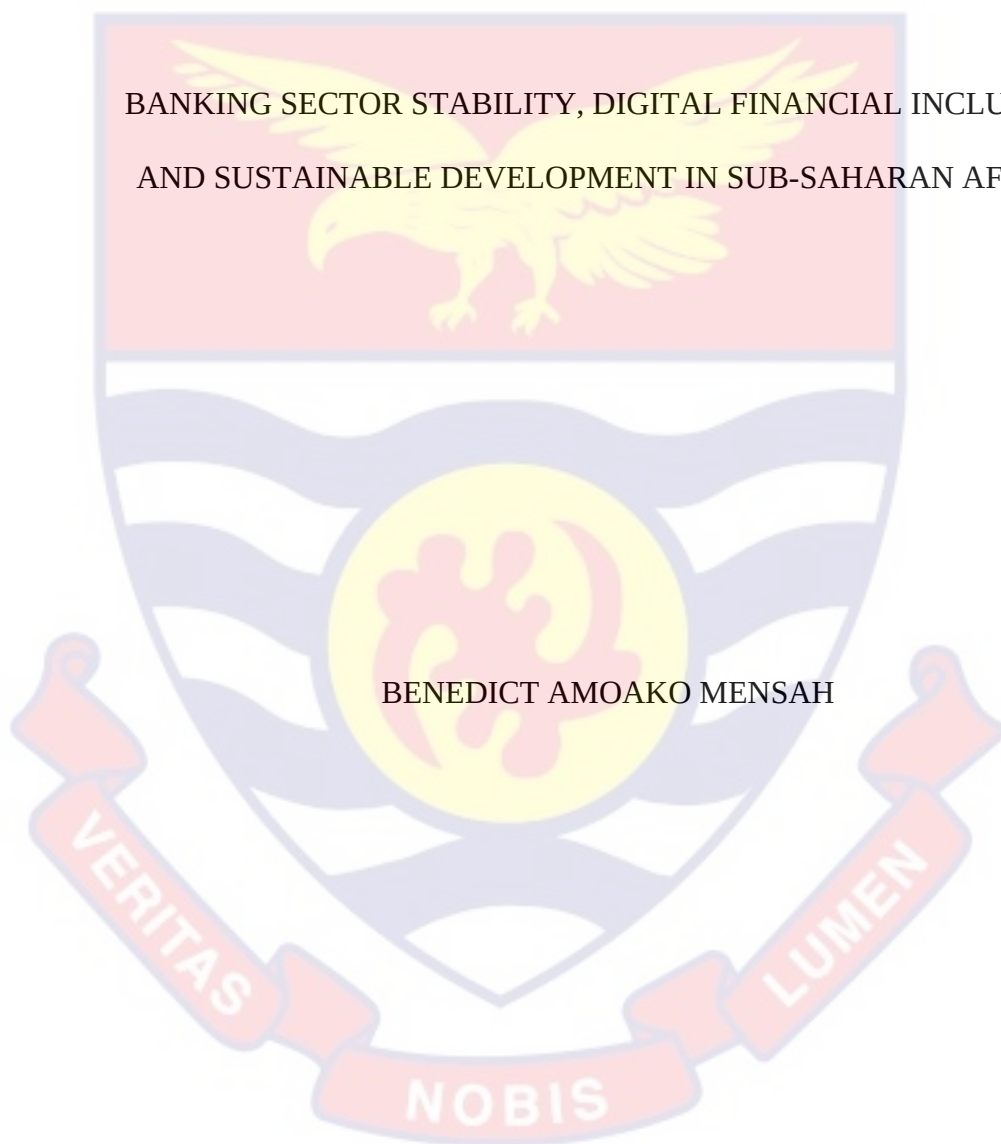


UNIVERSITY OF CAPE COAST

BANKING SECTOR STABILITY, DIGITAL FINANCIAL INCLUSION,
AND SUSTAINABLE DEVELOPMENT IN SUB-SAHARAN AFRICA

BENEDICT AMOAKO MENSAH



2024

UNIVERSITY OF CAPE COAST

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AND SUSTAINABLE DEVELOPMENT IN SUB-SAHARAN AFRICA

BY

BENEDICT AMOAKO MENSAH

Thesis submitted to the Department of Finance, School of Business, College
of Humanities and Legal Studies, University of Cape Coast in partial
fulfillment of the requirements for the award of Master of Commerce Degree
in Finance

AUGUST 2024

DECLARATION

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's signature..... Date.....

