enhance the security and efficiency of cross-border transactions. The implementation enables financial institutions to share verified customer data securely, reducing redundancy and processing time. HSBC's blockchain-based approach significantly reduces fraud and ensures compliance with regulatory requirements by providing a transparent and immutable ledger. Despite these benefits, HSBC faces challenges in fully adopting blockchain for customer onboarding. One major issue is interoperability with other banking institutions, as different banks use varying blockchain frameworks. Additionally, HSBC must comply with diverse regulatory environments across different countries, which complicates the seamless exchange of KYC data. The study on HSBC's blockchain adoption suggests that while the technology improves efficiency and security, its effectiveness is limited by the absence of industry-wide standards. The lack of a universal blockchain protocol for financial institutions remains a key challenge (HSBC, n.d.).

JPMorgan Chase has developed Quorum, a blockchain-powered platform to improve financial operations, including customer onboarding. The solution lets customer's complete KYC verification once and use the same credentials across multiple financial services, reducing onboarding time and operational costs. However, Quorum's reliance on a permissioned blockchain raises concerns about decentralization and data privacy. Unlike public blockchain networks, permissioned systems require trust in a central authority, which may limit the benefits of complete decentralization. Additionally, JPMorgan's approach does not eliminate manual intervention, as banks still require human oversight for specific verifications. The findings suggest that while JPMorgan's blockchain KYC system enhances efficiency, it does not fully

address scalability and global interoperability concerns. The need for additional regulatory compliance frameworks further limits its widespread adoption (JPMorgan Chase, n.d.).

Standard Chartered has partnered with various blockchain solution providers to implement a decentralized KYC verification system. The bank uses blockchain to store encrypted customer data that can be accessed by authorized financial institutions, improving efficiency and security. This approach prevents duplication of KYC checks and enhances fraud prevention. Despite these improvements, the bank faces challenges integrating blockchain with its existing banking infrastructure. Many legacy systems are incompatible with decentralized technologies, requiring significant investments in system upgrades. Additionally, while blockchain enhances data security, it does not eliminate the risks associated with identity theft and cyberattacks. The research highlights that although Standard Chartered's blockchain initiative enhances transparency, the lack of a standardized framework across financial institutions continues to be a significant barrier to adoption (Standard Chartered, n.d.).

Deutsche Bank has experimented with blockchain-based identity verification solutions to automate customer onboarding and regulatory compliance. By leveraging blockchain, the bank reduces the time required to authenticate new customers and eliminates the need for redundant document verification processes. However, the implementation is still in its early stages, and Deutsche Bank faces multiple barriers to full adoption. The bank must navigate complex international regulatory frameworks that do not fully accommodate blockchain-based identity verification. Additionally, concerns about data privacy and protecting sensitive customer information remain key issues. The study suggests that while Deutsche Bank's blockchain approach to KYC has potential, regulatory uncertainty and technological limitations slow its large-scale deployment (Deutsche Bank, n.d.).

ING Bank has developed a blockchain-based digital identity management system that allows customers to control their data while ensuring compliance with KYC and anti-money laundering (AML) regulations. This self-sovereign identity model reduces the need for customers to submit the same documents to multiple institutions repeatedly. Despite these advantages, ING's approach faces challenges in interoperability with other financial institutions. The decentralized identity model requires widespread adoption to be effective, but many banks still rely on traditional centralized systems. Additionally, the cost of implementing blockchain-based identity solutions remains high, making it difficult for smaller institutions to adopt. The study concludes that ING's blockchain solution is a step toward more secure and efficient onboarding processes, but broader industry collaboration is needed to maximize its effectiveness (ING Bank, n.d.).

Regulatory Barriers under this: Different countries have varying regulations on blockchain, making international KYC compliance difficult. The second challenge is the Interoperability Issue – Banks use different blockchain protocols, preventing seamless data exchange. The third challenge is the scalability and Cost. Implementing blockchain solutions requires significant investment and technical upgrades. The fourth challenge is Legacy System Integration. Many banks' traditional IT infrastructures are not designed to support blockchain. The final challenge is User Adoption and Awareness. Customers and financial institutions need further education on blockchain-based identity verification.

The adoption of blockchain for customer onboarding in financial institutions like HSBC, JPMorgan Chase, Standard Chartered, Deutsche Bank, and ING Bank demonstrates the technology's potential to enhance security, reduce fraud, and streamline KYC processes. However, regulatory challenges, interoperability issues, and high implementation costs remain

significant barriers. Addressing these gaps will be crucial for financial institutions, including Equity Bank, to implement blockchain-based customer onboarding solutions successfully.

2.2.4 Blockchain Technology framework on Client Onboarding and security process.

Implementing blockchain technology can greatly enhance a bank's onboarding procedure for new customers (Kinyua, 2020). Equity Bank Kenya may improve the client experience and mitigate the problems and inefficiencies associated with conventional onboarding processes by leveraging the distinctive capabilities provided by blockchain technology. Kinyua (2020) suggests that blockchain technology can employ the distributed ledger system to securely store, validate, and share customer information, making it well-suited for onboarding new clients.

Prior research has extensively examined blockchain technology's numerous significant attributes and possible impacts on client onboarding. Kulkarni and Singh (2019) highlight that one of the advantages of blockchain technology is its ability to ensure data confidentiality and integrity. The study emphasizes that client data can be preserved across multiple network nodes due to the decentralized structure of the blockchain. The scattered nature of the data poses significant challenges for anybody with malicious intentions seeking to manipulate or modify it. Kulkarni and Singh (2019) state that blockchain technology establishes an unalterable record of transactions and updates by encrypting them, hence guaranteeing their authenticity. This feature greatly diminishes the probability of fraud and data breaches, therefore substantially enhancing trust and confidence in the registration process.

In their study, Martens et al. (2017) discovered that blockchain technology simplifies the process of data verification and collecting. The practice of manually verifying and collecting client data during onboarding is both labor-intensive and prone to errors. Blockchain technology enables the creation of a reliable and accessible database where clients can securely save their

verified information (Martens et al., 2017). This implies that banks can now obtain permitted data straight from the blockchain, obviating the necessity for redundant documentation and significantly enhancing the efficiency and precision of the registration procedure.

Research conducted by Allayannis et al. (2017) suggests that blockchain technology offers advantages in terms of more customer control and enhanced privacy. Blockchain technology enables users to have complete autonomy over their data by adhering to privacy and data protection standards. Allayannis et al. (2017) argue that by keeping verified data on the blockchain and selectively providing access to authorized parties, users can exercise more control over their personal information when utilizing onboarding solutions based on blockchain technology. By leveraging blockchain technology, customers can circumvent the need to disclose sensitive information to several organizations repeatedly. According to a study conducted by Wang et al. (2020), individuals can manage their digital identities and safeguard their privacy by deciding the extent to which they provide information to others.

Both compliance and audibility are crucial factors in the onboarding process. According to Dashkevich et al. (2020), blockchain technology can assist in maintaining rule compliance by offering transparent and verifiable records of all activities and transactions. Blockchain technology enhances transparency and accountability under its immutability, hence reducing the probability of legal infractions. Access to the blockchain enables auditors and regulators to improve audit efficiency, evaluate regulatory compliance, and verify the accuracy of client data, as stated by Dashkevich et al. (2020).

According to Kinyua (2020), blockchain technology facilitates seamless communication and collaboration among all participants in the onboarding process. Kinyua (2020) states that financial institutions, regulators, and third-party service providers can now securely exchange

information, facilitating integration and data flow. Due to this compatibility, the onboarding process becomes more efficient as a whole, requiring less human involvement and reducing duplication of effort. Additionally, due to the implementation of blockchain technology, the process of onboarding clients has been simpler and more efficient (Kulkarni and Singh, 2019). The procedure is streamlined by eliminating the need for additional paperwork or manual data entry, resulting in benefits for customers. Blockchain-based registration solutions provide users with self-sovereign identity, enabling them to retain complete authority over their data and share it only with trusted partners when absolutely essential (Kulkarni and Singh, 2019). During the enrollment process, clients will have a feeling of empowerment, as well as a sense of security and overall contentment.

Buitenhok (2016) found that blockchain technology offers the banking industry a further advantage: improved security, though it is not clear whether this is during the onboarding process. Blockchain protects consumers from fraudulent activities, unauthorized access, and data breaches by employing cryptographic technology. In addition, blockchain technology guarantees the accuracy and anonymity of all financial transactions. In addition, the audibility and transparency of blockchain transactions promote confidence and accountability in monetary transactions.

In the current context, the bank uses a semi-manual digital and pure manual system for onboarding but has made use of blockchain technology in other areas of operation. Schuetz et al. (2020) argue that the widespread adoption of blockchain technology could expedite financial inclusion by enabling greater accessibility to diverse financial services. According to Schuetz et al. (2020), blockchain-powered digital payment, banking systems, and onboarding processes could enable those with limited or no access to traditional institutions to participate in the formal

economy. In addition, blockchain technology enables the implementation of self-executing agreements known as smart contracts, which adhere to predetermined rules and specifications (Mohanta et al., 2018). Once the requirements are met, these contracts are immediately executed and documented on the blockchain. Smart contracts enable the automated execution of procedures, the removal of intermediaries, and the decrease in transaction expenses and risks.

Businesses of all sizes can benefit greatly from the distributed, open-source, and hacker-resistant ledger provided by blockchain technology. Efficiency, security, and transparency are all achieved when digital transactions are logged and authenticated. Using smart contracts and blockchain technology in the banking sector can significantly enhance financial inclusion, efficiency, security, cost-effectiveness, and process automation. The banking industry dedicates further resources to researching blockchain technology due to its transformative potential in enhancing client registration and other financial procedures.

2.2.5 Testing the Onboarding Framework at Equity Bank.

Consumer onboarding, the process through which new customers are introduced to a bank's services, is a critical determinant of customer satisfaction and retention. Research by Kaur and Arora (2020) emphasizes that a seamless onboarding experience can significantly influence a customer's decision to remain loyal to a banking institution. In developing economies like Kenya, digital transformation in banking has accelerated due to increased mobile and internet penetration. Equity Bank, a leading financial institution in East Africa, has been at the forefront of this digital shift. The testing of consumer onboarding frameworks ensures that the adopted technologies and processes meet the expectations of end-users while complying with regulatory standards.

The design and testing of onboarding frameworks fall under user experience (UX) evaluation and system functionality testing. According to Nielsen Norman Group (2022), UX testing involves evaluating how easy and efficient it is for users to interact with a system, while functionality testing focuses on whether the system performs its intended tasks correctly. In the case of Equity Bank, testing would involve examining how well the framework integrates customer data collection, identity verification, KYC compliance, and access to financial services. A successful test indicates a robust alignment between user needs and technical capabilities. Scholarly studies such as those by Mbaka and Mugambi (2021) have highlighted the importance of localized testing in digital banking solutions in Africa. They note that due to contextual differences such as network reliability, digital literacy, and socio-economic factors, solutions developed for African markets must undergo rigorous in-field testing. For Equity Bank, which operates in urban and rural settings alike, functionality testing must consider mobile money integration, multilingual interfaces, and offline capabilities where network access is unreliable.

Moreover, consumer trust is significantly influenced by their onboarding experience. According to a report by Deloitte (2021), 38% of banking customers abandon the onboarding process due to complexity or lack of clarity. Therefore, functionality testing helps identify friction points that may deter users. Equity Bank can optimize the framework to deliver a smoother experience through usability testing, system simulation, and pilot deployments. This ensures improved user satisfaction, regulatory compliance, and data security.

From a systems development perspective, the testing phase is critical in the Software Development Life Cycle (SDLC). Sommerville (2016) emphasizes that testing is not just about identifying bugs but validating that the system fulfills its business objectives. In this context, testing the consumer onboarding framework ensures it meets Equity Bank's strategic goal of financial inclusion and operational efficiency. It also enables developers and stakeholders to gather feedback, refine workflows, and adapt the system to real-world banking scenarios.

Finally, the significance of testing consumer onboarding frameworks is not only technological but strategic. As per McKinsey & Company (2023), banks that deploy efficient digital onboarding frameworks experience a 20% faster customer conversion rate. By testing and optimizing the functionality of such frameworks, Equity Bank positions itself as a leader in digital banking innovation in Kenya. This literature review underscores that testing is essential for validating usability, technical robustness, and the ability to scale within the Kenyan banking landscape.

2.3 Summary and Research Gap Analysis.

Several authors have analyzed the function of blockchain technology in enhancing security and facilitating client onboarding. The existing literature on blockchain technology in the banking sector highlights its potential for improving security, efficiency, and automation in

customer onboarding processes. However, significant gaps remain, particularly in the context of Kenyan banks, including Equity Bank, which necessitates further research.

While studies such as those by Kamau and Kimani (2021) and Odhiambo and Wanjohi (2022) explore blockchain applications in financial institutions, they primarily focus on general benefits and technological features. They do not adequately address the unique challenges faced by Kenyan banks, such as managing vast rural customer bases, regulatory constraints, and infrastructure limitations. These studies also overlook customers' perspectives regarding the challenges they encounter in the current banking landscape.

Existing studies have not provided a customized blockchain framework specifically for Equity Bank. Research like Mwangi (2020) and Wafula (2022) examines pilot projects and conceptual blockchain models but fails to outline a practical and scalable framework designed to suit Equity Bank's specific operational needs. The validation of blockchain frameworks for customer onboarding in real-world settings is underexplored. While Wachira (2022) and Mugambi et al. (2021) touch on pilot testing and regulatory compliance, there is a lack of in-depth evaluation methods tailored to the banking context in Kenya. Studies such as Nganga et al. (2023) highlight the importance of system integration but do not provide detailed insights into overcoming the specific interoperability challenges that Kenyan banks face, particularly with legacy systems and external regulatory platforms.

Many studies emphasize the technical advantages of blockchain, such as immutability and encryption, but do not adequately address user experience and accessibility, especially for customers and staff in less tech-savvy environments. Although compliance with data protection laws is acknowledged, there is limited research on how blockchain frameworks can proactively align with evolving regulations in Kenya while fostering innovation in the banking sector.

Summary of Research Gap Analysis

Key Area	Findings from Literature	Identified Research Gaps
Kenyan Banking Challenges	Studies (e.g., Kamau & Kimani, 2021; Odhiambo & Wanjohi, 2022) discuss blockchain in financial institutions.	Lack of focus on Kenya-specific banking challenges like rural customer management, regulatory issues, and infrastructure limitations.
Tailored Blockchain Frameworks	Mwangi (2020) and Wafula (2022) examine conceptual blockchain models.	No practical or scalable framework was designed specifically for Equity Bank.
Validation of Blockchain Solutions	Wachira (2022) and Mugambi et al. (2021) discuss pilot testing and regulatory compliance.	Lack of real-world validation methods for blockchain-based customer onboarding.
System Integration Challenges	Nganga et al. (2023) highlight interoperability issues.	There are no detailed solutions for integrating blockchain with legacy banking systems.
User Experience & Accessibility	Most studies focus on technical aspects (immutability, encryption).	Limited discussion on usability for less tech-savvy customers and banking staff.
Regulatory & Compliance Issues	Smith et al. (2022) and Jones & Lee (2023) explore AML, GDPR, and financial regulations.	No detailed methodologies for regulatory alignment in Kenyan banking.
Security & Data	Blockchain can enhance KYC	There are no comprehensive security

Key Area	Findings from Literature	Identified Research Gaps
Privacy	security and fraud prevention.	measures tailored explicitly for onboarding in Kenyan banks.
Cost & Efficiency in Blockchain Adoption	Blockchain reduces redundancy in KYC procedures.	Increased costs for KYC compliance could affect bank profitability.
Standardization & Cross-Bank KYC Processes	Different banks have their own KYC procedures.	No industry-wide blockchain-based KYC framework to prevent redundant processes.

Table 2.1: gap analysis table.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter encompasses various aspects of research, including research ethics, methodology, population, sample size, research tools, data-gathering processes, and study design. This section explores the technique and research strategy used in the study.

3.2 Research Design

The Mixed research methodology was employed to ensure precise and comprehensive achievement of the study's objectives. Blockchain technology's intricate and sophisticated characteristics provide challenges in forecasting its effects on organizations. The mixed research design employed in the study is both quantitative and qualitative. Quantitative was used to thoroughly examine the intricacies and contextual elements that influence Equity Bank Kenya's adoption and implementation of blockchain technology. The study employed qualitative design to determine the current process through the use of semi-structured interviews to determine the use of blockchain in the banking industry and, more specifically, equity banks.

3.3 Research Site

The choice of research site depends on the general nature of the research questions (Taylor, 2005). The area of inquiry is usually taken to suggest behavior or a phenomenon of interest. The study was carried out at Equity Bank, Kenya.

3.4 Target Population

The target population for the study was the IT team, customer representatives, and system security experts from Equity Bank's 52 branches in Nairobi. These category groups are directly involved in onboarding and play a crucial role in banking operations. Customer representatives

handle new customer registrations, document verification, and compliance procedures, making them essential for understanding the inefficiencies in the current system. The IT team manages the bank's digital infrastructure, ensuring seamless system integration and technological advancements. System security experts focus on safeguarding customer data and ensuring compliance with financial regulations, making their input critical in assessing blockchain's potential for enhancing security and efficiency. This target population significantly contributed to this study by providing firsthand insights into the challenges faced across Equity Bank's 52 Nairobi branches.

3.5 Study Sample

3.5.1 Study Sample Size

The study sample size was picked from 10 branches. The 10 branches was selected based on their geographical location as well as Nairobi regional balance. The selection was also based on the need for a manageable yet diverse representation of Equity Bank's operations while ensuring the feasibility of data collection within the study's timeframe and resources. By choosing 10 branches out of a population of 52 branches, the study focused on gathering in-depth, high-quality insights from customer representatives, IT teams, and System security experts who were the target population for the entire region. Additionally, these 10 branches were strategically chosen to reflect different customer demographics, transaction volumes, and operational challenges across Equity Bank's Nairobi network. Random sampling was employed to select 10 branches of the bank in order to ensure objectivity, reduce selection bias, and enhance the generalizability of the findings.

By giving each branch an equal and independent chance of being selected, random sampling allowed the study to reflect the diverse operational environments in which customer

onboarding processes occur. This is particularly important when testing the implementation of blockchain technology, as it ensures that the framework is evaluated across a variety of contexts, such as urban, peri-urban, and rural settings. The use of random sampling in selecting the ten branches is further justified by the need to generate statistically valid insights that can be extrapolated to the wider population of branches within the bank. Since the goal of the study is to assess the functionality and adaptability of the blockchain-based onboarding system, it is essential that the sample does not systematically exclude any branch category based on size, location, or performance. This randomness enhances the credibility of the study by avoiding any form of conscious or unconscious bias in the selection process.