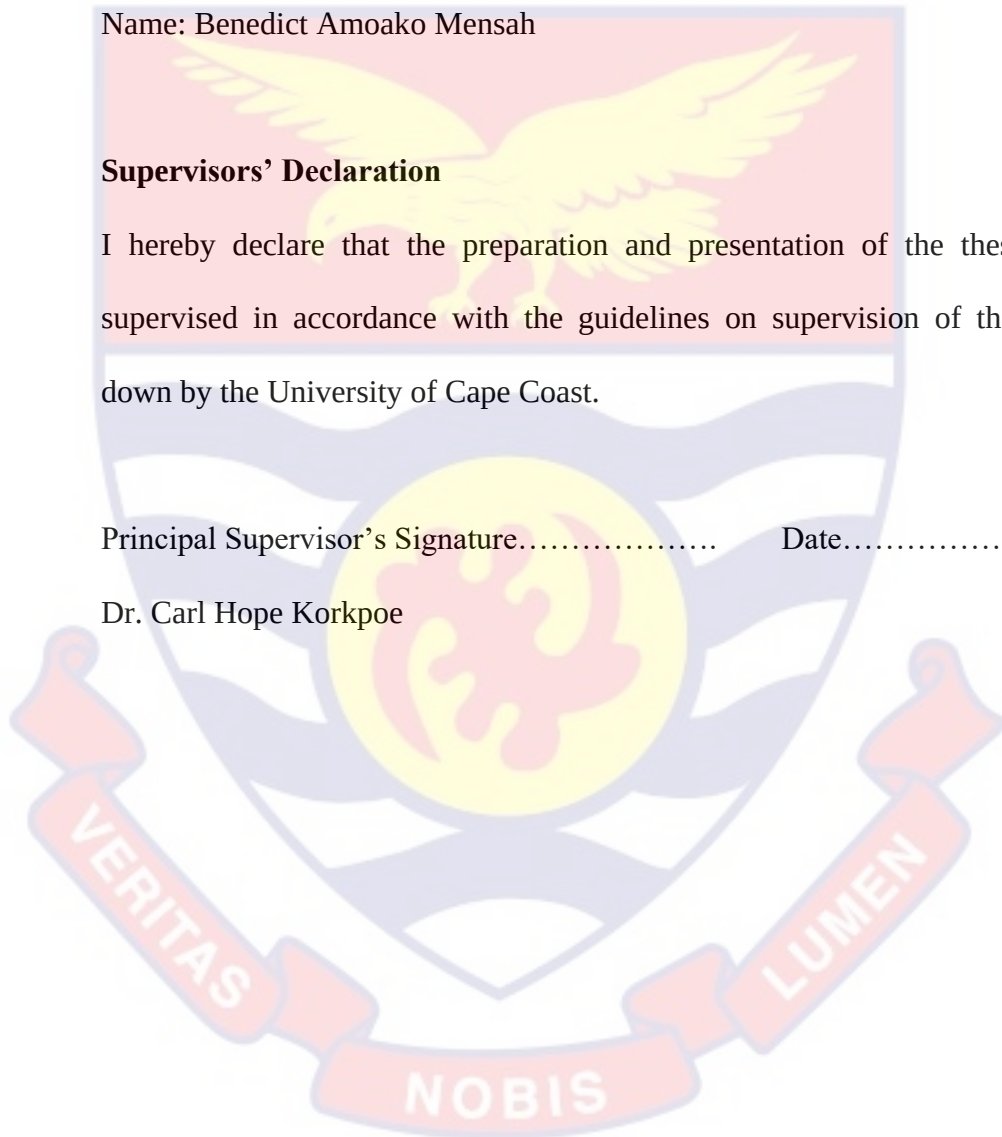
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Supervisors' Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature..... Date.....

Dr. Carl Hope Korkpoe



ABSTRACT

Despite evidence on the importance of banking sector stability and sustainable development, little is known about the role of digital financial inclusion (DFI) in the relationship between banking sector stability and sustainable development. Using panel data of 28 Sub-Sahara Africa countries (SSA) for the period 2012-2021, this study analyses the effect of banking sector stability on sustainable development in SSA as well. The study also examines the effect of digital financial inclusion on sustainable development as well as the role digital financial inclusion performs in the nexus between banking sector stability and sustainable development. The study uses Two-Step System Generalised Method of Moment technique to estimate the results with the control of inflation, research and development, political instability, inequality and real interest rate. The study discovered that banking sector stability has a significant positive and negative relationship with sustainable development, depending on the indicator used to measure stability. On various dimensions, banking sector stability had a negative influence on social sustainability, a positive impact on economic sustainability, and environmental sustainability. It was also revealed that digital financial inclusion has a significant positive link with sustainable development in SSA. Additionally, the findings revealed that DFI enhances the contribution of banking sector stability to sustainable development. The study recommends that governments and policymakers in various SSA regions prioritise strengthening banking sector regulations and promoting digital financial inclusion through investments in infrastructure, technology, education, and incentives for all stakeholders.

KEYWORDS

Financial Inclusion

Banking Sector Stability

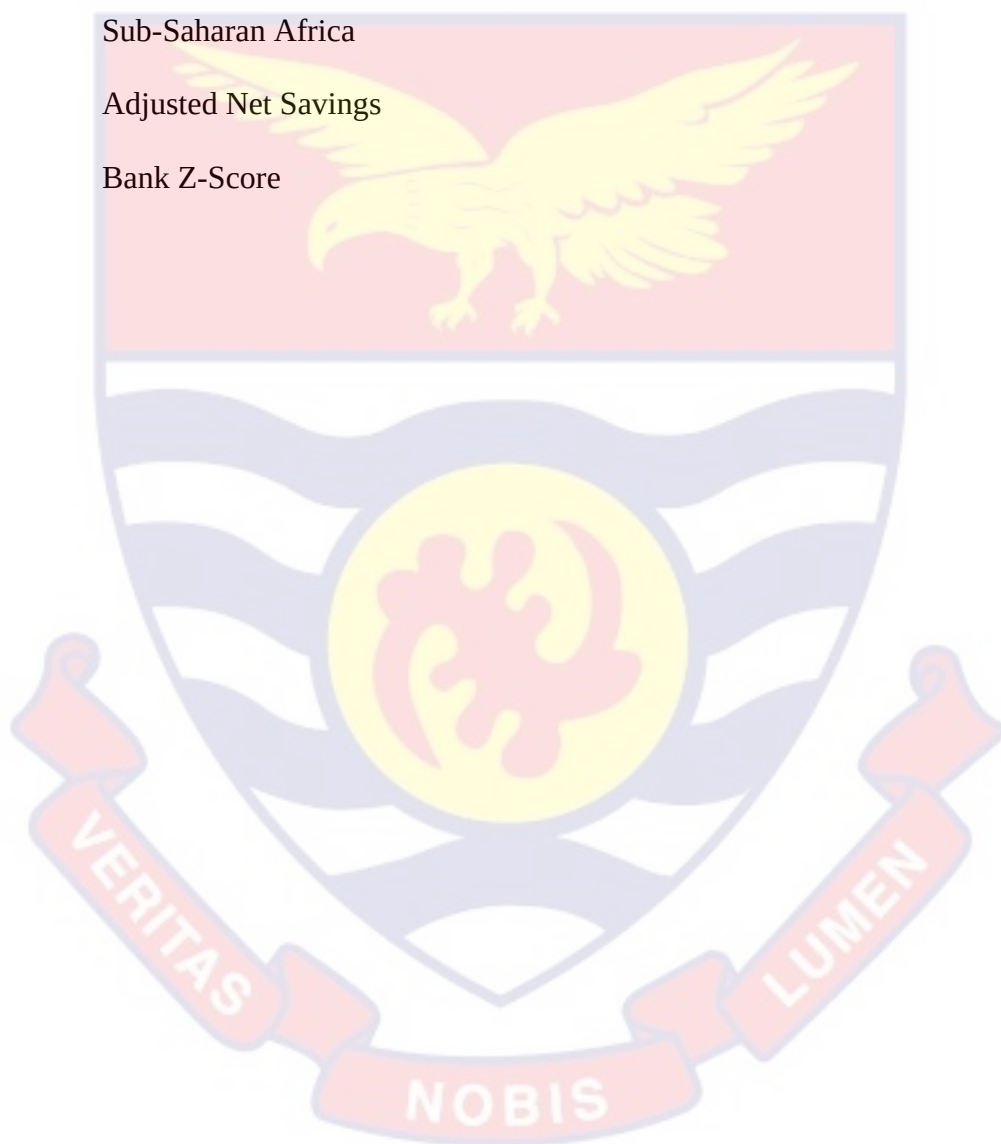
Sustainable Development

System Generalised Method of Moment

Sub-Saharan Africa

Adjusted Net Savings

Bank Z-Score

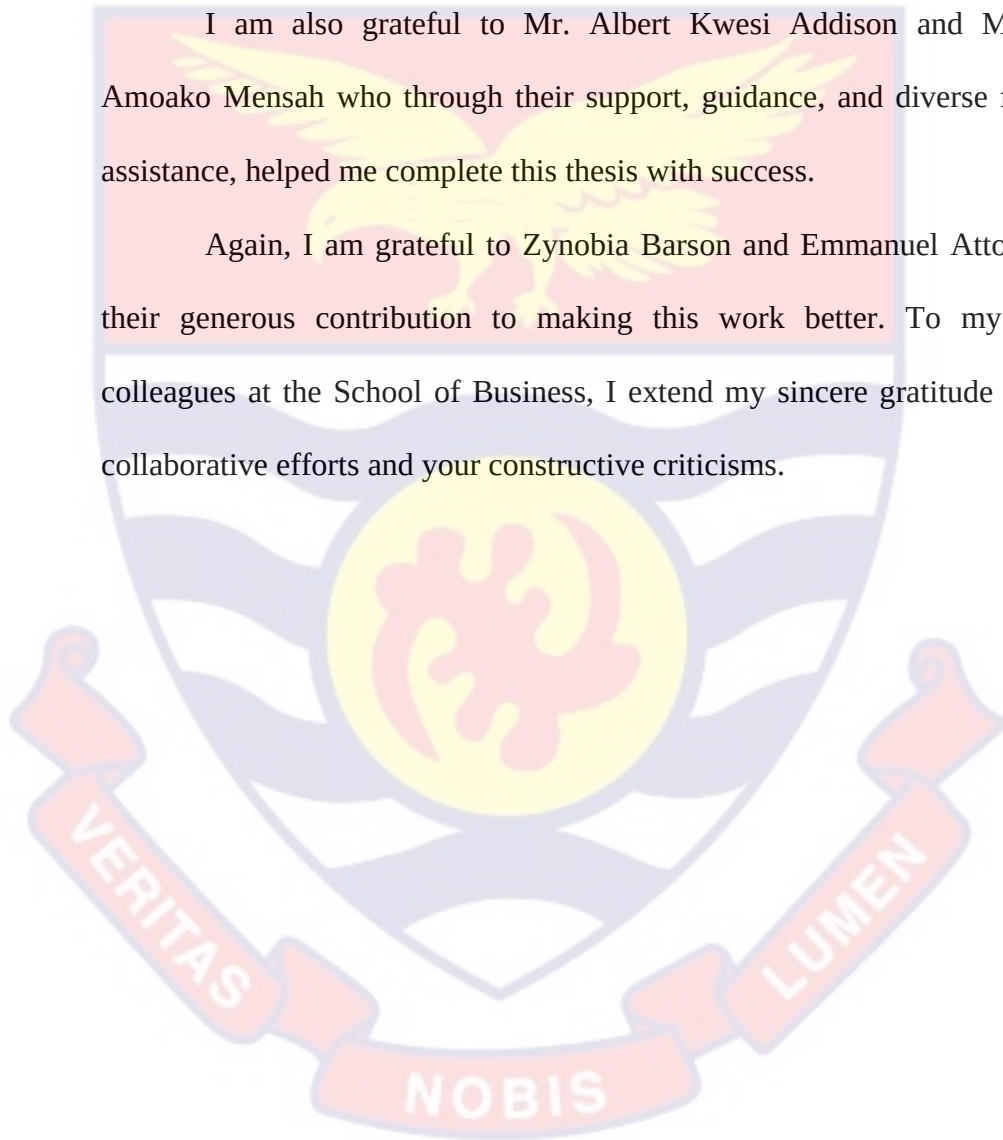