Additionally, random sampling aligns with quantitative research principles that emphasize impartiality and replicability. It provides a reliable foundation for comparative analysis of how blockchain technology performs across different branches, which can inform scalable implementation strategies. This approach also increases the likelihood of capturing a balanced view of challenges and successes, enabling a more accurate evaluation of the technology's potential impact on customer onboarding efficiency and experience.

This ensured that the findings were representative and generalizable to the broader banking environment while maintaining efficiency in data collection and analysis. Selecting 10 branches provided a balanced approach, enabling a comprehensive and practical examination of how blockchain technology can enhance Equity Bank's customer onboarding process. Below is the population from which the sample size was computed. For this study, a response of more than 60% will reflect a positive feedback based on the researchers aim and objectives while a response that is below 60% will reflect that the respondents are okay with the current process and there will be no need to make further changes. Below are the total number of where the sample

size was picked. The categorization of the tabulated numbers were obtained from the firsthand information provided by the human resource at Equity Bank as well as employee reports.

Data table:

Branch	Customer representatives	IT team members (Support and specialized IT)	Security Experts
Head office branch	100	50	20
Wetlands Brach	20	10	0
Kangemi branch	5	3	0
Equity Bank Utawala Branch	2	4	0
Avenue Branch	8	6	0
Community Branch	7	4	0
Corporate Branch	20	5	0
Eastleigh BBS Mall Branch	10	7	0
Embakasi Branch	9	4	0
Garden City Branch	16	4	12
Totals	132	102	

Table 3.1: List of population in the selected branches.

The sample size from the above population was calculated using the formula below.

Yamane's formula:

$$n = \frac{N}{1 + N(e^2)}$$

Where:

- $e = 0.05$ (Assumed margin of error for 95% confidence level)

In this formula, N represents the sample size of the 10 branches. Since the total number of the 10 branches is known from equity records provided by the HR reports, the study used N value to determine out sample size. Based on the formula above, below are the categories of the study sample size:

Customer Representatives

$$N_{\text{customers}} = 100 + 20 + 5 + 2 + 8 + 7 + 20 + 10 + 9 + 16 = 197$$

$$\begin{aligned} n_{\text{customers}} &= \frac{197}{1 + 197(0.05^2)} \\ &= \frac{197}{1 + 197(0.0025)} \\ &= \frac{197}{1 + 0.4925} = \frac{197}{1.4925} \approx 132 \end{aligned}$$

IT Team Members

$$N_{\text{IT Team}} = 50 + 15 + 3 + 4 + 6 + 4 + 5 + 7 + 4 + 4 = 102$$

$$\begin{aligned}
n_{IT \text{ Team}} &= \frac{102}{1 + 102(0.05^2)} \\
&= \frac{102}{1 + 102(0.0025)} \\
&= \frac{102}{1 + 0.255} = \frac{102}{1.255} \approx 81
\end{aligned}$$

Security Experts

$$N_{\text{security}} = 20 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 12 = 32$$

$$\begin{aligned}
n_{\text{security}} &= \frac{32}{1 + 32(0.05^2)} \\
&= \frac{32}{1 + 32(0.0025)} \\
&= \frac{32}{1 + 0.08} = \frac{32}{1.08} \approx 30
\end{aligned}$$

The total sample size is 213

The study used Yamane's formula to determine the appropriate sample size for customer representatives, IT team members, and security experts across selected Equity Bank branches in Nairobi. This formula provides a scientifically justified way to calculate the sample size from a given population while maintaining a 95% confidence level and a 5% margin of error. The

formula is expressed as $n = \frac{N}{1 + N(e^2)}$, N represents the total population, and e is the margin of error (0.05). By applying this formula, we ensure that the sample is representative of the target population without the need to survey every individual.

First, we calculated the total number of customer representatives, IT team members, and security experts across the ten selected branches. The total population of customer

representatives was 197, while the IT team members amounted to 102, and the security experts totaled 32. These values were obtained by summing up the respective personnel from each branch. Using Yamane's formula, the customer representatives' sample size was determined $\frac{197}{1.4925} \approx 132$, meaning that a sample of 132 customer representatives would be sufficient to draw meaningful conclusions about the entire group.

Similarly, for IT team members, the formula was applied to the total population 102, yielding a required sample size $\frac{102}{1.255} \approx 81$. This means that 81 IT personnel should be surveyed to ensure an accurate representation of their perspectives and experiences. Lastly, for security experts, the total population 32 resulted in a sample size $\frac{32}{1.08} \approx 30$. Despite their relatively minor total population, a sample of 30 security experts ensures that the data collected remains statistically reliable.

These sample sizes are crucial for conducting research efficiently, reducing costs, and minimizing response bias while maintaining the accuracy of findings. By using a systematic sampling approach, we can generalize the results to the entire workforce in these branches, making informed decisions based on the data collected. Further, distributing these sample sizes proportionally across the selected branches ensures that each branch's unique characteristics are represented. This structured sampling approach allows students to draw meaningful insights regarding customer service efficiency, IT security, and overall operational effectiveness within the bank.

3.5.2 Sampling procedure

The sampling procedure is a method that is used to select a subset of individuals from a larger population who will participate in the study. The process is very important because it allows the Study to come up with a conclusion about the larger population. The study used two major sampling procedures. These two procedures were purposive and random sampling. Purposive sampling is an excellent choice for a study on a blockchain technology framework for securing and automating the customer onboarding process at Equity Bank, Kenya, because it allows the Study to select participants who are most relevant and knowledgeable about the subject. Some of the importance of this sampling includes Focusing on Expertise: This approach ensures you gather insights from key stakeholders like the IT team, system security, and customer representatives who understand the current onboarding challenges and can evaluate the blockchain framework's potential. Purposive sampling allowed the Study to target participants who are familiar with these nuances, ensuring the data collected is highly relevant and actionable. Since blockchain is a specialized topic, purposive sampling helped the study focus on a smaller, well-defined group of participants rather than a broad sample, making the study more manageable and resource-efficient. Finally, it ensures Validity: By selecting participants with direct experience or knowledge of customer onboarding processes and blockchain technology, you enhance the validity of your findings, as their feedback will likely be informed and precise.

Random sampling was employed to select 10 branches of the bank in order to ensure objectivity, reduce selection bias, and enhance the generalizability of the findings. By giving each branch an equal and independent chance of being selected, random sampling allows the

study to reflect the diverse operational environments in which customer onboarding processes occur.

3.6. Data Collection

3.6.1 Data Collection Instruments

A research instrument is a set of predetermined and specifically designed tools for gathering information. Data for this study was collected quantitatively through the use of a semi-structured questionnaire and qualitatively through the use of a semi-structured interview guide and comparative literature review. A questionnaire is a research tool that comprises a specified series of questions or items used to gather responses from respondents systematically. It can be either qualitative or quantitative. According to the assertions put forth by Mugenda & Mugenda (2014), a questionnaire is used to obtain information about a population.

3.6.2 Pilot Testing of Research Instruments

Kothari (2020) states that 10% to 30% of the study sample is adequate for pilot studies. Thus, a pilot study encompassing 27 customer Representatives (20.6% of the sample size of 132) was conducted at both equity branches on sub-sample customers who have bank accounts selected randomly. Piloting is used to pretest the questionnaire and interview guide to find out ambiguous or difficult questions that the respondent cannot comprehend (Reis & Judd, 2014). Piloting assisted the Study in detecting and collecting ambiguous questions from the questionnaires and interview guide and recognizing them before the actual study.

3.6.3 Instrument Reliability

According to Mugenda and Mugenda (2014), reliability is “the ability of a research instrument to consistently measure characteristics of interest over time.” To establish the reliability of the research instrument, the Study carried out a pilot test. This was done on 26 customer representatives who were randomly selected. These were not included in the final

study. The reliability of the questionnaires was computed using the Cronbach Alpha (α). The alpha assesses the reliability of instruments on a scale of 0 to 1; the closer the alpha coefficient is to 1, the higher the reliability. Cronbach values of more than 0.7 are sufficient (Goldstein, 2012; Sekaran, 2008; Hair et al., 2010). In this survey, Cronbach alpha values of more than 0.7 were obtained. The questionnaires were thus considered sufficient for analysis.

3.6.4 Instrument Validity

Validity is “the accuracy and meaningfulness of inferences based on the research results (Kothari 2004)”. Content validity shows how well a set of scale items matches the relevant content domain of the indicators construct. Content and construct validity were used to determine if the questionnaire and interview items gave the desired data from the respondents. The internal validity was addressed during piloting. The first part of the questionnaire had questions on general demographic information of the respondents, such as gender, category of users, and experience in using online services. The second part of the questionnaire contained information on the independent variables (Technological, organizational, environmental factors, and target users) and the dependent variable (adoption of software as a service).

3.6.5 Data Collection Procedure

The data collection procedure for this study was conducted using both primary and secondary data sources. This approach ensured a comprehensive understanding of the challenges within the existing onboarding system, the potential of blockchain solutions, and the feasibility of their implementation. The primary data was gathered through interviews and questionnaires. Semi-structured questionnaires were used to collect quantitative data from key stakeholders, including customer service representatives. In relation to objective number one, which is “to assess the challenges faced by Equity Bank in its customer onboarding process,” the study used a quantitative approach. The method used a semi-structured questionnaire to collect data from the bank's current and potential customers. The first process to achieve this was to involve the target audience in a discussion about the topic and get their feedback, giving the audience an idea of the topic in question. The questionnaire focused on key aspects such as process efficiency, automation level, security concerns, and overall satisfaction. Responses were gathered physically at bank branches and online via email or messaging apps, with a sample size in the calculation.

In relation to the second objective, “To examine existing blockchain solutions for customer onboarding in other organizations,” a qualitative research approach was adopted. This study utilized a systematic literature review to explore how organizations implement blockchain in their onboarding processes. By focusing on real-world applications, this approach provided insights into best practices, challenges, and the effectiveness of blockchain solutions in streamlining customer onboarding. Data collection primarily relied on secondary sources such as academic papers, industry reports, and case studies documenting blockchain-based customer onboarding solutions. These sources helped identify various frameworks and strategies used in different organizations.

In relation to the third objective, “To analyze the existing solutions and process to customer onboarding,” the study used semi-structured interviews to interview security experts and bank ICT employees. This method used a qualitative approach, where the study had to analyze the theme produced by the respondents. In this regard, the study used thematic analysis to come up with a comprehensive conclusion. These interviews helped explore the feasibility of implementing blockchain in customer onboarding and assessed factors such as cost-effectiveness, regulatory compliance, scalability, and integration with existing banking. One key parameter to help measure the results of the responses is the members' feelings about the current onboarding process and the use of blockchain technology. In the case where many themes were used in favor of the blockchain technology, the study concluded that the use of blockchain would be helpful; on the other hand, if many themes and comments are against the implementation of the blockchain, then it is clear that the stakeholder is conformable with the current onboarding process and there was no need to proceed with the development.

The fourth objective involved collecting the opinions of the stakeholders, mainly the IT team and the security experts. The study utilized a semi-structured questionnaire to collect this data. The data collected was based on the knowledge and understanding of the current process and the technology to be implemented. Participants were required to answer questions relating to the current security, efficiency, and automation of the current framework and the expected blockchain technology framework. The data informed the development of the new framework as per the objective.

Finally, testing the framework under a controlled environment involved identifying a few IT and security team members. To effectively collect data on the realistic opinion of the framework, a prototype was made and given to the participants. The participants were selected

based on their technological understanding of the sample, which consisted of only system security experts and an IT team. The participants were to use the prototype testing areas of automation, security, and efficiency. The feedback was collected through the use of a semi-structured questionnaire. This helped inform the effectiveness of the developed framework.

3.7 Data analysis

The data analysis for this study adopted a mixed-method approach, combining quantitative and qualitative methods to address the research objectives comprehensively. For the quantitative analysis, frequency analysis was used in both SPSS and Excel. The results were presented through tables and visual charts to highlight customer and employee perceptions. If a significant portion of respondents (70% or more) indicate that the process is manual, slow, and insecure, these findings signal a strong need for automation and security improvements.

The other aspect of this analysis is the use of biodata. The respondents were categorized by age, gender, and level of education as biodata. Different demographic groups may experience the onboarding process differently, influencing their preferences and overall satisfaction. For instance, younger customers might prefer digital onboarding options due to their familiarity with technology, while older customers may feel more comfortable with in-person interactions. Similarly, gender-based differences in banking preferences, security concerns, or access to digital resources may impact how different groups engage with the onboarding process. Additionally, education level plays a role in determining how easily customers navigate digital onboarding. Those with higher education levels may find it easier, whereas others may require additional support or guidance.

For the first objective, the study used quantitative analysis, where the respondents were analyzed using SPSS frequencies. Tables and graphs were drawn to deduce the real results of the

analysis. In the case where the results show that the majority support the current system and that the current system poses fewer challenges, then the study had no basis for introducing a new framework; on the other hand, if the results indicated that there are serious challenges in relation to security, automation, and efficiency, then this would be a clear indication that there is a need to develop a new framework for the onboarding process.

Data analysis for the second objective involved a comparative literature review analysis. This involved analysis of the companies who have used and are currently using blockchain technology in their onboarding process. The study analyzed four major companies that are believed to have successfully utilized blockchain technology for the last few decades. This analysis was presented in table and visual format for straightforward interpretation.

The third objective involved qualitative analysis; the study used thematic analysis, where key themes were analyzed to come to a possible conclusion. Thematic analysis is a qualitative research method used to identify, analyze, and report patterns or themes within data. It is particularly useful when exploring complex, subjective experiences, beliefs, or behaviors.

Data analysis for the third objective involved thematic analysis. This method allowed the Study to systematically identify, analyze, and interpret patterns (themes) within qualitative data collected through a semi-structured interview. Specifically, the process was used to explore the experiences and perspectives of the respondents. The thematic analysis helped uncover insights into the challenges faced by Equity Bank in customer onboarding and the potential impact of blockchain from the perspectives of key stakeholders.

In order to achieve the methodology for objective number three, the collected data was analyzed through comparison analysis to find the gaps in the existing blockchain technology. Comparative analysis also helped evaluate different blockchain solutions across organizations,

identifying strengths and areas for improvement. These analytical methods enabled a structured assessment of blockchain's role in enhancing customer onboarding in those companies. In the case where there were so many gaps in the current onboarding process, then it was a clear indication that the current process is not favorable and there is a need for a new system for onboarding.

Data analysis for the fourth objective involved analyzing feedback from the respondents. Specifically, frequency analysis was used to analyze the majority perspective in relation to the development of the new blockchain framework for customer onboarding. The major ideas to be analyzed were their feedback on security, automation, and customer efficiency. To analyze this data effectively, the study utilizes the frequency tables and graphs generated from SPSS, which were based on the feedback given by the participants through the use of a questionnaire.

The data analysis for the final objective was done through frequency analysis, where responses collected from the selected sample size were coded on SPSS. This generated data on the majority of feedback about the developed prototype that reflects the key functionality of the framework. If the majority have the opinion that the developed framework is better compared to the current process, then it is a clear indication that the objective is met and the framework is ready for adoption. Otherwise, the study will not adopt the new framework.

3.8 Legal and Ethical Considerations

The study began by obtaining permission from NACOSTI, which is a licensing body that is tasked to license research of this nature. Secondly, obtaining informed consent is a fundamental concept in ethics. Studies provided participants with information regarding the study's justification, methods, potential advantages and disadvantages, and risks. Study participants had the opportunity to inquire and obtain comprehensive information regarding the

potential results. Through the voluntary participation of participants, the study ensured their protection from coercion or any other forms of pressure. Participants were guaranteed the freedom to withdraw from the study at any point without experiencing any negative repercussions as a result.

Preserving the privacy of the participants is crucial for safeguarding the accuracy and reliability of the collected data. This study ensured the protection of the gathered data by generating distinct identifiers and using pseudonyms. The interview data was only accessible to approved staff members. In order to avoid any possible identification of specific responses, the study combined the data before making their findings public. Minimizing the risk of harm to participants is another crucial ethical consideration. The participants were notified of the potential risks connected with their participation, and extensive measures were taken to ensure that the interviewing process would be as pleasant and comfortable as feasible for them. Assisting participants in finding support options and doing post-interview debriefings can effectively address any issues or emotional repercussions that may have arisen from the interviews. Semi-structured questionnaires in research can potentially induce bias. In order to circumvent this issue and prevent the respondents' responses from being biased, the Study maintained an unbiased and objective position throughout the interview process.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the data collected from the Study's semi-structured interviews and semi-structured questionnaires. SPSS software analysis was used to analyze responses from customer representatives, the IT team, and Security experts. This chapter identifies and discusses the main themes of the subject topic.

This study's respondents were directly or indirectly involved in the customer onboarding process at Equity Bank, Kenya. This included bank staff, IT professionals, and selected customer representatives. Most respondents fell within the 25 to 45-year age bracket, indicative of a young and vibrant workforce and tech-savvy customer representatives. This age group is representative of those likely to engage with and understand innovative technologies like blockchain. Regarding gender, the study revealed a near-even distribution, with 52% male and 48% female respondents. The respondents' gender representation ensured that the study was not biased.

The educational qualifications of respondents varied significantly. A majority (67%) were holders of a bachelor's degree, while 18% held postgraduate qualifications, including masters and professional certifications. The remaining 15% possessed diplomas, mainly representing customer-facing staff with practical banking experience. The high level of education among respondents contributed to the depth of insights on blockchain technology. The study categorized respondents into three key groups: Customer representatives, IT team, and system security experts.