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DEDICATION

To my twin sister, Benedicta Amoako Mensah



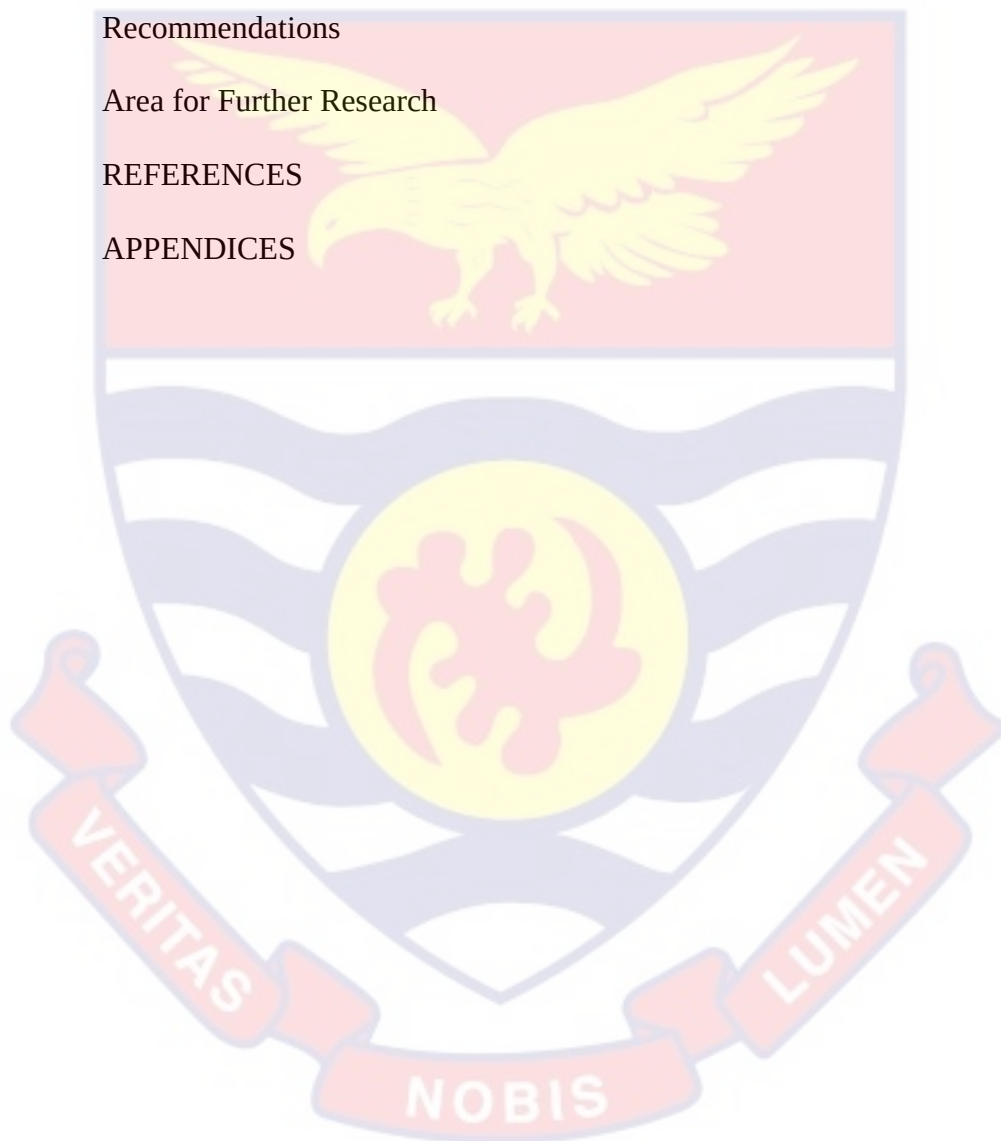
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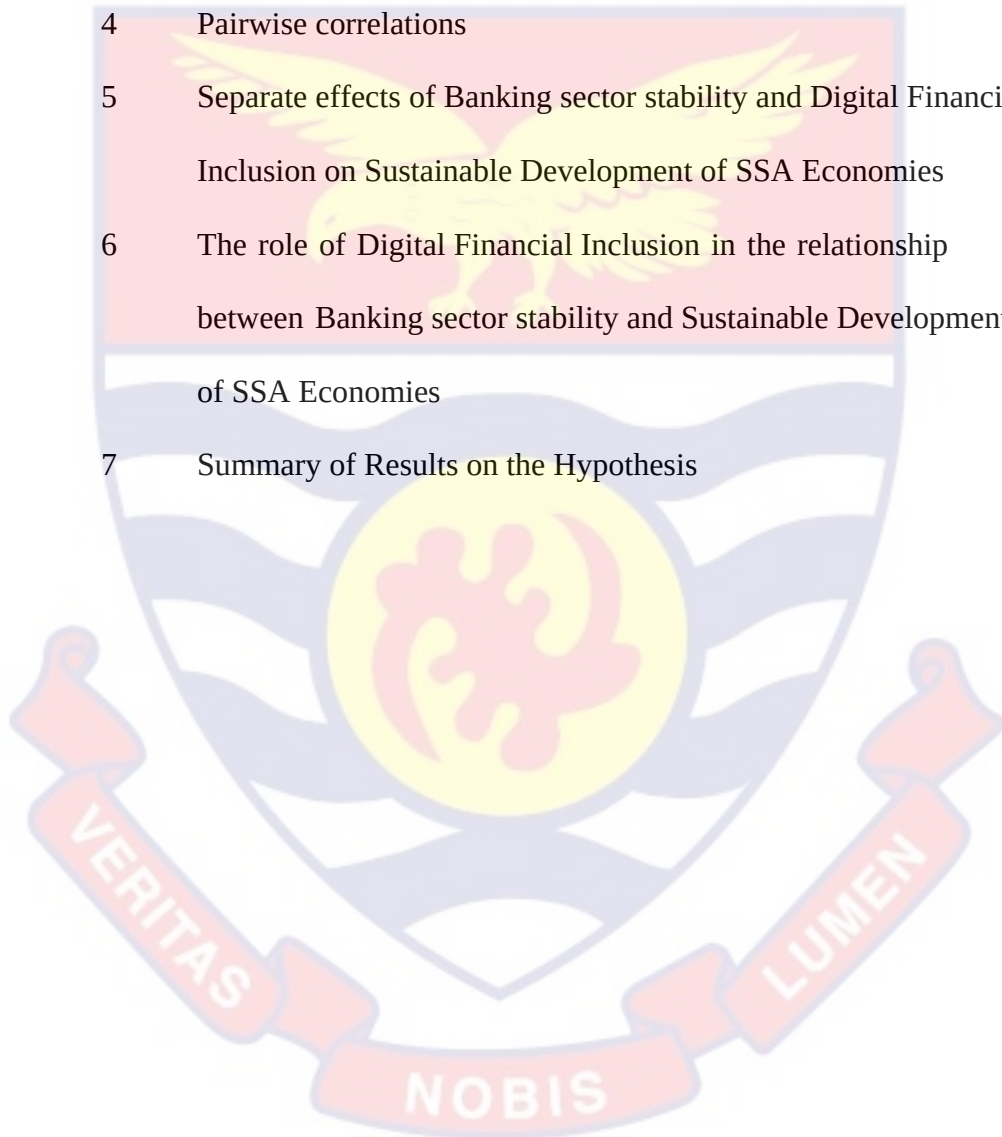
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LIST OF ABBREVIATIONS

GMM	Generalised Method of Moment
BCD	Bank credit as a percentage of deposit
BZS	Bank Z-Score
ANS	Adjusted Net Savings
SD	Sustainable Development
SSA	Sub-Saharan Africa
MDGs	Millennium Development Goals
SDGs	Sustainable Development Goals
DFI	Digital Financial Inclusion



CHAPTER ONE

INTRODUCTION

There is a growing call on policymakers on the African continent to formulate and implement initiatives aimed at achieving a substantial portion of the Sustainable Development Goals (SDGs) by 2030. This call is prompted by the continent's limited progress in reaching the SDG targets (Banik, 2022). At the forefront of these concerns is the stability of the financial sector, particularly the banking sector, which plays a pivotal role in advancing sustainable development (Guru & Yadav, 2019). Recent discourse has intensified around the intricate relationship between bank sector stability and sustainable development, emphasising the overriding significance of the banking sector in facilitating the provision and allocation of financial resources for development in Sub-Saharan Africa (SSA) (Abekah-Nkrumah, Assuming, & Mohammed, 2020). The financial intermediation theory explains how financial intermediaries, such as banks, bridge the gap between savers and borrowers, manage risk, and contribute to economic stability and sustainable growth (Gurley & Shaw, 1960). Practically, this study will be essential for policymakers as they coordinate efforts toward the attainment of sustainable development in SSA.

Background of the study

The Sustainable Development Goals (SDGs), which succeed the Millennium Development Goals (MDGs), represent a refined and ambitious global effort to improve lives worldwide by 2030. Key Sustainable Development Goals (SDGs) linked to this study include SDG 1: No Poverty, SDG 8: Decent Work and Economic Growth, SDG 9: Industry, Innovation, and Infrastructure, SDG 10: Reduced Inequalities, and SDG 16: Peace, Justice,

and Strong Institutions. No Poverty has seen significant strides in reducing global poverty, with the proportion of people living in extreme poverty decreasing from 10% in 2015 to 8.4% in 2019. However, the COVID-19 pandemic reversed some of these gains, pushing millions back into extreme poverty.

Decent work and economic growth has also seen global unemployment rates decrease and improvements in economic productivity in many countries. However, economic disruptions due to the pandemic and geopolitical tensions have slowed progress. Furthermore, industry, innovation, and infrastructure has experienced increased investment in infrastructure and innovation, particularly in developing countries. Despite this, there remains a significant infrastructure gap, especially in SSA. While global progress has been made in reducing poverty and boosting economic productivity, challenges persist, particularly in SSA, where infrastructure gaps, inequality, and weak institutions hinder development (World Bank Report, 2020).

To advance these goals, strategies such as expanding financial inclusion, fortifying banking sector stability, investing in infrastructure, promoting economic inclusivity, and strengthening institutional capacity are crucial. Specifically, progress in poverty reduction has been significant, but disparities remain. Economic growth has improved in many regions, yet unemployment and underemployment persist. Infrastructure development is accelerating, but gaps, especially in SSA, hinder progress. Inequality reduction has seen advancements, but disparities continue. Efforts to strengthen institutions are ongoing, but challenges related to corruption and accountability remain (World Bank Report, 2020).

It is widely recognised that achieving sustainable development relies

heavily on the stability of the banking sector (Zadek & Kharas, 2018; Guru & Yadav, 2019), as its stability is significantly influenced by environmental, social, and economic sustainability issues (Murphy et al., 2017; Famiyeh, Asante-Darko, & Kwarteng, 2018). The banking sector assumes a pivotal role in providing the necessary financing and liquidity for both human and economic activities, making it a linchpin for future development and sustainability (Demirgüç-Kunt, Pedraza, & Ruiz-Ortega, 2021).

To achieve the Sustainable Development Goals (SDGs), Schmidt-Traub and Shah (2015) estimate a global annual investment need of US\$2.4 trillion in low-carbon infrastructure, health, education, energy, agriculture, and other sustainability sectors. This necessitates a significant shift in financial flows. Financial regulators, therefore, bear a pivotal responsibility. They must work to reduce excessive risks that threaten banking sector stability while simultaneously fostering access to basic financial services. This two-pronged approach will ultimately facilitate the sustainable growth and development required to achieve the SDGs (Sain, Rahman, & Khanam, 2016). Additionally, the global banking sector has undergone a significant recovery in regulatory and supervisory standards, in response to the 2008 global financial crisis and the failure of Lehman Brothers (Global Financial Stability Report, 2018). Capital adequacy, liquidity standards, and prudential policies have improved across the globe, contributing to the stability of the banking sector (Global Financial Stability Report, 2018).