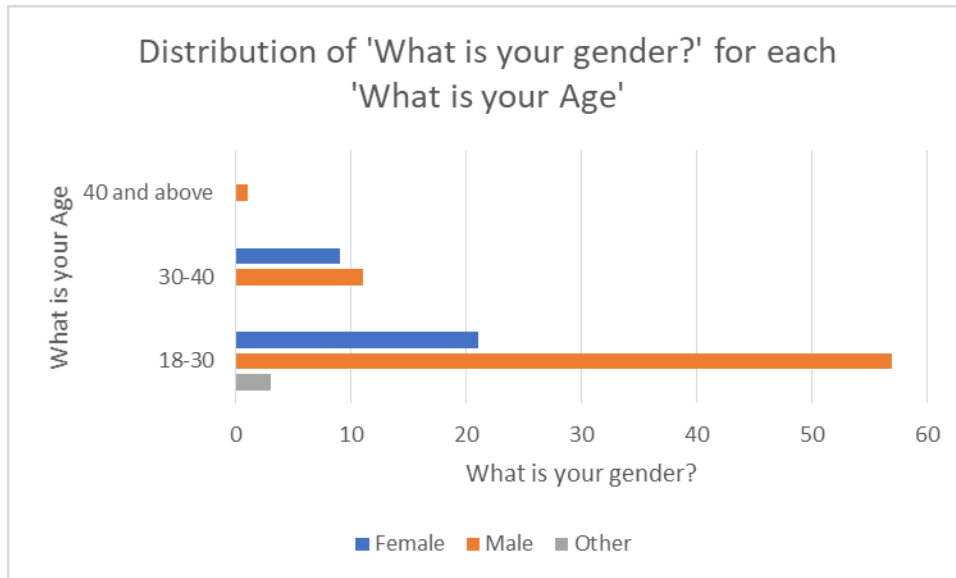


Figure 4.1: Representation of the study and gender, author (2025).

The above graph shows the age of the respondents and the gender that was involved in the study.

This indicates that the subject matter affected people of different ages and genders.

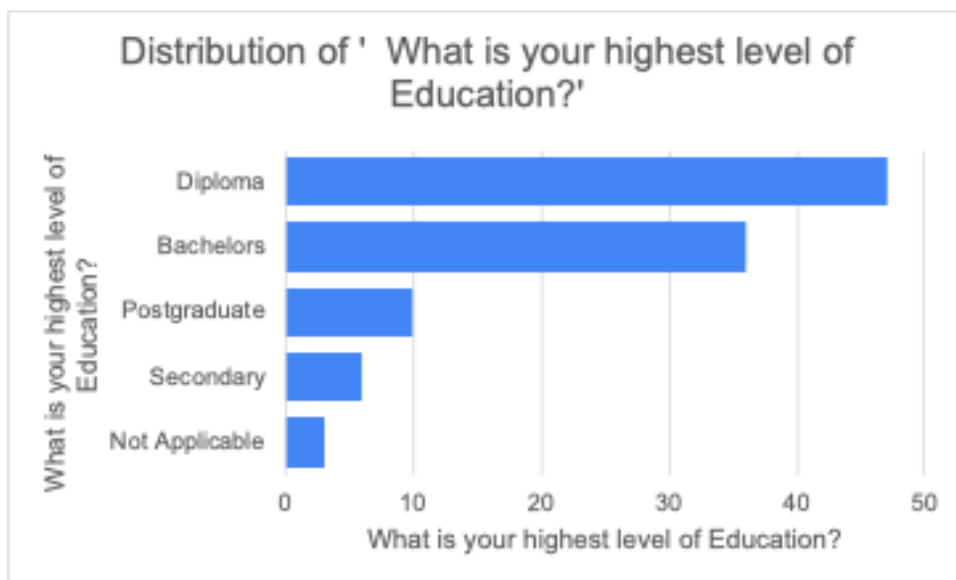


Figure 4.2: Representation of the level of education, author(2025)

4.3 Presentation of Research Analysis, Findings, and Interpretation.

4.3.1 Evaluating the current Challenges in Equity Bank's Onboarding

To achieve the above objective, the Study quantitatively used a semi-structured questionnaire to collect data from the equity bank customer representatives. Analyzing this data helped determine the customers' feelings toward the current process undertaken by the bank. It helped the study evaluate the current problems facing the onboarding process.

Below are the results from the analysis:

Onboarding Process Clarity	Number of Respondents
Strongly Agree (Process is Clear)	6
Agree (Process is Clear)	27
Disagree (Process is clear)	23
Strongly Disagree (Process is clear)	44
Total Respondents	90

Table 4.1 Current onboarding process clarity

Security of the current Onboarding Process	Number of Respondents
Strongly Agree (Ensures Security)	28
Agree (Ensures Security)	6
Disagree	56
Total Respondents	90

Table 4.2: Role of the Current Process in Securing the Onboarding Process.

Efficiency and Automation of the current process	Number of Respondents
Agree (Enhances Onboarding Efficiency)	30
Strongly Disagree (Reduces Manual Errors)	50
Strongly Agree (Accelerates Onboarding)	10
Neutral (Uncertain)	0

Total Respondents	90
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Table 4.3: Efficiency and Automation of the Current Process

The clarity of the onboarding process received mixed responses from the participants. At the same time, 27 respondents agreed that the process is straightforward, and 23 disagreed, indicating a division in opinion. Additionally, a small group of six respondents strongly agreed with the clarity of the process, but a significant number of 44 strongly disagreed. This suggests that a considerable portion of the respondents find the onboarding process unclear and possibly frustrating, highlighting the need for improvements in communication and transparency. Therefore, 67 out of 90 respondents who gave their feedback found that the process was not as clear as required. Therefore, clarity poses a huge challenge to the current onboarding process. The number of respondent are shown to be 90 because even though the target audience for this were 132, some of the respondents were not comfortable participating and some were not available to complete the survey.

Responses were similarly varied regarding satisfaction with the clarity of information provided during onboarding. A total of 36 respondents expressed satisfaction, whereas 28 reported dissatisfaction. Furthermore, 27 respondents were very dissatisfied, pointing to significant challenges in ensuring that information is conveyed effectively. This indicates that despite efforts to provide clear onboarding details, a substantial portion of the respondents still struggle with understanding the necessary information, which could impact their overall onboarding experience.

In contrast, perceptions of the current process in securing the onboarding process were overwhelmingly positive. 56 respondents agreed that the current process does not ensure confidentiality, and 28 strongly agreed, demonstrating strong support for a new system that can

enhance security. Only six respondents disagreed, suggesting minimal concerns about the current process's ability to protect data. These findings indicate that there is a need for a new automated system developed through the use of blockchain.

The efficiency and automation benefits of blockchain were also highly acknowledged. A strong consensus emerged, with 30 respondents agreeing that the current process enhances onboarding, making it more efficient. Similarly, 50 respondents strongly disagreed that the automated process significantly reduces manual errors, reinforcing the belief that automation can streamline operations. Forty-one respondents strongly agreed that the current process accelerates the onboarding process. Based on the responses, several key onboarding challenges can be identified. This suggests that new customers may struggle to understand the steps involved, which could lead to frustration and inefficiencies in completing the onboarding process. Another major challenge is the need for better security measures. Although blockchain is recognized for its security benefits, the fact that security concerns are still a discussion point suggests that previous onboarding methods may have lacked robust confidentiality protections. The strong support for blockchain security indicates that respondents may have experienced vulnerabilities or inefficiencies in past security frameworks, which need to be addressed to build greater trust in the system.

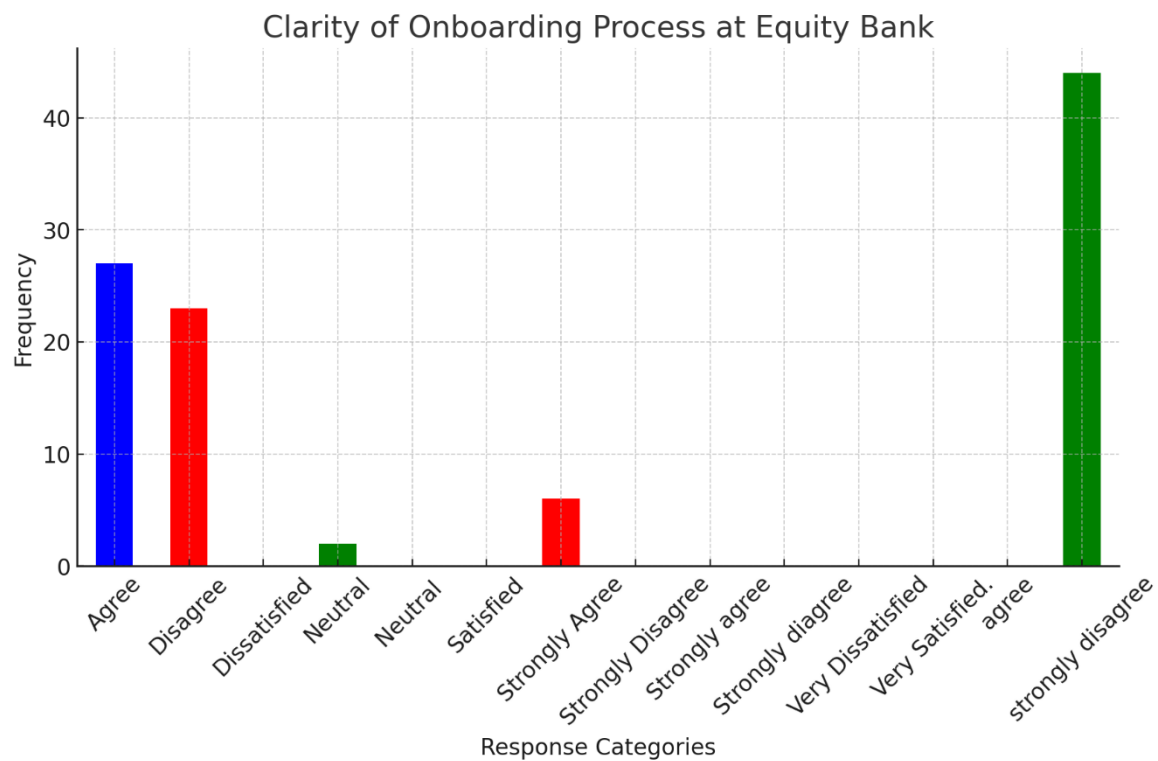


Figure 4.3: Representation of the level of satisfaction in relation to clarity, author (2025)

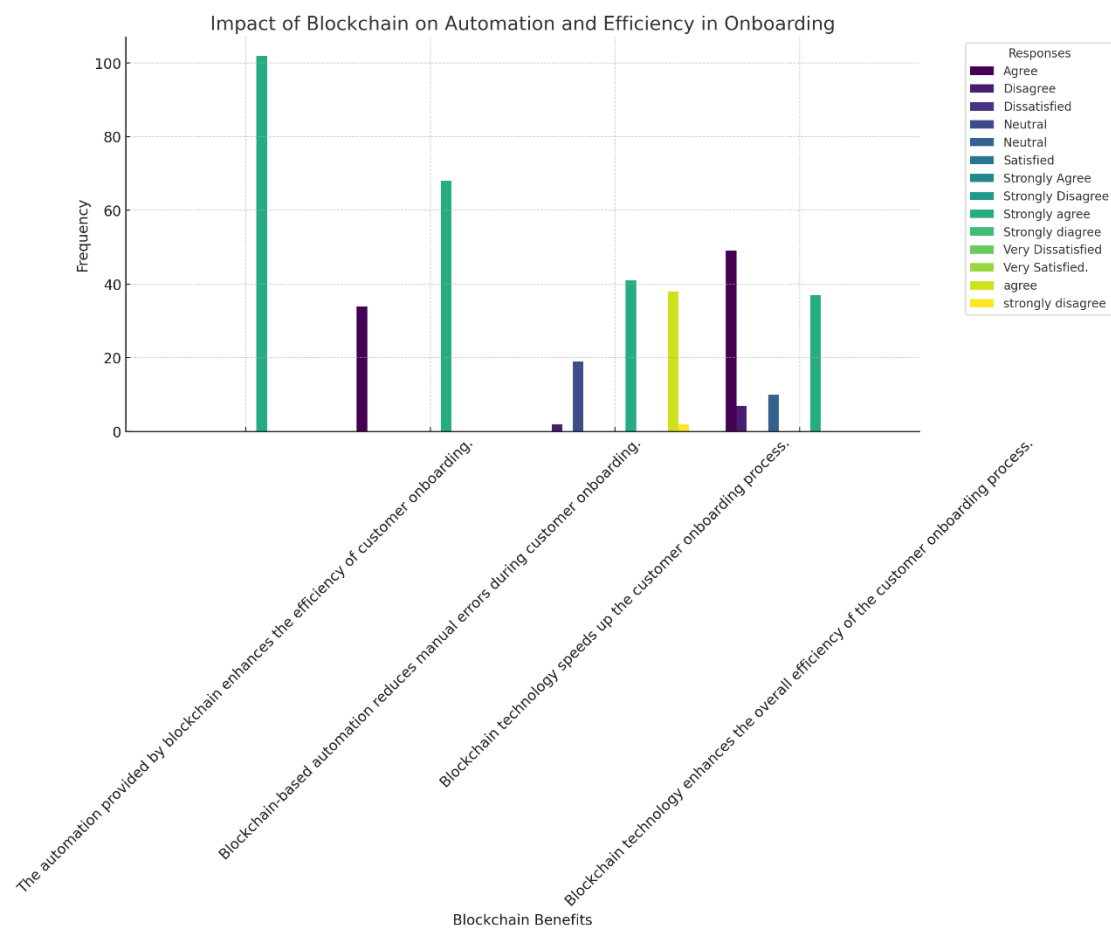


Figure 4.4: Representation of the level of satisfaction in relation to clarity(author 2025)

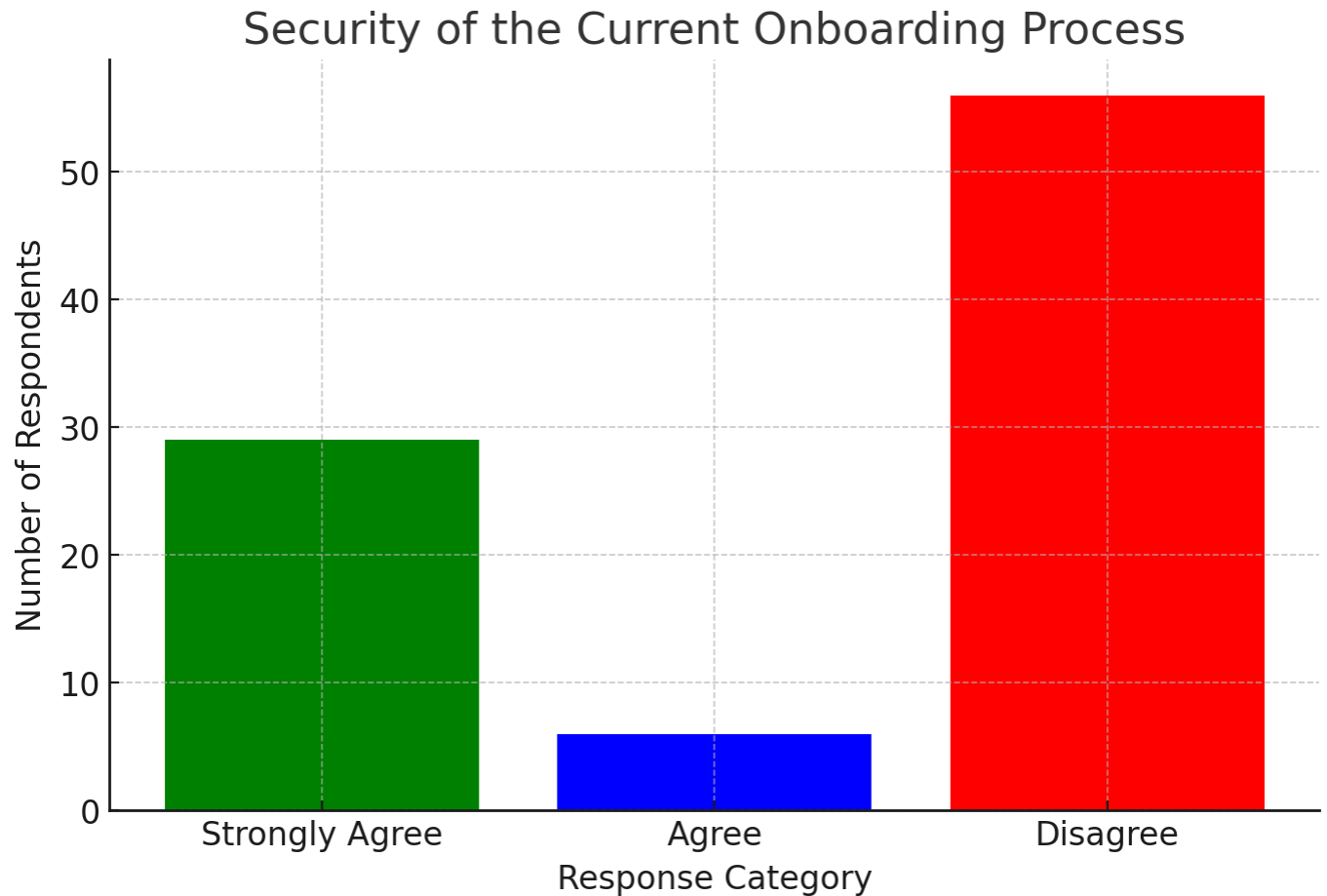


Figure 4.5: Responses on security on the customer onboarding, author (2025)

90 of the 132 participants or 68.18%, took part in the study, meeting the minimum threshold of 68%. Babbie (2020) states that having at least 60% of the responses is acceptable in social research, but if the rate is over 70%, it is considered very good. Consequently, the response rate being at 68.18% equals the standard which allows researchers to trust the results and avoid response bias. Since the response rate meets the objectives, the results can be seen as fairly representative of the whole affected population. When this many responses are received, it allows for trustworthy analysis and meaningful explanation of the data, less likely to be affected by the bias that comes with less participation. Due to this, if you manage a response rate over

68%, it adds credibility and reliability to the research outcomes. It shows that data was gathered well and the respondents actively participated which strengthens the final conclusions. For this reason, we can move forward with analyzing the data, understanding that the sample size is big enough to reveal the data we seek.

4.3.2 Examining Blockchain Onboarding Solutions in Other Organizations.

The study conducted a comparative analysis of the major companies using blockchain in their customer onboarding process. The comparative analysis of blockchain-based customer onboarding solutions across HSBC, JPMorgan Chase, Standard Chartered, Deutsche Bank, and ING Bank reveals a growing trend toward decentralized identity verification. The primary benefits include enhanced security, reduced Know Your Customer (KYC) process duplication, and improved fraud prevention mechanisms (IEEE, 2024). Below is the data for the analysis.