However, despite these improvements, the World Bank Report, (2020) highlighted that issues of bank instability remain unresolved. The World Bank Report (2020) indicated a weakened global growth in Europe and Asia, with a decline in the estimated global growth rate from 3.7% in 2019 to 3.5% in

2020. This decline can be attributed to reduced optimism in the banking sector of advanced economies due to concerns about financial crises and increased monetary policy rates. Furthermore, the global banking sector is described as having banking executives becoming more conservative about risk, together with declining feelings about developmental prospects (Choudhry, 2018; Sunney, 2020).

From the perspective of Sub-Saharan Africa (SSA), most economies highly depend on the banking sector as their main source for almost all financial services (Griffith-Jones, Karwowski, & Dafe, 2014). However, over the last decade, SSA has encountered a myriad of challenges in its banking sectors; these challenges include the rampant volatility of the exchange and interest rate and the problem of the high cost of financial fragility (Akinsola, Foluso, Odhiambo & Nicholas, 2017). According to Fowowe (2013), the problem of bank instability which is common in many SSA economies stems from weak implementation of financial policies. Misati and Nyamongo (2018) argue that a weakened banking system not only stifles capital formation but also hinders the efficient distribution and allocation of capital to different sectors of the economy, which is critical for development.

Muhammed and Wei (2014) observed that in developing countries a large proportion of the population is dependent on agriculture and resides in the rural areas of these countries where financial intermediation has been poor and is unable to meet sustainable development. Hence, it is worth considering that digital financial inclusion may be a way to make financial facilities available for the poor at all levels of income to achieve sustainable development (Yang & Zhang, 2020). Digital financial inclusion (DFI) is not different from the notion of financial inclusion (FI). It is the extension phase

of Financial Inclusion where financial services are carried out remotely in a cashless manner using different electronic devices from which both parties (providers and receivers) gain benefits (Klapper 2017; Ozturk & Ullah, 2022). Technology has fundamentally altered the traditional practices of the financial sector, making it easier for people to access a wide range of financial services (Ozili, 2018). In this regard, digital financial inclusion is seen as a changing agent that can bring revolutionary development to the financial sector (Ozili, 2018). Moreover, the Covid-19 pandemic has put forward the implementation of digital financial services to accelerate financial inclusion and enhance financial services that can be enjoyed through electronic devices in a cashless manner without much pain by which both the service providers and receivers can benefit (Klapper, 2017). Banks responded by focusing on improving their mobile apps and online platforms, making them more user-friendly and feature-rich.

Reckoning the undeniable impact and importance of digital financial inclusion, most SSA countries are also on their way to a fully-fledged implementation of digital financial services such as mobile money platforms, digital wallets, and online banking systems. For example, Kenya has seen tremendous success with M-Pesa, a mobile money transfer and payment service, which has revolutionised financial transactions in the country. Similarly, Nigeria has adopted platforms like Paga and Flutterwave to facilitate digital payments and financial inclusion. Ghana's Mobile Money Interoperability system enables seamless transactions across different mobile money networks, enhancing financial access for its citizens. Uganda's mobile money services, such as MTN Mobile Money and Airtel Money, have significantly increased financial inclusion, especially in rural areas.

These initiatives demonstrate the growing commitment of SSA countries to embrace digital financial technologies and improve financial access for their populations (Jameaba, 2020). The impacts and prospects of digital financial inclusion are no longer abstract notions; rather, time demands their proper execution. Manyika et al. (2016) posit that digital finance has the potential to provide access to financial services for 1.6 billion people in emerging economies. Widespread adoption and use of digital finance could increase the growth of all emerging economies by 6%, or USD 3.7 trillion, by 2025. Moreover, 95 million new jobs would be created in all sectors across the world through this additional GDP. The implementation of digital finance in the banking sector will contribute to enhancing GDP, which will help to alleviate poverty and ultimately lead to inclusive economic growth to achieve the SDGs (Chien, & Sadiq, 2022).

Financial analysts foresee the prospects of digital financial inclusion to meet the huge investment gap for attaining sustainability, through a wider lens as it is the recent phase of financial inclusion, which played a great role during the 2007–2009 global financial crisis (Banna, Hassan, & Alam, 2020). The crisis caused a USD15 trillion loss in the global financial sector but financial inclusion played a major role in retaining banking stability (Ahamed & Mallick 2019). Although financial inclusion has brought a myriad of positive changes and benefits for underprivileged and less developed people, its proper implementation and utilisation have become a burden for those who are unable to afford it (Koomson & Danquah, 2021). Both the negative and positive effects of financial inclusion raise the question of whether the implementation of digital financial inclusion, the latest innovation of financial inclusion, can be a solution for attaining banking stability by ensuring

sustainable development or not. Against this background, this study assessed the impact of banking sector stability, digital financial inclusion, and sustainable development in SSA economies.

Statement of the Problem

The global financial crisis of 2007-2009 exposed significant vulnerabilities within the banking sector, resulting in adverse repercussions for economies worldwide (Egan, Hortaçsu, & Matvos, 2017). In response to these weaknesses, numerous countries, groups, and the international community implemented regulatory measures aimed at restructuring and stabilising their respective banking sectors (Vander Stichele, 2015; Bremus & Lambert, 2014). Over the past decade, several SSA economies, such as Nigeria in 2009, Kenya in 2016, Ghana in 2017, and Tanzania in 2018, have embarked on extensive cleanup initiatives within their banking sectors, with the objective of enhancing banking sector performance (Chakamera & Alagidede, 2018). The argument is that a stable banking system will be in a better shape to fund many sustainable development projects within and across countries (Gangi, D'Angelo, & Daniele, 2019). With all these initiatives to ensure stability in the banking sector, researchers and policymakers are keen to know how stability in the banking sector and DFI influence sustainable development (Korzeb, & Samaniego-Medina, 2019). The financial intermediation theory is particularly relevant in this context. This theory highlights how financial intermediaries manage risks, provide liquidity, and allocate capital efficiently (Diamond & Dybvig, 1983; Tobin, 1969). Digital financial inclusion enhances these roles by reducing transaction costs, improving risk management, and broadening access to financial services. In SSA, where banking stability is crucial for

economic growth and development, digital financial services can fortify the banking sector by expanding its reach and improving its efficiency.