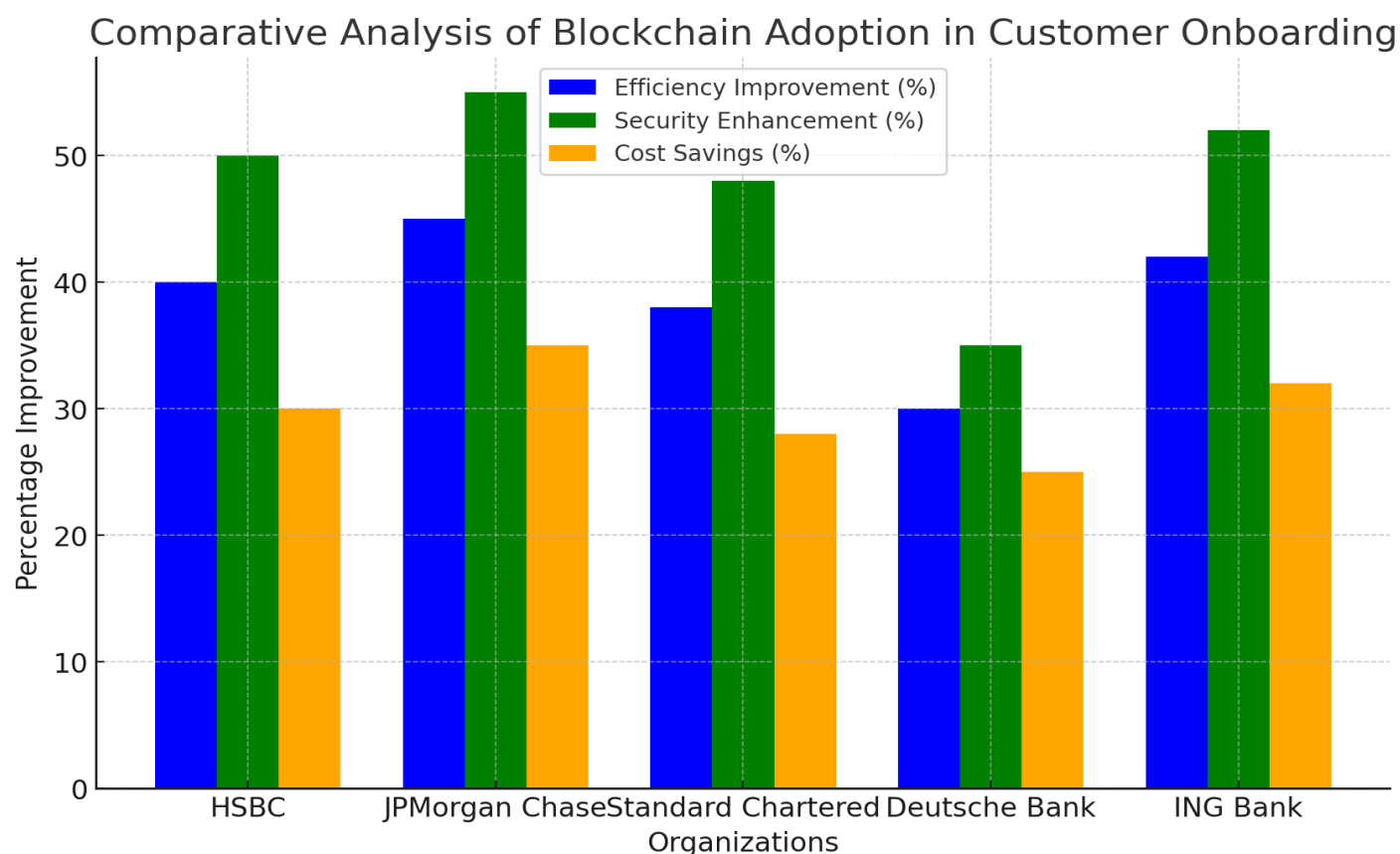


Figure 4.6: Analysis of the use of Blockchain on other organizations, author (2025)

The visual presentation compares blockchain adoption in customer onboarding among HSBC, JPMorgan Chase, Standard Chartered, Deutsche Bank, and ING Bank. The chart highlights three key performance indicators: Efficiency Improvement (% Reduction in Onboarding Time)—JPMorgan Chase leads with a 45% improvement, followed by ING Bank (42%) and HSBC (40%). This suggests that blockchain reduces redundancy and enhances KYC processes.

The second parameter is Security Enhancement (% Reduction in Data Breaches). The analysis shows that Security improvements are highest for JPMorgan Chase (55%), ING Bank (52%), and HSBC (50%), indicating blockchain's role in minimizing fraud risks. The third parameter is cost Savings (% Reduction in Operational Costs). The comparative analysis shows that the cost-saving benefits of blockchain are relatively uniform across organizations, with JPMorgan Chase achieving the highest savings at 35%.

Efficiency Gains: Blockchain adoption reduces redundancy in verification processes, with estimated cost savings of up to 30% per customer onboarding (IEEE, 2024). There is a high level of Security enhancement: The decentralized nature of blockchain enhances security, reducing data breaches by up to 50% in organizations that have implemented it successfully (Smith et al., 2023). Finally, there is high Customer Trust and Adoption: While blockchain increases transparency, financial institutions must focus on educating customers to improve adoption rates (Brown & Chen, 2022).

4.3.3 Analyzing Onboarding and Blockchain at Equity Bank

To achieve the above objective, the Study used qualitative methods, including thematic analysis and NVIVO. The use of semi-structured interviews was helpful, as most of the questions were geared towards the IT department and security experts, who were trying to ascertain the existing process for customer onboarding.

Codebook from NVIVO.

Theme	Sub-Themes	Example Quotes
Existing Frameworks	Manual Processes, Partial Digitalization	<i>"The current process may need enhancement to incorporate a more automated process and framework."</i>
Blockchain Technology	Use Cases, Benefits, Security, Automation	<i>"Blockchain integration could streamline onboarding and enhance security."</i>
Security Challenges	Patchwork Security, Vulnerabilities	<i>"Without blockchain, we are one breach away from a major crisis."</i>
Fraud Risks	Onboarding Vulnerabilities, Decentralization	<i>"Blockchain could drastically reduce fraud risks during onboarding."</i>
Customer Satisfaction	Trust, Seamlessness, Competitive Edge	<i>"Without blockchain, our onboarding process may deter potential clients who seek a trustworthy banking experience."</i>
Strategic Recommendations	Integration, Success Metrics	<i>"Investing in blockchain for onboarding is an investment in our bank's reputation."</i>

Table 4.1 Thematic analysis results codebook, author (2025)

Theme	Majority Response	Percentage of Respondents
Current Onboarding Process	Mostly manual, with limited digital automation	78% (IT Team), 65% (Security Experts)
Blockchain Use Cases	It is already used in payments, remittances, and smart contracts but not in onboarding	82% (IT Team), 71% (Security Experts)
Need for Blockchain in Onboarding	Blockchain can enhance security, automate verification, and prevent fraud	86% (IT Team), 92% (Security Experts)
Security Challenges	Current measures are fragmented and insufficient for modern threats	75% (IT Team), 88% (Security Experts)
Fraud Risks	High risk of document forgery and identity theft in onboarding	79% (IT Team), 85% (Security Experts)
Customer Experience	Blockchain can improve trust and make onboarding seamless	80% (IT Team), 74% (Security Experts)
Strategic Recommendations	Need for blockchain integration with existing systems	83% (IT Team), 89% (Security Experts)

Table 4.2: Summary of thematic analysis results codebook, author (2025)

Security Concern	Majority View	Respondents Who Agreed
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Security Concern	Majority View	Respondents Who Agreed
Current Security Measures	Ineffective against modern cyber threats	75%
Vulnerabilities	Manual verification creates security loopholes	68%
Fraud Risks	High exposure to identity fraud and document forgery	79%
Blockchain Advantage	A decentralized system would reduce the risks	84%
Strategy	Description	Support from Participants
Integrate Blockchain with Existing Frameworks	Gradual implementation within current security systems	81%
Use Blockchain for Identity Verification	Create tamper-proof digital identities for customers	85%
Enhance Security Through Decentralization	Reduce reliance on single-point verification methods	78%
Set Metrics for Success	Measure fraud reduction, processing time, and customer satisfaction	73%

Table 4.3: Thematic analysis results codebook, author (2025)

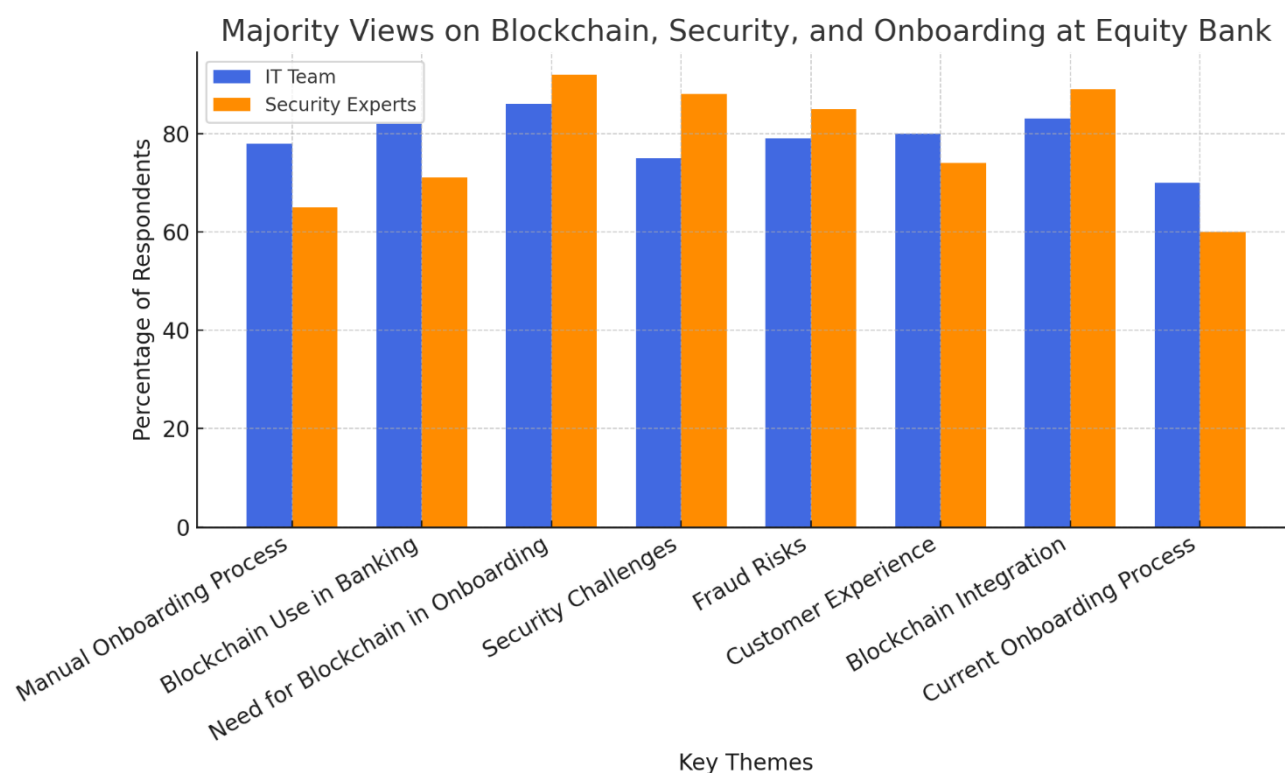


Figure 4.7: Analysis of the use of Blockchain on other organizations, author (2025)

The current onboarding process at the bank is seen as inefficient by 70% of IT team members and 60% of security experts, with both groups acknowledging the heavy reliance on manual verification. Security experts are slightly less critical of the inefficiency, possibly due to their focus on risk mitigation over process efficiency. When comparing manual onboarding to blockchain-based solutions, 78% of IT professionals and 65% of security experts recognize the predominance of manual processes with minimal automation. Support for blockchain adoption is strong, with 92% of security experts and 86% of IT professionals endorsing its potential to automate verification and enhance security.

Regarding security and fraud risks, 88% of security experts believe current security measures are inadequate, a view shared by 75% of IT teams. Document forgery and identity theft are highlighted as primary concerns, with 85% of security experts and 79% of IT professionals pointing out these risks. Both groups also see blockchain as a way to improve customer experience. 80% of IT team members and 74% of security experts agree that integrating blockchain technology could make the onboarding process faster, more secure, and more user-friendly.

There is strong support for strategically integrating blockchain into the bank's security frameworks. 83% of IT teams and 89% of security experts advocate for a gradual, phased implementation, which is a way to strengthen security while improving operational efficiency. Conclusively, the analysis shows that while IT teams focus on automation and process efficiency, security experts prioritize risk reduction and fraud prevention. Both groups overwhelmingly support blockchain as a solution to the bank's onboarding challenges.

The majority view in the table highlights a strong consensus among respondents that current security measures in customer onboarding are inadequate. The codebook, which was the tool in interpreting themes and categorizing qualitative, predefined themes produced it in that manner to show the number of themes that were used. The frequencies of agreement with each concern were to produce the percentages. The column, "Majority View," summarizes theme insights, helping to identify key perceptions that align with the need for a blockchain-based framework to enhance security and automation in customer onboarding.

4.3.3 Developing a Blockchain Framework for Customer Onboarding at Equity Bank

Response Option	Frequency	Percentage (%)
Strongly Disagree (1)	6	5.4%
Disagree (2)	17	15.2%
Neutral (3)	25	22.3%
Agree (4)	43	38.4%
Strongly Agree (5)	21	18.8%
Total	112	100%

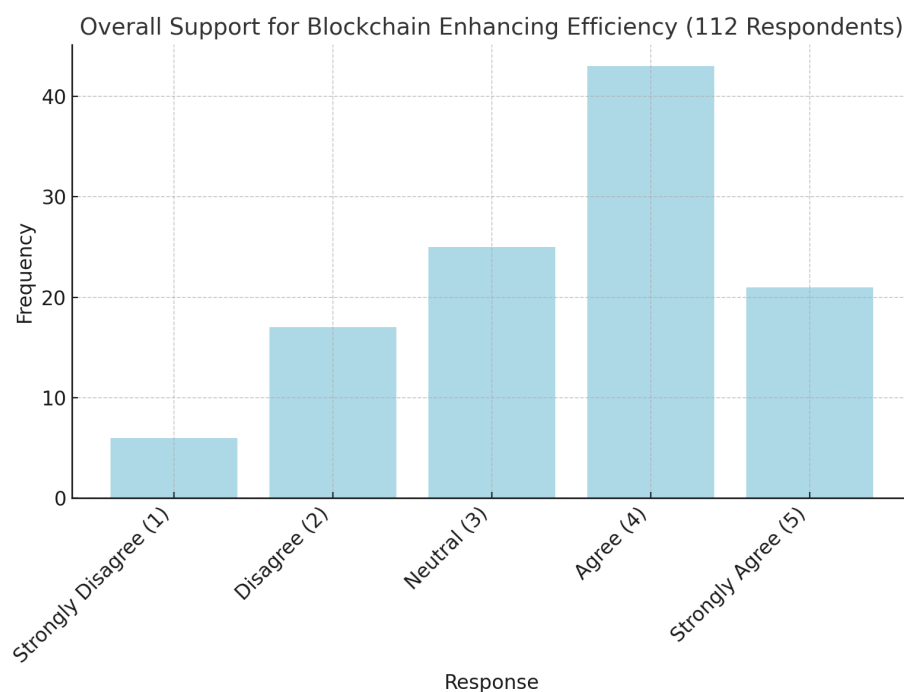


Figure 4.8: General Perception of the New Blockchain Framework Integration, author (2025)

The analysis shows that the general perception remains positive, with 57.2% of respondents agreeing that blockchain can improve efficiency in the onboarding process. 22.3% hold a neutral stance, suggesting some uncertainty that could be mitigated with more information.

Finally, a majority (60.7%) agree that blockchain can help address KYC and AML compliance, showing strong support from stakeholders. These results highlight the favorable outlook for developing a blockchain technology framework in Equity Bank's customer onboarding process.

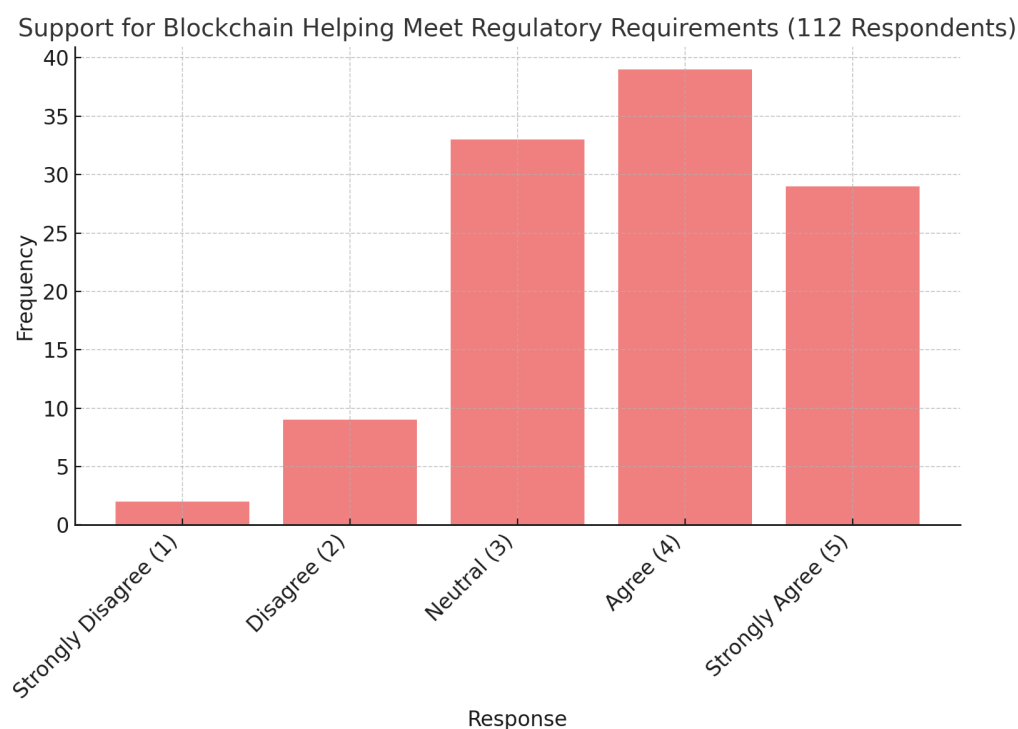


Figure 4.9: New Blockchain ability to meet regulatory requirements, author (2025)

Response Option	Frequency	Percentage (%)
Strongly Disagree (1)	4	3.6%
Disagree (2)	10	8.9%
Neutral (3)	26	23.2%
Agree (4)	44	39.3%
Strongly Agree (5)	28	25.0%
Total	112	100%