Barriers in traditional financial systems continue to fall (Kooli et al., 2022; Wysokińska 2021; Babayan et al., 2022), resulting in a rise in digital financial inclusion, which is recognised as a key enabler for achieving the 2030 Sustainable Development Goals (Allen et al., 2016). However, global financial inclusion gaps persist, emphasising the significance of digital financial inclusion (Demirgüç-Kunt et al., 2018; Pazarbasioglu et al., 2020). According to the World Bank Global Financial Index report, only 33% of the adult population owned a bank account at a formal banking institution in SSA in 2020 which is less than any other sub-region globally (Global Financial Index Report, 2020). On the other hand, 65% of the adult population in the poorest developing countries still lack access to a formal bank account, and only 20% use a formal financial institution to save (Pazarbasioglu et al., 2020). Considering the prospects and importance of digital financial inclusion, banks in SSA countries have started implementing digital financial services in a full-fledged manner (Babayan et al., 2022), because broader digital financial inclusion helps banks achieve financial advancement (Demirgüç-Kunt et al., 2018), stability (Ahamed and Mallick 2019), and a flourishing banking sector.

From 2014 to 2020, there has been a notable upsurge in digital financial inclusion variables across SSA, such as mobile subscriptions per 100 people, registered mobile money agents per 100,000 adults, active mobile money accounts per 1000 adults, and the percentage of the population using the Internet. By 2019, SSA had amassed a remarkable 469 million active mobile money accounts, with over 181 million registered accounts. This represented more than 15% of active users within more than 40% of the

region's total population (Munoz et al., 2022). Furthermore, the advent of COVID-19 epidemic propelled these activities, leading to significant advancements in mobile money-driven activities and the digital economy, particularly in African nations such as Zimbabwe (Ecocash), Kenya (M-Pesa), South Africa (E-wallet), Ghana (MoMo), among others (Wysokińska, 2021; Babayan et al., 2022). These developments highlight the necessity for formulating policies that promote digital financial inclusion in the banking sector of SSA economies, ultimately enhancing the stability of the banking sector.

Despite the recognised importance of implementing digital financial inclusion in the banking sector to foster stability and sustainable development, studies on the nexus between bank stability, digital financial inclusion, and sustainable development are scarce. Yusheng, Ntarmah, Cobbinah, and Menyah (2021) explored the impacts of banking system stability on economic sustainability for the period 2000-2016 covering pre and post-global financial crisis periods. They employed the dynamic fixed effects, system GMM and most recently estimator panel quantile regression with fixed effects and parameter heterogeneity approaches. The findings of their study unveiled that, when considering other factors influencing sustainable development, the stability of the banking system exerts a significant influence on sustainable development. Additionally, the research provided empirical evidence of varying parameter responses for sustainable development in countries that are situated on both low and high sustainable development trajectories, both in the short term and the long term. The study by Ozili and Terhemba Iorember (2023) examines the relationship between financial stability and sustainable development. They analyse 26 countries from 2011 to 2018 using the system GMM method. The

findings of the sustainable development index analysis show that financial stability has a significant effect on the level of sustainable development and the effect is negative in Asian countries.

Ahamed and Mallick (2019) investigated the impact of traditional financial inclusion but not digital financial inclusion on bank stability in different international samples and concluded a positive effect of financial inclusion on bank stability. In addition, Danisman and Tarazi (2020) and Boachie et al. (2021) investigated the interplay between financial inclusion and banking stability in Europe and SSA countries, respectively. The results of the studies suggest that financial inclusion positively and significantly influences bank stability in these regions. These results are also in line with Jungo et al. (2022), who employed the Feasible Generalised Least Squares (FGLS) model to assess the moderating role of financial regulation on the effect of financial inclusion and competitiveness on banks' financial stability in SSA and Latin American and Caribbean (LAC) countries. Banna et al. (2021) deployed the Panel-Corrected Standard Errors, Two-Stage Panel Least Squares-Instrumental Variables, and Two-Step System Generalised Method of Moments dynamic panel estimation method to investigate the nexus between digital financial inclusion and bank stability using an unbalanced panel data of 65 Islamic banks from six countries between 2011 and 2020. The result suggests that digital financial inclusion accelerates Islamic banking stability in the studied region.

None of the previous studies explored these variables (banking sector stability, digital financial inclusion, and sustainable development) within the context of SSA countries. Also, earlier studies limited stability measures to only z-score (Al-Moulani & Constantinos, 2017) or exclusively considered

non-performing loans for banking sector stability (Jiang, 2014). Additionally, many studies have primarily relied on macroeconomic stability indicators like GDP per capita and real output growth to measure sustainability, but these indicators may not offer a comprehensive view of stability and sustainable development. In contrast, this study differs from earlier studies in several ways. It extends the literature by providing empirical evidence on whether banking sector stability and digital financial inclusion affect sustainable development. Importantly, this study employs robust measures of the variables of interest, covering the period from 2012 to 2021 in SSA. This approach helps minimise likely endogeneity problems resulting from measurement errors found in earlier studies (AlMoulani & Constantinos, 2017; Jiang, 2014).

This study aims to fill this gap by investigating how digital financial inclusion impacts the relationship between banking sector stability and sustainable development in SSA. By employing robust measures and covering the period from 2012 to 2021, this study seeks to provide comprehensive insights into how digital financial inclusion can enhance banking stability and promote sustainable development in the region.

Purpose of the Study

The purpose of the study is to analyse the nexus between banking sector stability, digital financial inclusion, and sustainable development in SSA economies.

Research Objectives

Specifically, the study sought to achieve the following objectives;

1. analyse the effect of banking sector stability on sustainable development in SSA economies.