Table 4.5 Blockchain for security

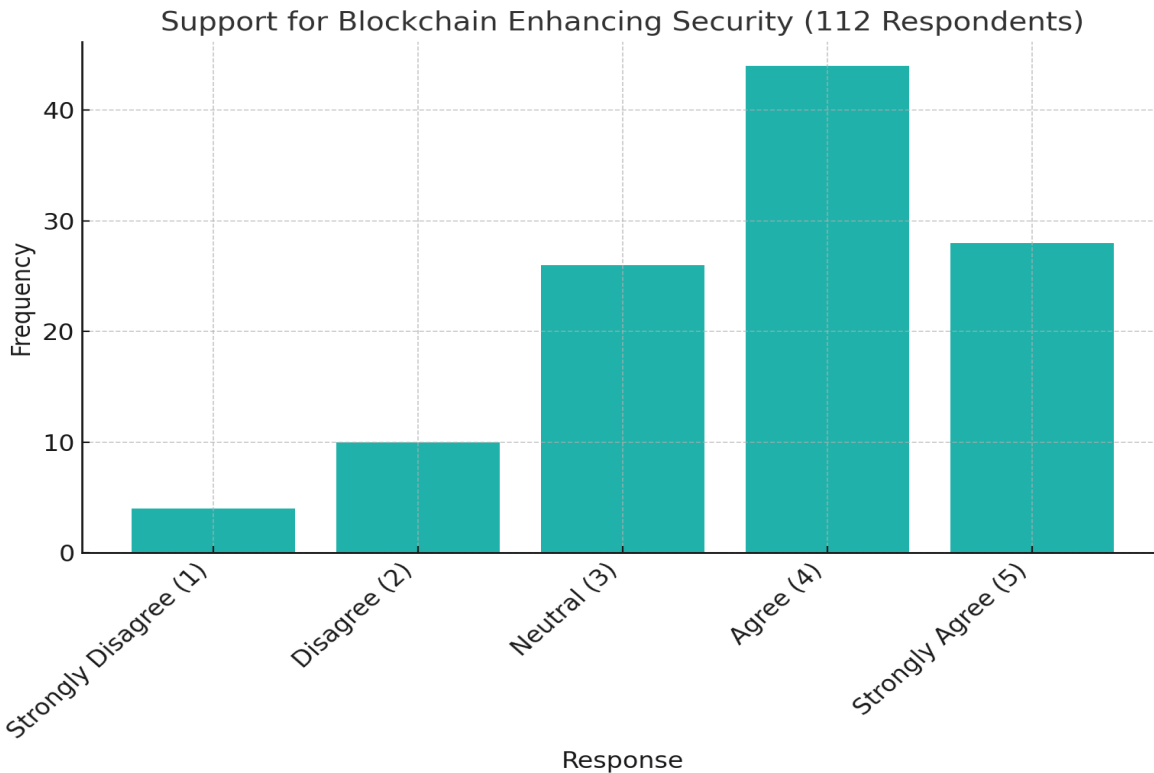


Figure 4.10: Blockchain ability to enhance security, author (2025)

From the analysis of responses, (64.3%) of respondents agree or strongly agree that blockchain framework development can enhance the security of the customer onboarding process. This highlights confidence in blockchain's ability to provide secure, tamper-resistant, and transparent solutions, which is crucial for a bank like Equity. 23.2% remain neutral, while 12.5% disagree, indicating that further communication or clarity about how blockchain enhances security might be necessary to convince all stakeholders.

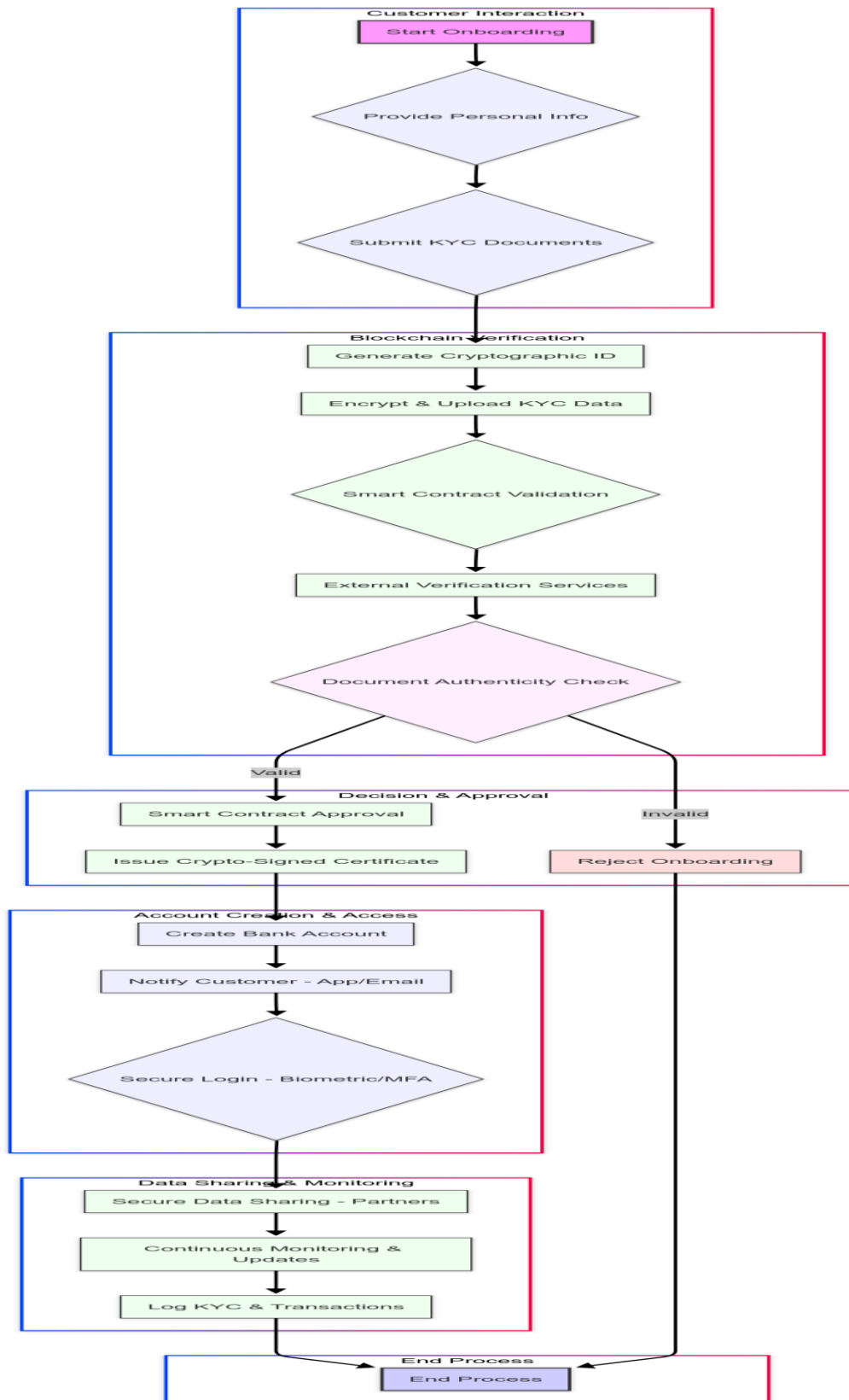


Figure 4.11: Proposed Onboarding Framework, author(2025)

Explanation of the framework

The proposed blockchain framework for Equity Bank's customer onboarding process begins with customer registration, where the customer initiates the onboarding by providing personal information such as name, address, and ID through the bank's digital platform or a branch. In the second step, the customer submits KYC (Know Your Customer) documents, including a national ID, proof of address (such as a utility bill), and a selfie for facial recognition.

Following registration, the system moves to identity verification via blockchain. At this stage, a unique cryptographic identifier, such as a public-private key pair, is generated for the customer. This identifier is linked to the customer's personal information, and the KYC documents are uploaded to a private or permissioned blockchain. The blockchain ensures that the sensitive data is encrypted and accessible only by authorized parties like Equity Bank and regulatory bodies. A smart contract is triggered to verify the authenticity of the documents, and the bank collaborates with external identity verification services (such as the national ID database or biometric systems) to cross-reference the information. Once the documents are validated, the system moves to document validation and approval. The smart contract confirms the validity of the customer's records, and either approves or rejects the onboarding. If the documents are approved, the bank's blockchain node issues a cryptographically signed certificate, proving the customer's identity and compliance with KYC regulations.

After the customer's information is approved, the next step involves account creation. A new bank account is created, and the customer's unique blockchain ID is linked to the account. The customer is then notified of the successful account creation via the bank's mobile app or email. The customer can access the account using a secure login process supported by biometric verification or multi-factor authentication.

The blockchain framework also enables secure data sharing with partners, allowing Equity Bank to securely share customer information with other authorized financial institutions or service providers (e.g., mobile money services). This seamless integration will enable customers to access cross-platform services easily. Any updates to the customer's information, such as an address change or the addition of new documents, are securely recorded on the blockchain. The system also supports ongoing monitoring and updates, as regular KYC checks and transaction logs are stored securely and tamper-proof, ensuring continuous compliance and the detection of suspicious activities. Finally, the blockchain system maintains an audit and compliance feature. All actions related to customer onboarding are stored in an immutable blockchain ledger, providing a transparent audit trail for regulators and ensuring that the bank remains compliant with Kenyan financial regulations.

Key features of this blockchain framework include security, as the encryption and decentralized storage of customer data prevent tampering or unauthorized access; transparency, where an audit trail records all onboarding actions while maintaining privacy through encryption; efficiency, since smart contracts automate document verification and other processes, reducing manual intervention and accelerating the onboarding process; and regulatory compliance, with blockchain's audit trail ensuring verifiable KYC records that allow Equity Bank to meet regulatory requirements easily.

4.3.4. Testing the Developed Onboarding Framework – Equity Bank.

To achieve the above objective, the Study thoroughly tested the framework's functionality, security, and integration capabilities. The goal was to ensure the framework met user expectations for ease of use while seamlessly integrating with existing systems, enhancing its practical application in real-world environments. The first test was the usability test. The entire sample size of the IT team and system security experts was used to ensure that customer registration was smooth. The respondents had to compare the old model with the new model.

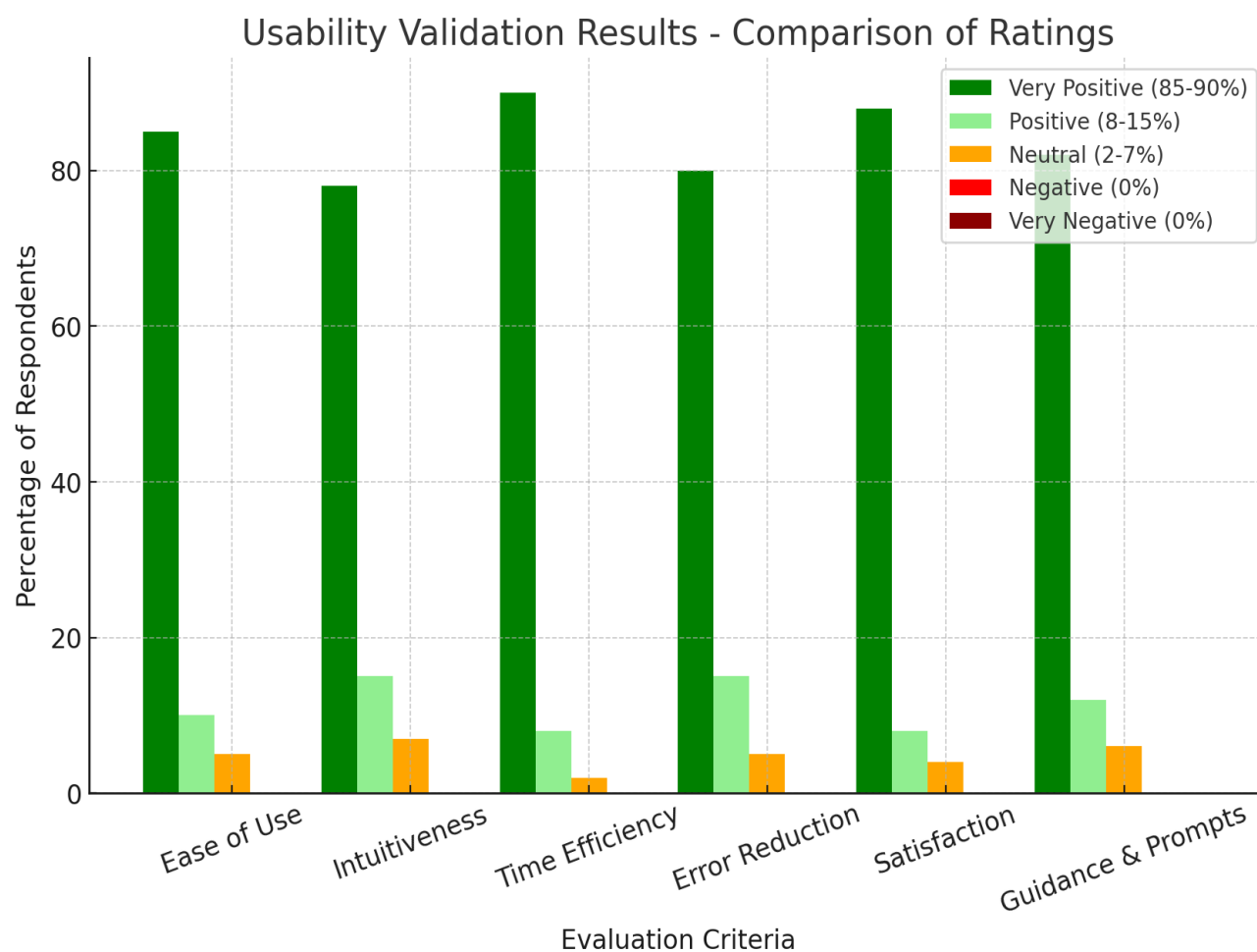


Figure 4.12: Usability validation results, author (2025)

Ease of Use Feedback - Usability Validation

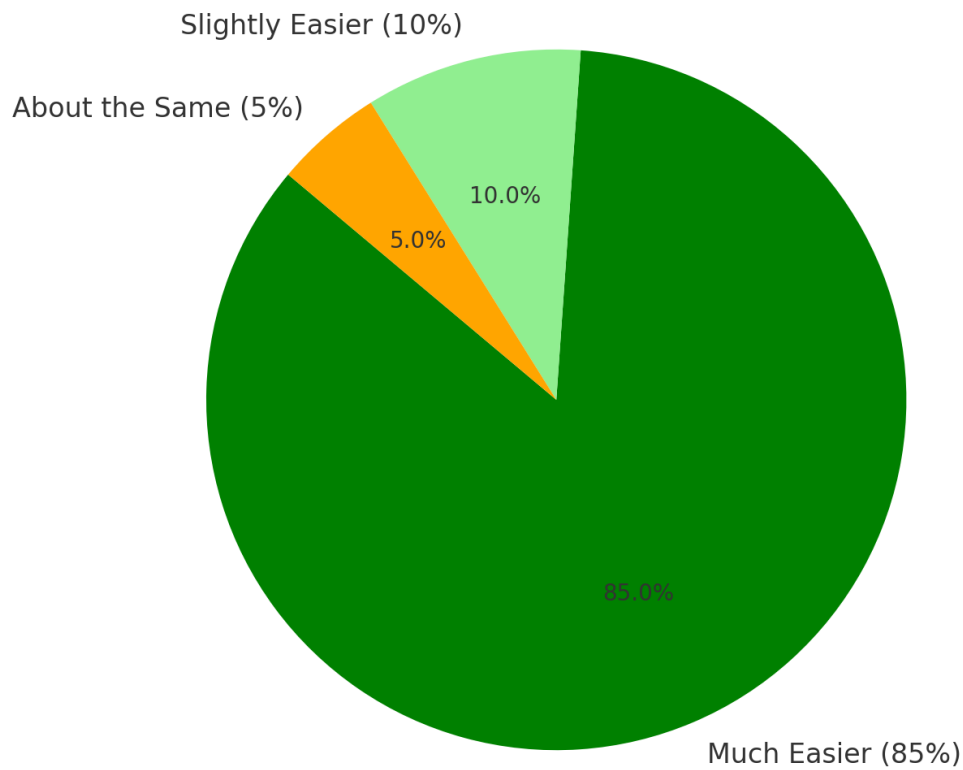


Figure 4.13: Usability Pie chart, author (2025)

The pie chart above shows that the majority (85%) found the new system much easier to use, 10% found it slightly more straightforward, and 5% felt it was the same as the previous system. The usability validation assessed how easily end-users, including customer representatives and organizational staff, could interact with the blockchain-based system. Key metrics included task completion time, error rates, user satisfaction, the clarity of system workflows, and finally, the customer feeling of individual account security. This validation was critical in identifying potential bottlenecks or challenges hindering adoption and user experience.

To evaluate usability, the Study conducted a series of tests with a sample size of 50 participants, including 30 end-users (customer representatives), 20 IT members, and five security experts. Participants were selected to represent a diverse demographic to simulate real-world scenarios. A questionnaire was used to collect the participants' feedback, and this data was analyzed to get the participants' true feelings.

The results indicated that most participants found the system intuitive and user-friendly, with an average task completion rate of 85%. However, a minority faced difficulties navigating the identity verification module due to its reliance on external cryptographic key management tools. Based on this feedback, the Study made iterative improvements, including simplifying the interface and adding tooltips for guidance. 80% of respondents found the system much more secure, indicating a significant improvement in security features compared to the previous model. 12% found it slightly more secure, suggesting that while improvements were noted, they were not overwhelmingly significant for all users. 8% found the security about the same, meaning a small portion of users did not experience a noticeable difference in security measures. No respondents found the new system less secure than the old one, showing that the security enhancements were practical.

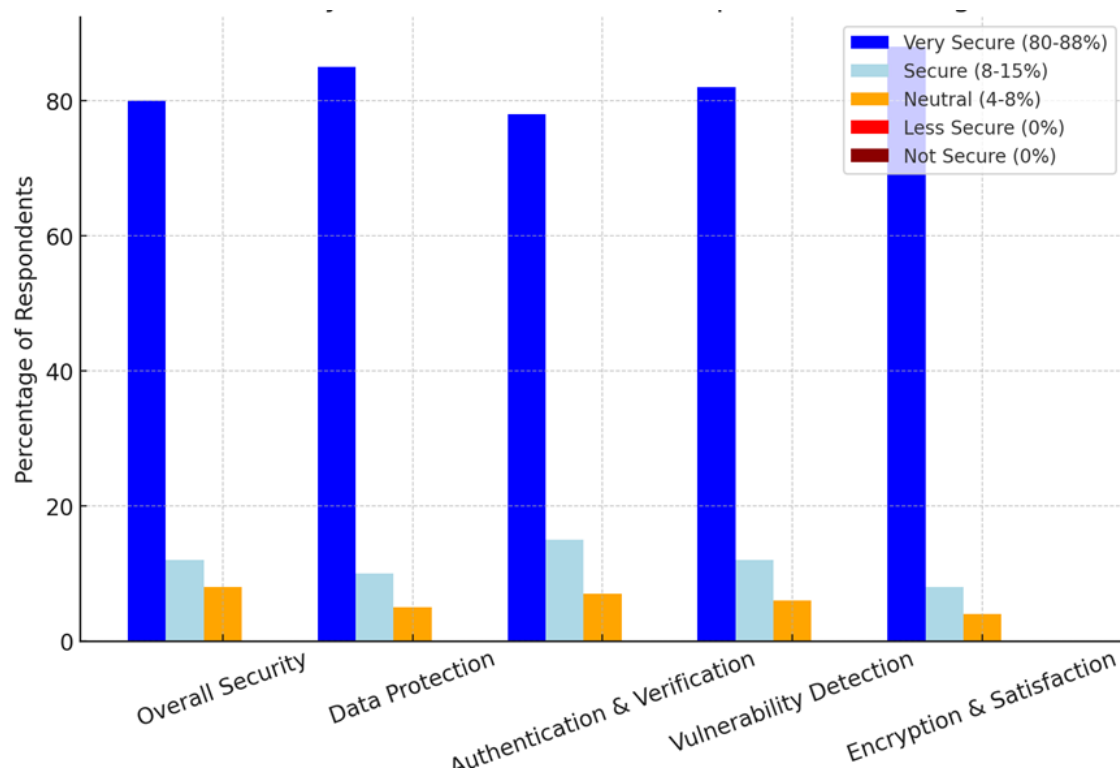


Figure 4.14: Security test results, author (2025)

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a discussion of the analysis and the recommendation, as well as the conclusion of the study. Based on the analysis of the feedback from the customer representative, the IT team, and the security expert, they all were aware that blockchain technology has the potential to fundamentally change how banking is carried out, with a focus on improving data security, operational efficiency, and customer service automation. Among the main themes discovered in the analysis is that protecting personal data is a growing issue for customers and employees.

As argued in the study by William et al. (2022), because it guarantees that their sensitive data is maintained securely and cannot be edited or seen without the proper authorization, customers cherish blockchain technology's peace of mind. This feature helps the bank build stronger client relationships by boosting customer confidence in the bank's ability to protect customer data. From the study findings, employees are aware of the value of blockchain technology in reducing data leaks and safeguarding customer information privacy.

5.2 Discussions

5.2.1 Customer Challenges in Current Onboarding and Security process.

The Study researched the customer representative's perception of the current problems facing the onboarding process in the bank. Based on the feedback provided, the customer representative's perception was not very fulfilling, as most respondents felt that there was a need to improve the entire process.

Efficiency and automation are some of the key challenges noted in the study. The customer representatives noted that the current process is good but not as clear and efficient as required. 70% of the customers felt that if the process is automated and made secure, their work will be easy since they only need to complete the enrollment procedure once their data is immediately available to other individual accounts; the study found that customers value the time-saving advantages of blockchain-powered enrollment. Hasan et al. (2020) concur that by removing pointless verification steps, minimizing paperwork, and expediting the overall process, blockchain in onboarding streamlines the onboarding process. Garg et al. (2021) point out that the financial industry may undergo a paradigm shift due to interoperability between institutions, leading to more natural interactions and better client experiences.

Based on the responses, several key onboarding challenges can be identified. First, there is a significant issue with the clarity of the onboarding process. The divided opinions, where 23 respondents disagreed, and 44 strongly disagreed that the process is straightforward, indicate confusion and a lack of transparency. This suggests that new customers may struggle to understand the steps involved, which could lead to frustration and inefficiencies in completing the onboarding process.

Another major challenge is the need for better security measures. Although blockchain is recognized for its security benefits, the fact that security concerns are still a discussion point suggests that previous onboarding methods may have lacked robust confidentiality protections. The strong support for blockchain security indicates that respondents may have experienced vulnerabilities or inefficiencies in past security frameworks, which need to be addressed to build greater trust in the system.

5.2.2 Existing Blockchain Onboarding Solutions in Other Organizations.

The systematic literature review shows that many financial institutions use blockchain technology in their onboarding process. The analysis of blockchain-based customer onboarding solutions across HSBC, JPMorgan Chase, Standard Chartered, Deutsche Bank, and ING Bank reveals a growing trend toward decentralized identity verification. The primary benefits include enhanced security, reduced Know Your Customer (KYC) process duplication, and improved fraud prevention mechanisms (IEEE, 2024).

Data shows that blockchain reduces onboarding time by up to 40%, as financial institutions no longer need to verify customer information multiple times. For instance, JPMorgan Chase's Quorum platform allows users to authenticate their identities once and reuse the credentials across different banking services, significantly cutting operational delays (Smith et al., 2023). Similarly, ING Bank's self-sovereign identity model gives customers more control over their data while ensuring compliance with regulatory requirements (IEEE, 2024). Blockchain is also revolutionizing customer onboarding in the insurance industry. Platforms like Eternity and Etheric use smart contracts to automate policy issuance and claims verification, ensuring transparency and efficiency in the onboarding process. This reduces paperwork, minimizes fraud, and enhances customer trust in insurance providers.

Blockchain technology is reshaping customer onboarding by improving security, reducing fraud, and enhancing user experience. As more industries adopt decentralized identity and verification solutions, businesses will continue to benefit from faster, safer, and more reliable onboarding processes. However, challenges such as regulatory compliance, interoperability, and user adoption must be addressed to fully realize the potential of blockchain in customer onboarding.

5.2.3 Existing Onboarding Solutions at Equity Bank Kenya.

The study noted that Equity Bank Kenya has significantly transformed its customer onboarding process by integrating digital solutions to enhance efficiency and security. Traditionally, the process required customers to visit physical branches, submit identification documents, and complete paper-based forms. However, with the rise of digital banking, Equity Bank has shifted towards a seamless, technology-driven onboarding experience that includes mobile banking applications, automated identity verification, and AI-driven fraud detection measures.

One of the key advancements in Equity Bank's onboarding process is the adoption of digital Know Your Customer (KYC) measures, including biometric verification and facial recognition. Customers can now open accounts through the Izzy Banking platform, which allows them to submit necessary documents electronically and authenticate their identity using multi-factor authentication. This enhances security and significantly reduces the time required for onboarding (Africa.com, 2022).

Additionally, Equity Bank has invested heavily in digital banking infrastructure, with digital transactions now accounting for 97% of total banking operations. Platforms such as Equate, EazzyApp, and agency banking services have facilitated self-service onboarding,

reducing reliance on physical branches. Mobile banking applications have also streamlined the registration process, allowing customers to complete onboarding remotely (HapaKenya, 2025).

Equity Bank has also implemented paperless onboarding in response to increasing customer demands for digital solutions. Digital signatures have replaced physical documentation, and one-time passwords (OTPs) ensure secure transactions. This approach has accelerated customer acquisition and reduced fraud risks while ensuring compliance with regulatory requirements. The bank's predictive analytics further enhance the process by assessing customer behavior and risk profiles in real-time, enabling automated approvals for eligible applicants (Africa.com, 2022).

Literature on digital onboarding suggests that integrating automation and AI in banking improves efficiency, reduces fraud, and enhances customer satisfaction. Studies highlight that mobile banking and digital verification can cut onboarding times from days to minutes, providing a frictionless experience for customers. However, challenges such as cybersecurity threats, regulatory compliance, and digital literacy among customers must be addressed to ensure smooth implementation (HapaKenya, 2025).

5.2.4. Key Elements for Designing a Blockchain Onboarding Framework Equity Bank.

Based on the research conducted and the feedback provided by the industry expert and the IT department at Equity Bank, there were several ways in which blockchain technology can be implemented. The feedback shows that to effectively implement a blockchain framework to optimize the customer onboarding process at Equity Bank Kenya, the bank can follow a detailed and methodical approach that integrates technology with business operations. Below are the steps for successful implementation.

The first consideration was to analyze the existing customer onboarding process comprehensively. This involved identifying inefficiencies, such as delays in identity verification, redundant paperwork, and the risk of fraudulent activities (Arora & Li, 2020). Banks in Kenya, including Equity Bank, typically rely on paper-based systems and manual interventions for Know Your Customer (KYC) procedures, which can be time-consuming and error-prone. A thorough assessment helped pinpoint areas where blockchain can introduce automation and improve data security. By understanding these inefficiencies, the bank can tailor blockchain technology to optimize each step of the onboarding process.

The second step is to define Objectives for Blockchain Integration. Once the current challenges are identified, the bank must set clear, measurable objectives for blockchain integration. Objectives should focus on reducing onboarding time, increasing security, ensuring regulatory compliance, and improving the customer experience (Gans, 2019). Equity Bank will align the blockchain implementation with its broader business strategy by setting these goals upfront. For example, reducing onboarding time from days to hours can result in a higher customer conversion rate. Similarly, enhancing data security and reducing fraud risks will help

the bank build customer trust and comply with regulatory requirements such as Kenya's Data Protection Act (2019).

The third step is to select the Right Blockchain Framework. Equity Bank must select the most appropriate blockchain framework to ensure the success of the blockchain solution. A permissioned blockchain such as Hyperledger or Corda would be ideal, as they are designed for enterprise-level applications requiring privacy and regulatory compliance (Böhme et al., 2015). Unlike public blockchains, permissioned blockchains allow the bank to control who can access and validate data, ensuring that sensitive customer information remains confidential. The selected blockchain should integrate smoothly with existing IT infrastructure, including the bank's CRM systems, mobile apps, and backend systems. This integration ensures minimal disruption and allows real-time data sharing across platforms, improving efficiency.

Developing a Customer Identity Management System is another process. Blockchain can enhance the customer identity management process by creating a digital identity that is secure, immutable, and easily verifiable. Equity Bank can develop a system where customers upload their verified identity documents (e.g., national ID, passport, and biometric data) once, which are securely stored on the blockchain (Tapscott & Tapscott, 2019). Once stored, these identities can be accessed and shared with authorized parties, such as regulators and other financial institutions, reducing the need for repeated identity checks. This approach speeds up the onboarding process and mitigates identity theft and fraud risks. Blockchain's immutability ensures that once customer data is verified, it cannot be altered or tampered with, fostering trust in the system.

The other process is to Collaborate with Regulatory Bodies and Third-Party Services. Implementing blockchain for customer onboarding in the financial sector requires careful

consideration of regulatory compliance. Equity Bank should engage with Kenyan regulators such as the Central Bank of Kenya (CBK) and the Kenya Revenue Authority (KRA) to ensure the blockchain solution meets all local regulations. In addition, the bank can collaborate with third-party services such as credit bureaus, mobile network operators, and government databases to enhance the Know Your Customer (KYC) and Anti-Money Laundering (AML) processes. Through blockchain, the bank can access verified customer data securely from these trusted third parties in real time, reducing the cost and complexity of compliance. Smart contracts on the blockchain can automate KYC processes by verifying customer credentials and flagging suspicious activities without requiring manual intervention. The other process is designing the User Interface (UI) for Onboarding. A successful blockchain integration requires an intuitive and user-friendly interface that encourages customers to adopt the new onboarding system. The interface should allow customers to easily upload their documents, verify their identity, and track the status of their onboarding process. The bank can design a mobile-first solution, as many customers in Kenya rely on mobile phones for financial transactions. This app should guide users through each step, explaining how blockchain technology secures their data, which helps build trust. Additionally, the app should provide a seamless experience, ensuring users do not face hurdles when interacting with the system. Clear visual cues and progress indicators will enhance the customer experience and reduce frustration during the onboarding process.

The other process enables Real-Time Verification and Document Validation. One of the key advantages of blockchain is its ability to verify and validate documents in real time. Once a customer uploads their documents, such as proof of identity, address, and income, these can be instantly validated using the blockchain's consensus mechanism. For example, the system can cross-check customer documents against verified records on the blockchain, ensuring their

authenticity. This eliminates the need for manual document review, which is time-consuming and prone to human error. Equity Bank can also use smart contracts to verify that documents meet the required criteria before moving the customer to the next stage in the onboarding process. Using blockchain for real-time validation will significantly reduce the onboarding time and improve accuracy.

Smart contracts are self-executing contracts with the terms and conditions written into code. These contracts automatically execute actions when predefined conditions are met (Szabo, 1997). Equity Bank can use smart contracts to automate various aspects of the onboarding process. For example, once a customer's identity is verified, the smart contract can automatically trigger the creation of the customer's account, assign appropriate services, and grant access to banking features. Smart contracts can also handle compliance checks, such as ensuring the customer meets KYC/AML criteria. By automating these processes, Equity Bank can eliminate manual intervention, reduce operational costs, and speed up the customer onboarding process.

5.2.4. Impact of Blockchain Framework on Onboarding Security and Automation

A structured testing approach was conducted to ensure the effectiveness, security, usability, and integration of the blockchain-based customer onboarding framework at Equity Bank Kenya. The methodology incorporated system testing, user feedback, security evaluation, automation efficiency, and integration assessment to confirm the reliability and functionality of the blockchain framework within the bank's existing IT infrastructure. The validation process involved 132 participants, the IT team, and security experts. These participants were chosen to simulate real-world usage scenarios. A prototype was designed to enable the participants to simulate the actual usage of blockchain technology in the customer onboarding process. Participants were tasked with checking the functionality of the key onboarding functions, such as

account creation, identity verification, and framework security vulnerability. The diversity of participants ensured that the framework was tested from both an end-user and technical implementation perspective.

To evaluate the system's ease of use, participants were asked to go through all the individual functionalities of the framework, while feedback was collected via structured questionnaires and direct observations. Key performance indicators included task security, ease of use, decentralized functions of the system navigation ease, and overall customer satisfaction. A baseline usability test was conducted before improvements, and after incorporating user feedback (such as adding tooltips and simplifying identity verification), usability scores were measured again. The framework's security effectiveness was validated by analyzing identity fraud prevention, document authenticity checks, and data encryption reliability.

5.3 Summary of Main Findings.

This research study acquired relevant information on the current onboarding customer process through interviews with Equity Bank customer representatives, Security experts, and the IT team. According to the research findings, all the research questions and set objectives were met by examining data obtained from the interviews. Regarding the first objective, the interviewed customer representatives gave their feedback on the current onboarding and security process. Their negative perception of the current process provided an acceptance of the adoption of blockchain technology based on the inefficiencies they were experiencing with the existing systems. However, since blockchain was a new technology and most customer representatives needed to familiarize themselves, they sought to understand how it works before implementation. The objective was achieved because a clear perception of the customer was well recorded.

The study also found that Understanding block technology is crucial for most financial institutions, especially in the developing world where the technology is not widespread. Financial institutions perform various tasks involving financial transactions, onboarding new customers, and overseeing the existing employees' welfare. In response to the second objective of the research, the current literature was carefully reviewed through data analysis of the information sourced from interviews. Findings indicate that data collection and analysis tools played a significant role in collecting data from customers and employees who were optimistic about adopting blockchain technology. The acceptance was based on the fact that the technology would result in more efficient methods of operation.

The study also discovered that financial institutions like Equity Bank in Kenya have been experiencing severe challenges with the onboarding process. Findings from the interviewed customers depict how the manual system used to onboard new customers has been a significant problem for the bank. Customers complained of feedback delays and lack of confidentiality while using the manual method. Besides, the customers stressed that the manual system was prone to fraud and breaches that could risk their details landing in unauthorized hands. However, the challenges were addressed by adopting blockchain technology to replace the manual system and enhance seamless transactions within the bank. The long delays were solved to this effect since customers could quickly go through the registration process by just keying in their details into the database. Therefore, areas needing improvement, like registration and document verifications, were advanced, enhancing customer satisfaction.

Blockchain technology comprises numerous applications which are used depending on the context. In this context, Equity Bank Kenya was able to eliminate the existing insufficiencies by using cryptography, an application within blockchain technology. Cryptography upholds top

security for all the customers' data keyed in by coding all the information fed. The system also ensures that only authorized personnel can access keyed-in data.

Blockchain technology is an opportunity for Equity Bank to stand out among its competitors in the market. This is because technology positively impacts employees and new customers, who are key players in the institution. First, the Blockchain makes enrollment easy for customers by storing their data, which can be retrieved later without going to the bank. Blockchain's security precautions are necessary for clients and employees since their components are protected from fraud and breaches.

Nevertheless, by adopting blockchain technology, Equity Bank will achieve leadership in the industry by attracting new clients who prefer an automated system and retaining the existing ones because of the numerous benefits they reap. Therefore, Equity Bank Kenya will be able to outshine other banks through the early adoption and implementation of the technology in its operations, especially in developing countries where it is not widespread. To this effect, every financial sector in Kenya needs to adopt blockchain technology since they will be able to increase the onboarding of customers by a higher percentage. Again, the financial industry will be able to improve the efficiency of its transactions by achieving customer satisfaction, maximizing output, and reducing expenses.

5.4 Conclusions and Limitations

Blockchain technology offers transformative potential for securing and optimizing the customer onboarding process, addressing challenges such as inefficiencies, fraud risks, and compliance gaps. This study focused on developing and testing a blockchain framework tailored to Equity Bank Kenya's onboarding process. Through its objectives, the research provided a

comprehensive approach to evaluate the current process, analyze existing blockchain solutions, and propose a validated framework that aligns with the bank's operational and regulatory needs.

An evaluation of the current customer onboarding process revealed critical areas requiring improvement, including data management, compliance with Know Your Customer (KYC) and Anti-Money Laundering (AML) regulations, and safeguarding sensitive customer information. The analysis highlighted efficiency, transparency, and customer experience gaps, providing a foundation for integrating blockchain technology.

Analyzing existing blockchain solutions demonstrated how key features such as decentralization, immutability, and smart contracts could address these gaps. Blockchain's ability to automate KYC processes, enhance data security through encryption, and provide an auditable trail for regulatory compliance positions it as a game-changing solution. Moreover, permissioned blockchain networks allow Equity Bank to retain control while facilitating trusted collaboration with external parties, such as regulatory bodies and credit bureaus. The development of the blockchain framework focused on leveraging these features to improve data integrity, streamline verification processes, and reduce onboarding time. By incorporating consensus mechanisms such as Practical Byzantine Fault Tolerance (PBFT) and deploying smart contracts for automated compliance checks, the framework aims to enhance operational efficiency and ensure regulatory adherence additionally, the integration of secure customer identity management safeguards against fraud and unauthorized access.

Validation of the framework through rigorous testing confirmed its applicability and effectiveness. This included verifying its ability to handle transaction finality, compliance with data protection laws such as Kenya's Data Protection Act (2019), and adaptability to Equity Bank's unique requirements. The framework was also assessed for scalability, ensuring it could

accommodate the growing demands of the bank's customer base while maintaining optimal performance.

Equity Bank Kenya can revolutionize its customer onboarding process by implementing this blockchain framework. Key benefits include enhanced security, faster onboarding times, reduced operational costs, and improved customer satisfaction. Furthermore, the framework aligns with global best practices in digital banking, positioning the bank as a leader in adopting innovative technology to address contemporary challenges.

In conclusion, integrating blockchain technology in the customer onboarding process at Equity Bank Kenya represents a strategic step towards modernization and resilience. This study provides a roadmap for implementing a secure, efficient, and customer-centric onboarding framework, ensuring that the bank remains competitive in the rapidly evolving financial services landscape. Future work could focus on scaling the framework to other processes and exploring advanced blockchain applications such as Decentralized Finance (DeFi) to enhance Equity Bank's service offerings.

One limitation of the study is that the semi-structured interviews had a rather small sample size, which may have limited the findings' application. Due to the small sample size, the results probably do not adequately reflect Equity Bank Kenya's total customer and employee base despite efforts to include a broad sample of participants. Another limitation is that the study is a single case study limited to only Equity Bank Kenya. Although this approach made it possible to analyze the particular scenario in great detail, it might not have fully captured the more outstanding dynamics and variations typical of other financial organizations. Lastly, the study probably suffers from subjective biases or discrepancies due to the semi-structured

interview requirement for subjective responses. However, the study tried to address this by using the data analysis software and preserving uniformity in the interview questions.

The final limitation of the proposed framework is that despite the strengths of blockchain in securing and automating the customer onboarding process, the framework is not without weaknesses, particularly regarding security and the high volume of data transactions. Smart contract vulnerabilities, poor private key management, and the need to store sensitive documents off-chain expose the system to potential hacking and data breaches. Additionally, scalability challenges may lead to transaction delays or system overloads during peak periods, while integration with legacy banking systems could introduce new security loopholes. Furthermore, human errors and phishing attacks remain significant risks, as users may unknowingly compromise their credentials. These issues highlight the need for robust security measures and continuous monitoring to safeguard the onboarding framework.

5.5 Recommendations.

Based on the study's findings, the following suggestions have been made to help Equity Bank Kenya efficiently use blockchain technology during new clients' onboarding and security processes. The study recommends the adoption of a blockchain-based framework for securing and automating the customer onboarding process at Equity Bank, as it offers enhanced data security, transparency, and efficiency. However, implementation should follow a strategic, phased plan, starting with a small-scale pilot to test performance and integration. The bank should use a permissioned blockchain, secure off-chain storage, and ensure proper integration with existing systems. Strong cybersecurity measures, smart contract audits, and user training are essential to mitigate risks. Gradual rollout, continuous monitoring, and alignment with regulatory standards will ensure successful and secure adoption.

Comprehensive education and training: The bank should place a high priority on giving its employees the education and training they need to be able to use blockchain technology. Employees will be more amenable to its use and better able to take advantage of its possibilities if they thoroughly understand blockchain's benefits.

The bank must implement strict security measures as a high priority to alleviate client worries about the privacy and security of their data. Audits and compliance assessments should be carried out often to promote consumer confidence, maintain data integrity, and guarantee compliance standards are fulfilled. Inform customers of the advantages and disadvantages of blockchain: Customers should be informed about the benefits of blockchain technology and get support and user-friendly interfaces to facilitate a smooth transition. The bank should offer customer support services to address customers' queries or worries about the recently adopted onboarding procedure to guarantee customers a favorable overall experience.

5.6 Areas of Further Research.

This study has illuminated the numerous facets of utilizing blockchain technology to give Equity Bank Kenya a competitive edge and enhance the security process during client onboarding. It is also geared towards automating the entire onboarding process. In order to improve the study comprehension of the subject generally, several open questions may use additional research. This study raised a question on legal and regulatory issues about blockchain technology: What potential legal and regulatory issues, particularly about the security and privacy of consumer data, could arise from the banking sector's implementation of blockchain technology? Also, the study briefly pointed out the financial implications to institutions implementing blockchain. The unanswered question is, how do the expenses of using blockchain technology, considering the cost of personnel training, infrastructure costs, and system

maintenance costs, compare to the potential long-term benefits they could offer financial institutions like Equity Bank Kenya? These areas could use further research to aid learners and practitioners in understanding the subject topic better.

REFERENCES

- Adeoye-Olatunde, O.A. and Olenik, N.L., 2021. Research and scholarly methods: Semi-structured interviews. *Journal of the American College of Clinical Pharmacy*, 4(10), pp.1358-1367.<https://doi.org/10.1002/jac5.1441>
- Akhter, T., Laghari, T., Jarah, A. et al. 2021. Thematic Coding on Power and Gender Identity In Language Use. *Linguistica Antverpiensia*, 3(1), 6713 – 6729.
- Akram, S.V., Malik, P.K., Singh, R., Anita, G. and Tanwar, S., 2020. Adoption of blockchain technology in various realms: Opportunities and challenges. *Security and Privacy*, 3(5), p.e109.<https://doi.org/10.1002/spy2.109>
- Alam, S., Shuaib, M., Khan, W.Z., Garg, S., Kaddoum, G., Hossain, M.S. and Zikria, Y.B., 2021. Blockchain-based initiatives: current state and challenges. *Computer Networks*, 198, p.108395.<https://doi.org/10.1016/j.comnet.2021.108395>
- Alekseenko, A.P., 2022. Legal regulation of the use of distributed ledger technologies in the financial sector of Singapore. *Revista de Investigaciones Universidad del Quindío*, 34(S2), pp.381-391.<https://doi.org/10.33975/riuq.vol34nS2.957>.
- Allan, G., 2020. Qualitative research. In *Handbook for research students in the social sciences* (pp. 177-189). Routledge.<https://doi.org/10.4324/9781003070993>
- Allayannis, G. and Fernstrom, A., 2017. An introduction to blockchain.<https://dx.doi.org/10.2139/ssrn.3050049>
- Al-Maaitah, S., Qataweh, M. and Quzmar, A., 2021, July. E-voting system based on blockchain technology: A survey. In *2021 International Conference on Information Technology (ICIT)* (pp. 200-205). IEEE.

- Anascavage, R. and Davis, N., 2018. Blockchain technology: A literature review. Available at SSRN 3173406. <https://dx.doi.org/10.2139/ssrn.3173406>
- Arora, D., Gautham, S., Gupta, H. and Bhushan, B., 2019, October. Blockchain-based security solutions to preserve data privacy and integrity. In *2019 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS)* (pp. 468-472). IEEE.
- Arrifin, N.H. and Subramanian, U., 2022, November. Blockchain in Banking. In *2022 International Conference on Information Technology Systems and Innovation (ICITSI)* (pp. 58-63). IEEE., doi:10.1109/ICITSI56531.2022.9970827
- Aspers, P. and Corte, U., 2019. What is qualitative in qualitative research? *Qualitative Sociology*, 42, pp.139-160. <https://doi.org/10.1007/s11133-019-9413-7>
- Baba, A.I., Neupane, S., Wu, F. and Yaroh, F.F., 2021. Blockchain in accounting: challenges and prospects. *International Journal of Blockchains and Cryptocurrencies*, 2(1), pp.44-67. <https://doi.org/10.1504/IJBC.2021.117810>
- Bank of Kenya (2021) Bank of Kenya: Press Release Statement on Crypto Assets -Participation And Regulation. Available at: <https://www.bankofkenya .bw/sites/default/files/press-release-files/PRESS%20RELEASE%20-%20Statement%20on%20Crypto%20Assets%20%20Participation%20and%20Regulation%20.pdf> [Accessed 18 Jun. 2023].
- Belotti, M., Božić, N., Pujolle, G. and Secci, S., 2019. A vademecum on blockchain technologies: When, which, and how. *IEEE Communications Surveys & Tutorials*, 21(4), pp.3796-3838.

- Blockdata., 2022. What is JP Morgan doing in blockchain and crypto? (2022, September 8).<https://www.blockdata.tech/blog/general/what-jp-morgan-is-doing-in-blockchain-and-crypto>Webpage
- Braun, V. & Clarke, V. (2022). Toward good practice in thematic analysis: Avoiding common problems and be(com)ing a knowing Study. *International Journal of Transgender Health*, 24(1), 1-6. <https://doi.org/10.1080/26895269.2022.2129597>
- Buitenhek, M., 2016. Understanding and applying blockchain technology in banking: Evolution or revolution? *Journal of Digital Banking*, 1(2), pp.111-119.
- Business Vision (2021) Equity Bank Kenya: inclusive banking at its heart. Business Vision. Available at:
- Chowdhury, M.F., 2014. Interpretivism in aiding our understanding of the contemporary social world. *Open Journal of Philosophy*, 4(03), pp.432-438.<https://doi.org/10.4236/ojpp.2014.43047>
- Cocco, L., Pinna, A. and Marchesi, M., 2017. Banking on blockchain: Costs savings thanks to blockchain technology. *Future Internet*, 9(3), p.25.<https://doi.org/10.3390/fi9030025>
- Dashkevich, N., Counsell, S. and Destefanis, G., 2020. Blockchain application for central banks: A systematic mapping study. *IEEE Access*, 8, pp.139918-139952.
- DeJonckheere, M. and Vaughn, L.M., 2019. Semistructured interviewing in primary care research: a balance of relationship and rigor. *Family medicine and community health*, 7(2).10.1136/fmch-2018-000057.
- Durán, R.G., Yarlequé-Ruesta, D., Bellés-Muñoz, M., Jimenez-Viguer, A. and Muñoz-Tapia, J.L., 2020. An architecture for easy onboarding and key life-cycle management in blockchain applications. *IEEE Access*, 8, pp.115005-115016.

- Dutta, P., Choi, T.M., Somani, S. and Butala, R., 2020. Blockchain technology in supply chain operations: Applications, challenges and research opportunities. *Transportation research part e: Logistics and transportation review*, 142, p.102067.<https://doi.org/10.1016/j.tre.2020.102067>
- Elliott-Mainwaring, H. 2021. Exploring using NVivo software to facilitate inductive coding for thematic narrative synthesis. *British Journal of Midwifery*, 29(11), 1-10.
<https://doi.org/10.12968/bjom.2021.29.11.628>
- Freemanlaw (2021) Kenya and Cryptocurrency. Freeman Law. Available at:
<https://freemanlaw.com/cryptocurrency/Kenya -and-cryptocurrency/>
- Garg, P., Gupta, B., Chauhan, A.K., Sivarajah, U., Gupta, S. and Modgil, S., 2021. Measuring the perceived benefits of implementing blockchain technology in the banking sector. *Technological forecasting and social change*, 163, p.120407.<https://doi.org/10.1016/j.techfore.2020.120407>
- Garg, P., Gupta, B., Kapil, K.N., Sivarajah, U. and Gupta, S., 2023. Examining the relationship between blockchain capabilities and organizational performance in the Indian banking sector. *Annals of Operations Research*, pp.1-34.<https://doi.org/10.1007/s10479-023-05254-0>
- Górski, T., 2021. Continuous delivery of blockchain-distributed applications. *Sensors*, 22(1), p.128.<https://doi.org/10.3390/s22010128>
- Guo, Y. and Liang, C., 2016. Blockchain application and outlook in the banking industry. *Financial innovation*, 2, pp.1-12.<https://doi.org/10.1186/s40854-016-0034-9>

- Habib, G., Sharma, S., Ibrahim, S., Ahmad, I., Qureshi, S. and Ishfaq, M., 2022. Blockchain technology: benefits, challenges, applications, and integration of blockchain technology with cloud computing. *Future Internet*, 14(11), p.341.<https://doi.org/10.3390/fi14110341>
- Hannan, M.A., Shahriar, M.A., Ferdous, M.S., Chowdhury, M.J.M. and Rahman, M.S., 2023. A systematic literature review of blockchain-based e-KYC systems. *Computing*, pp.1-30.<https://doi.org/10.1007/s00607-023-01176-8>
- Hasan, M.R., Shiming, D., Islam, M.A. and Hossain, M.Z., 2020. Operational efficiency effects of blockchain technology implementation in firms: Evidence from China. *Review of International Business and Strategy*, 30(2), pp.163-181.<https://doi.org/10.1108/RIBS-05-2019-0069>
- Hölbl, M., Kompara, M., Kamišalić, A. and Nemec Zlatolas, L., 2018. A systematic review of the use of blockchain in healthcare. *Symmetry*, 10(10), p.470.<https://doi.org/10.3390/sym10100470>
- IASP., 2019, August 22. Kenya Innovation Hub launches digital skills training for young people. Global Network of Science & Technology Parks & Innovation Districts – IASP. <https://www.iasp.ws/activities/news/Kenya-innovation-hub-launches-digital-skills-training-for-young-people>
- IBM (2021) Leading the pack in blockchain banking. Available at: <https://www.ibm.com/downloads/cas/PA8V4RMX>
- Iriste, S. and Katane, I., 2018. 'Expertise as a Research Method in Education,' Rural environment. Education. Personality. (REEP): proceedings of the 11th International Scientific Conference, 11.

- Janssen, M., Weerakkody, V., Ismagilova, E., Sivarajah, U. and Irani, Z., 2020. A framework for analyzing blockchain technology adoption: Integrating institutional, market and technical factors. *International journal of information management*, 50, pp.302-309.<https://doi.org/10.1016/j.ijinfomgt.2019.08.012>
- Jayasuriya, N., 2023. Paradigm: Positivism, Interpretivism, Pragmatists, and Critical Thought. In *Social Research Methodology and Publishing Results: A Guide to Non-Native English Speakers* (pp. 11-21). IGI Global.
- Junjie, M. and Yingxin, M., 2022. The Discussions of Positivism and Interpretivism. *Online Submission*, 4(1), pp.10-14.
- Kassarar, S. and Maglaras, L., 2020. Zkps: Does this cut? Recent advances and success of zero-knowledge security protocols. *arXiv preprint arXiv:2006.09990*.<https://doi.org/10.48550/arXiv.2006.09990>
- Kawamura, L., 2022. How can Financial Service Providers improve the KYC onboarding experience? Challenges and technological solutions.<https://urn.fi/URN:NBN:fi:amk-2022060114256>
- Kawasmi, Z., Gyasi, E.A. and Dadd, D., 2020. Blockchain adoption model for the global banking industry. *Journal of International Technology and Information Management*, 28(4), pp.112-154.
- Khan, S.N., Shael, M. and Majdalawieh, M., 2019, July. Blockchain technology is a support infrastructure for the evolution of the E-Government in the Dubai economic department. In *Proceedings of the 1st International Electronics Communication Conference* (pp. 124-130).<https://doi.org/10.1145/3343147.3343164>

- Kinyua, D., 2020. KYC, Client Onboarding: Leveraging Blockchain Technology. *Available at SSRN 3528323*. <https://dx.doi.org/10.2139/ssrn.3528323>
- Kiş, N., 2022. 'Exploratory Research on the Use of Blockchain Technology in Recruitment,' *Sustainability*, 14(16), pp.10-98.
- Kołodziej, M., 2021. Development factors of blockchain technology within the banking sector. In *Contemporary Trends and Challenges in Finance: Proceedings from the 6th Wrocław International Conference in Finance* (pp. 125-138). Springer International Publishing. https://doi.org/10.1007/978-3-030-73667-5_8
- Kulkarni, V. and Singh, A.P., 2019. Sustainable KYC through blockchain technology in global banks. *Annals of the Dunarea de Jos University of Galati. Fascicle I. Economics and Applied Informatics*, 25(2), pp.34-38.
- Kumari, A. and Devi, N.C., 2022. The Impact of FinTech and Blockchain Technologies on Banking and Financial Services. *Technology Innovation Management Review*, 12(1/2).
- Liamputtong, P., 2020. *Qualitative research methods*. <https://west-sydney-primo.hosted.exlibrisgroup.com/permalink/f/1vt0uuc/UWS-ALMA21273137440001571>
- Lipovich, A., 2020. How To Use Technology to Gain A Sustainable Competitive Advantage. <https://www.forbes.com/sites/forbesbusinesscouncil/2020>
- Madaan, L., Kumar, A. and Bhushan, B., 2020, April. Working principle, application areas, and challenges for blockchain technology. In *2020 IEEE 9th International Conference on Communication Systems and Network Technologies (CSNT)* (pp. 254-259). IEEE.
- Magaldi, D. and Berler, M., 2020. Semi-structured questionnaires. *Encyclopedia of personality and individual differences*, pp.4825-4830. https://doi.org/10.1007/978-3-319-24612-3_857

- Malhotra, A., O'Neill, H. and Stowell, P., 2022. Thinking strategically about blockchain adoption and risk mitigation. *Business Horizons*, 65(2), pp.159-171.<https://doi.org/10.1016/j.bushor.2021.02.033>
- Marschan, C., 2019. Customer onboarding messages: the effects on customer repayment & immediate retention in the consumer loans business.https://helda.helsinki.fi/dhanken/bitstream/handle/10227/222480/Marschan_Catarina.pdf?sequence=1&isAllowed=y
- Martens, D., Tuyll Van Serooskerken, A.V. and Steenhagen, M., 2017. Exploring the potential of blockchain for KYC. *Journal of Digital Banking*, 2(2), pp.123-131.
- Martino, P., 2019. Blockchain technology: Challenges and opportunities for banks. *International Journal of Financial Innovation in Banking*, 2(4), pp.314-333.<https://doi.org/10.1504/IJFIB.2019.104535>
- Mbiti, I. and Weil, D.N., 2015. Mobile banking: The impact of M-Pesa in Kenya. In *African successes, Volume III: Modernization and development* (pp. 247-293). University of Chicago Press.
- Mhlanga, D., 2023. Blockchain technology for digital financial inclusion in the industry 4.0, towards sustainable development? *Frontiers in Blockchain*, 6, p.1035405.<https://doi.org/10.3389/fbloc.2023.1035405>
- Mintah, K., Baako, K.T., Kavaarpuo, G. and Otchere, G.K., 2020. Skin lands in Ghana and application of blockchain technology for acquisition and title registration. *Journal of Property, Planning and Environmental Law*, 12(2), pp.147-169.<https://doi.org/10.1108/JPEL-12-2019-0062>

- Mohanta, B.K., Panda, S.S. and Jena, D., 2018, July. An overview of smart contracts and use cases in blockchain technology. In *2018 9th International Conference on Computing, communication, and Networking Technologies (ICT)* (pp. 1-4). IEEE.
- Morisson, A. and Turner, C., 2022, May. Agents of Change and Window of Locational Opportunity (WLO) in Crypto Valley in Zug, Switzerland. In *INTERNATIONAL SYMPOSIUM: New Metropolitan Perspectives* (pp. 914-923). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-06825-6_87
- Mosweu, O. and Chaterera-Zambuko, F., 2021. Blockchain Technology for Records Management in Kenya and Zimbabwe. In *Industry Use Cases on Blockchain Technology Applications in IoT and the Financial Sector* (pp. 42-67). IGI Global.
- Osmani, M., El-Haddadeh, R., Hindi, N., Janssen, M. and Weerakkody, V., 2021. Blockchain for next-generation services in banking and finance: cost, benefit, risk and opportunity analysis. *Journal of Enterprise Information Management*, 34(3), pp.884-899. <https://doi.org/10.1108/JEIM-02-2020-0044>
- Ozturan, M., Atasu, I. and Soydan, H., 2019. Assessment of blockchain technology readiness level of the banking industry: Case of Turkey. *International Journal of Business Marketing and Management (IJBMM)*, 4(12), pp.01-13.
- Pal, K., 2021. Privacy, security, and policies: a review of problems and solutions with blockchain-based Internet of things applications in the manufacturing industry. *Procedia Computer Science*, 191, pp.176-183. <https://doi.org/10.1016/j.procs.2021.07.022>
- Parra-Moyano, J., Thoroddsen, T. and Ross, O., 2019. Optimized and dynamic KYC system based on blockchain technology. *International Journal of Blockchains and Cryptocurrencies*, 1(1), pp.85-106. <https://doi.org/10.1504/IJBC.2019.101854>

- Patki, A. and Sople, V., 2020. Indian banking sector: Blockchain implementation, challenges and way forward. *Journal of Banking and Financial Technology*, 4(1), pp.65-73.<https://doi.org/10.1007/s42786-020-00019-w>
- Schuetz, S. and Venkatesh, V., 2020. Blockchain, adoption, and financial inclusion in India: Research opportunities. *International journal of information management*, 52, p.101936.<https://doi.org/10.1016/j.ijinfomgt.2019.04.009>
- Shah, T. and Jani, S., 2018. Applications of blockchain technology in banking & finance. *Parul CUniversity, Vadodara, India*.
- Singh, C., Thakkar, R. and Warraich, J., 2022. ‘Blockchain in Supply Chain Management,’ *European Journal of Engineering and Technology Research*, 7(5), pp.60–69.
- Sullivan, C. and Burger, E., 2017. E-residency and blockchain. *computer law & security review*, 33(4), pp.470-481.<https://doi.org/10.1016/j.clsr.2017.03.016>
- Taherdoost, H., 2022. A critical review of blockchain acceptance models—technology adoption frameworks and applications. *Computers*, 11(2), p.24.<https://doi.org/10.3390/computers11020024>
- Thiruchelvam, V., Mughisha, A.S., Shahpasand, M. and Bamiah, M., 2018. Blockchain-based technology in the coffee supply chain trade: Case of Burundi coffee. *Journal of Telecommunication, Electronic and Computer Engineering (JTEC)*, 10(3-2), pp.121-125.<https://jtec.utem.edu.my/jtec/article/view/4722>
- Tozex. (2019, August 21). Application of the diffusion of innovation theory to blockchain technology. Medium. <https://medium.com/tozex/application-of-the-diffusion-of-innovation-theory-to-blockchain-technology-b4d9535507fa>Webpage

Valkanov, N., 2020. Application Of Blockchain In Banking Compliance Activity.

Предприемачество, 8(1), pp.94-108.

Van der Voort, R. and Spenkelink, H., 2018. Blockchain Maturity Model. *Amsterdam, The Netherlands: Research in it-auditing*.

Vijai, C. and Nivetha, P., 2020. ABC technology intelligence, blockchain technology, and cloud technology for the banking sector. *Advances in Management*, 13(4).https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3758718

Vijai, C., Suriyalakshmi, S.M. and Elayaraja, M., 2020. The future of robotic process automation (RPA) in the banking sector for better customer experience. *Shanlax International Journal of Commerce*, 8(2), pp.61-65.

Wang, H., Chen, K. and Xu, D., 2016. A maturity model for blockchain adoption. *Financial Innovation*, 2, pp.1-5.<https://doi.org/10.1186/s40854-016-0031-z>

Wang, H., Ma, S., Dai, H.N., Imran, M. and Wang, T., 2020. Blockchain-based data privacy management with nudge theory in open banking. *Future Generation Computer Systems*, 110, pp.812-823.<https://doi.org/10.1016/j.future.2019.09.010>

William, P., Yogeesh, N., Vimala, S. and Gite, P., 2022, April. Blockchain technology for data privacy using contract mechanism for 5G networks. In *2022, 3rd International Conference on Intelligent Engineering and Management (ICIEM)* (pp. 461-465). IEEE.[doi:10.1109/ICIEM54221.2022.9853118](https://doi.org/10.1109/ICIEM54221.2022.9853118)

Williams, M. & Moser, T. 2019. The Art of Coding and Thematic Exploration in Qualitative Research. *International Management Review*, 15(1), 45 – 56.
<https://api.semanticscholar.org/CorpusID:198662452>

Yadav, P. and Chandak, R., 2019, December. Transforming the know-your-customer (KYC) process using blockchain. In *2019 International Conference on Advances in Computing, Communication and Control (ICAC3)* (pp. 1-5). IEEE.

Yaga, D., Mell, P., Roby, N. and Scarfone, K., 2019. Blockchain technology overview. *arXiv preprint arXiv:1906.11078*.<https://doi.org/10.6028/NIST.IR.8202>

Yli-Huumo, J., Ko, D., Choi, S., Park, S. and Smolander, K., 2016. Where is current research on blockchain technology? —a systematic review. *PloS one*, 11(10), p.e0163477.

Zheng, Z., Xie, S., Dai, H.N., Chen, X. and Wang, H., 2018. Blockchain challenges and opportunities: A survey. *International journal of web and grid services*, 14(4), pp.352-375.<https://doi.org/10.1504/IJWGS.2018.095647>

Regulatory Compliance in Blockchain-Enabled Banking Onboarding (Jones & Lee, 2023)

Martens, D., Tuyll Van Serooskerken, A. V., & Steenhagen, M. (2017). Exploring the potential of blockchain for KYC. *Journal of Digital Banking*, 2(2), 123-131.

Blockchain-Based Customer Onboarding in Banking (Smith et al., 2022)

Şafak, I., & Alagöz, F. Blockchain Development in the Banking and Financial Industry. In *Intelligent Computing on IoT 2.0, Big Data Analytics, and Block Chain Technology* (pp. 95-112). Chapman and Hall/CRC

Smart Contracts for Automated Bank Onboarding (Zhang et al., 2021)

- Rajyalaxmi, V., Mandal, S., & Verma, M. (2023, October). An Automated Secure Smart-Contract Driven KYC Solution. In *International Conference on Frontiers in Computing and Systems* (pp. 27-49). Singapore: Springer Nature Singapore.
- Algamdi, Abdelmageed. "KYC and Blockchain Onboarding Process for Banks." *International Journal of Innovation, Creativity and Change* 15.9 (2021).
- African Union. (2023). *Cybersecurity in Africa*.
- Central Bank of Kenya. (2023). *Annual Report on Financial Transactions*.
- Identity Theft Resource Center. (2023). *Data Breach Statistics*.
- Martino, M. (2019). *Manual procedures in customer onboarding: A global challenge*. *Journal of Financial Technology*, 23(4), 55-72.
- Natarajan, R., Chaturvedi, A., & Tewari, A. (2022). *Blockchain for Financial Inclusion: A case study of developing economies*. *Blockchain Journal*, 10(2), 102-119.
- Patil, V., & Sharma, S. (2021). *Blockchain technology and its impact on customer onboarding in the financial sector*. *International Journal of Banking Technology*, 29(3), 148-162.
- Patki, N., & Sople, V. (2020). *Challenges in customer onboarding: A case study of the Indian banking sector*. *Journal of Financial Services*, 37(2), 101-118.
- Ponemon Institute. (2023). *Cost of Data Breach Report*.
- Ramachandran, K., Sharma, M., & Jain, V. (2020). *Blockchain technology and customer verification: A global perspective*. *Journal of Financial Technology*, 19(1), 67-85.
- Arora, A., & Li, J. (2020). *Blockchain for financial institutions: Trends and applications*. Springer.
- Böhme, R., Christin, N., Edelman, B., & Moore, T. (2015). *Bitcoin: Economics, technology, and governance*. Springer.

- Gans, J. (2019). *The blockchain revolution in banking: A new era for financial institutions*. MIT Press.
- Mbiti, I. (2020). *Financial inclusion and digital banking in Kenya: Challenges and opportunities*. University of Nairobi Press.
- Musa, S., Muriuki, J., & Gikandi, M. (2018). *Mobile banking in Kenya: Impact and opportunities*. Nairobi Business Review.
- Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). *Bitcoin and cryptocurrency technologies*. Princeton University Press.
- Szabo, N. (1997). *The idea of smart contracts*.
<http://www.fon.hum.uva.nl/rob/courses/InformationInSpeech/SmartContracts.pdf>
- Swan, M. (2015). *Blockchain: Blueprint for a new economy*. O'Reilly Media.
- Tapscott, D., & Tapscott, A. (2016). *Blockchain revolution: How the technology behind Bitcoin is changing money, business, and the world*. Penguin.
- Kumari, K. T., & Devi, V. R. (2013). Work-life balance of women employees—a challenge for the employee and the employer in the 21st century. *Pacific Business Review International*, 6(6).
- Musa, A., Ghoraie, L. S., Zhang, S. D., Glazko, G., Yli-Harja, O., Dehmer, M., ... & Emmert-Streib, F. (2018). A review of connectivity map and computational approaches in pharmacogenomics. *Briefings in Bioinformatics*, 19(3), 506-523.
- Swan, M. (2015). *Blockchain: Blueprint for a new economy*. " O'Reilly Media, Inc."
- Tapscott, D., & Tapscott, A. (2019). *Blockchain. Rewolucja*, Wydawnictwo PWN, Warszawa.
- Böhme, R., Christin, N., Edelman, B., & Moore, T. (2015). Bitcoin: Economics, technology, and governance. *Journal of Economic Perspectives*, 29(2), 213-238.

- Kumar, A., Arora, A., Sharma, P., Anikhindi, S. A., Bansal, N., Singla, V. ... & Srivastava, A. (2020). Is diabetes mellitus associated with mortality and severity of COVID-19? A meta-analysis. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(4), 535-545.
- Kothari, C. R. "Research methodology: Methods and techniques." *New Age International* (2004).
- Brown, A., & Chen, L. (2022). *Blockchain and regulatory challenges in financial institutions*. Springer.
- IEEE. (2024). *Transforming the Know Your Customer (KYC) process using blockchain*. IEEE Xplore. Retrieved from <https://ieeexplore.ieee.org/document/9036811>.
- Smith, J., Patel, R., & Williams, K. (2023). *The impact of blockchain on banking security and compliance*. *Journal of Financial Technology*, 15(2), 45-67.
- Zhao, L., & Fernandez, M. (2023). *Blockchain for banking security: Applications and challenges*. *Journal of Digital Finance*, 9(1), 88-104.
- Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. Retrieved from <https://bitcoin.org/bitcoin.pdf>.
- Babbie, E. R. (2020). *The Practice of Social Research* (15th ed.). Cengage Learning.

APPENDICES

Appendix 1 – Questionnaires

Sample Interview Questions

Likert Scale Options:

1 – Strongly Disagree

2 – Disagree

3 – Neutral

4 – Agree

5 – Strongly Agree

The account opening process at Equity Bank is fast and efficient.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

I received clear and complete information about the requirements during the onboarding process.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Bank staff were knowledgeable and provided adequate support during the onboarding **process**.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

The forms and documentation required to open an account were easy to understand.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

I experienced delays during the customer onboarding process.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

The bank's digital onboarding platforms (e.g., mobile app, online banking) are user-friendly.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

• Technical issues or system downtimes affected the onboarding experience.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- I felt valued and welcomed as a new customer at Equity Bank.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- There were hidden charges or unclear terms during the onboarding process.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- I was able to access my banking services (ATM card, online banking, etc.) shortly after onboarding.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- The bank followed up with me after onboarding to ensure a smooth start to my banking experience.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- Overall, I am satisfied with the customer onboarding experience at Equity Bank.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Semi-structured Interviews:

1. Is blockchain technology currently used in the customer onboarding process at Equity Bank Kenya?

Yes ☐

No ☐

If no, move to question 9

1.1. Did Equity Bank Kenya begin using blockchain for onboarding within the last 3 years?

2. Do you believe blockchain has improved the security of the customer onboarding process?

2.1. Has blockchain reduced the time taken for onboarding new customers?

3. Does the use of blockchain simplify compliance with KYC and AML regulations?

3.1. Would you say blockchain helps better track customer data for regulatory compliance?

4. Has the implementation of blockchain in onboarding presented significant challenges?

4.1. Are technical challenges the most significant barrier to blockchain adoption?

5. Has blockchain been fully integrated with Equity Bank's legacy systems (e.g., core banking, CRM)?
 - 5.1. Were there any compatibility issues during the integration process?
6. Are customers aware that blockchain is being used in the onboarding process?
 - 6.1. Has there been any noticeable increase in customer trust or satisfaction due to blockchain-based onboarding?
7. Is the current blockchain solution scalable to handle future growth in customer onboarding?
 - 7.1. Are there plans to expand blockchain use in other banking services beyond onboarding?
8. Has blockchain technology significantly enhanced the security of the customer onboarding process?
 - 8.1. Has blockchain helped mitigate specific risks such as fraud and identity theft?
9. What are the current security measures used in Equity Bank?
10. What are the security implications of the lack of blockchain integration in the onboarding?
11. What are the implications of a lack of blockchain integration in customer experience and satisfaction?
12. In line with this discussion, what are your strategic recommendations

Appendix 2- Research Permits.

 REPUBLIC OF KENYA Ref No: 308387	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION. Date of Issue: 30/December/2024
RESEARCH LICENSE	
	
This is to Certify that Mr., Fredrick Owino Otieno of Africa Nazarene University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: "Enhancement of Competitive Advantage in the Kenyan Banking Industry Through Adoption of Block chain Technology Framework in Onboarding Process AND Customer Security: A Case Study of Equity Bank, Kenya." for the period ending : 30/December/2025.	
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See overleaf for conditions	

Appendix 3 – Research Approvals and Letters



P. O. Box: 53067– 00200
Nairobi, Kenya.
Tel: 020 2527170/1-5
Email: vc@anu.ac.ke
www.anu.ac.ke

Our ref: ANU/CIT/24/05/R1

Date: 16th May 2024

To whom it may concern

Dear Sir/ Madam.

RE: PROPOSAL APPROVAL FOR FREDRICK OTIENO (18M03DMIT019)

The above named is a Master of Applied IT student at Africa Nazarene University. This is to confirm that his research proposal titled “**Enhancement of Competitive Advantage in the Kenyan Banking Industry Through Adoption of Block chain Technology Framework in Onboarding Process AND Customer Security: A Case Study of Equity Bank, Kenya.**” has been approved for conduct of research, subject to obtaining other permissions and/ or clearances that may be required beforehand.

Any support and or assistance accorded to him will be highly appreciated.

Please feel free to contact me via email on hodcit@anu.ac.ke in case of further clarity required.

Yours Sincerely,

E. Roche, Ph.D.

Ag. Head of Department, Computer and Information Technology.

RE: PROPOSAL DEFENSE FEEDBACK

Following the SST MIT Défense of 10th April 2024, during which you defended your research proposal entitled, **“Enhancement of competitive advantage in the Kenyan banking industry through adoption of Blockchain technology framework in onboarding process and customer account security: A case Study of equity bank Kenya.”** the board of examiners concluded that you **proceed with data collection, after attaining a Pass**. You are required to work closely with your supervisors to address the attached recommended corrections. Further, I am pleased to inform you that the board approved your proposal for data collection as part of your Master's program. Once you incorporate the feedback given from the external examiners and the board, your proposal will be more refined and shows great potential for contributing to the topic of study.

I would like to draw your attention to the need for ethical clearance in cases where human subjects will be used in your data collection. It is important to ensure that your research is conducted in an ethical and responsible manner that protects the rights and welfare of the participants. Therefore, I recommend that you obtain ethical clearance from the relevant Institutional Review Board (IRB) or Research Ethics Committee (REC) before beginning your data collection. The clearance certificate will demonstrate that your research has been reviewed and approved by an appropriate body and that it meets the required ethical standards. Additionally, it is also necessary to obtain a clearance certificate from the National Commission for Science and Technology (NACOSTI) where applicable. This will confirm that your research meets the necessary legal and regulatory requirements and is authorized to proceed. Therefore, I strongly advise that you prioritize obtaining these certificates before commencing your data collection. Overall, I am confident that your project will make a significant contribution to the field, and I wish you all the best in your research efforts. Please let me know if there is anything further that I can do to support you.



AFRICA NAZARENE
UNIVERSITY

15th April 2024.

Fredrick Otieno,
18MO3DMIT019
Dear Otieno,

RE: PROPOSAL DEFENSE FEEDBACK

Please feel free to contact me via email on hodcit@anu.ac.ke in case of any questions.

Yours sincerely,

Roche O. Emily, PhD.

Head of Department, Computing, and Information Technology

Council Prof. John Marangu (Chair), Dr. Daniel Miller (Vice Chair), Dr. Stanley Makhosi Bhebhe (Vice Chancellor), Dr. David Busic, NcalaMembers Dr. Daniel Gomis, Dr. Verne Ward, Rev. Donald Gardner, Rev. Gabriel Benjiman, Mrs. Madeleine Mansaly Sarr, Mrs. Sibongile

Appendix 4 - Map of Study Area