2. examine the effect of digital financial inclusion on sustainable development in SSA economies.
3. determine the role of digital financial inclusion on the nexus between banking sector stability and sustainable development in SSA economies.

Research Hypotheses

In line with the research objectives, the study seeks to test the following hypotheses:

For Objective One:

H₁: Banking sector stability significantly contributes to sustainable development in SSA economies.

For Objective Two;

H₁: Digital financial inclusion significantly influences sustainable development in SSA economies.

For Objective Three;

H₁: Digital financial inclusion affects the nexus between banking sector stability and sustainable development in SSA economies.

Significance of the Study

This study holds significant value for both the regulatory bodies of SSA economies and the research community. First, central banks of SSA economies will benefit from the study by formulating common policies that will contribute to the stability of the banking sector. These policies can help mitigate risks and enhance the robustness of financial institutions, fostering a more resilient economic environment.

Furthermore, the findings of the study will be valuable to businesses and the broader economy. By identifying the potential risks and opportunities associated with sustainable development, such as changes in consumer

preferences, regulatory requirements, and resource availability, companies will make informed decisions about investments, innovation, and risk management. This enables businesses to adapt to evolving market conditions and align their strategies with sustainable practices, thereby promoting long-term economic growth and stability.

Finally, this study fills gaps identified in the literature by adding to the existing knowledge regarding the relationship between banking sector stability, digital financial inclusion, and sustainable development in SSA. Previous studies have explored these concepts individually or in limited contexts, but there is a lack of comprehensive analysis that integrates these three dimensions in the SSA region. By addressing this gap, the study provides a more holistic understanding of how digital financial inclusion can enhance banking sector stability and contribute to sustainable development. This expanded perspective can guide policymakers, researchers, and practitioners in designing and implementing effective strategies to achieve these interconnected goals.

Delimitations of the Study

The study was conducted on 28 out of the 46 SSA economies which had complete data on bank stability, digital financial inclusion, and sustainable development over the research period. The main variables included in this study were bank stability which is measured by the bank z-score and bank credit as a percent of bank deposits, digital financial inclusion, and sustainable development. The study was conducted for a period of 10 years from 2012 to 2021, a period within which the banking sector in SSA has seen an expansion in digitalisation, policy, and regulatory reforms. Data for the analysis of the objectives were sourced from the Global Financial Development (GFD), and

World Development Indicators (WDI) of the World Bank.

Limitations of the Study

The study measured bank stability by using two indicators bank z-score, and bank credit as a percent of bank deposits, and not all the 46 SSA economies had complete data on the variable. The study is limited to the use of two-step System Generalised Methods of Moment in its estimation although other panel estimation techniques such as the fixed effect model and the pooled ordinary least squares estimation techniques exist. The two-step System Generalised Methods of Moment is more efficient in analysing panel data and also addresses endogeneity problems associated with panel data estimations. Again, the study is limited to the period under review due to data availability. Hence the result of this study was obtained based on only 28 SSA economies that had complete data from 2012 to 2021. However, generalisation can be drawn from the findings to other periods with similar characteristics.

Definition of Terms

Digital financial inclusion (DFI): Involves the deployment of cost-saving digital means to reach currently financially excluded and underserved populations with a range of formal financial services suited to their needs that are responsibly delivered at a cost affordable to customers and sustainable for providers. Digital financial inclusion denotes financial services that are carried out remotely in a cashless manner using different electronic devices from which both parties (providers and receivers) gain benefits (Klapper 2017). DFI usually refers to the extent of access and usage of digital financial services such as mobile banking, digital payments, and online financial platforms.

Bank Stability: Bank stability defines the robustness and resilience of the banking sector such that it can effectively perform its function of allocation of

financial resources to aid developmental projects.

Bank Z-Score (BZS): Bank z-score is a financial indicator that measures the stability and solvency of a bank. It is calculated using various financial ratios, such as profitability, leverage, and asset quality. A higher value of the bank z-score generally indicates a healthier and more stable bank, while a lower value suggests potential financial distress.

Bank Credit as a Percent of Bank Deposit (BCD): It is a financial indicator that measures the ratio of a bank's outstanding loans or credit to its total deposits. It provides insights into the bank's lending activities and the extent to which it is utilising its deposit base to extend credit to borrowers.

Sustainable development: Sustainable development refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Organisation of the Study

This chapter of the study covers sections including the background of the study, statement of the problem, objectives of the study, research questions and hypotheses, significance of the study, delimitation of the study, and the study's limitations. The second chapter considers the review of existing theoretical and empirical literature in the area of banking sector stability, digital financial inclusion, and sustainable development. The third chapter discusses the research design with much particular attention on the sample design and the estimation technique employed for the study. The fourth chapter shows the presentation of results and discussions. The last chapter of the study is organised into summary of findings with conclusion and recommendations and is followed by references and appendices.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter provides a review of the theoretical, conceptual, and empirical framework for banking sector stability, digital financial inclusion, and sustainable development. The review also shows how these constructs (bank sector stability, digital financial inclusion, and sustainable development) relate to the SSA region. This chapter is based on the study's research problem, research objectives, and hypotheses. The purpose of the study is to examine bank stability, digital financial inclusion, and sustainable development among selected SSA countries. The write-up of the chapter begins with a review of theories underpinning the study, before addressing conceptual and empirical issues of banking sector stability, digital financial inclusion, and sustainable development.

Theoretical Review

The theoretical frameworks that help provide a logical structure of meaning that guide the development of this study are the Endogenous Growth Theory, Information Asymmetry Theory, and Financial Intermediation Theory. These frameworks were chosen to help bring meaning and generalisation to the study. It also helps create the vision on which the research problem is focused.

Endogenous Growth Theory

The endogenous growth theory, propounded by Romer (1987), provides insights into the relationship between banking sector stability, digital financial inclusion, and sustainable development, particularly in Sub-Saharan Africa (SSA). According to this theory, the economic growth of a country,

both in the short run and long run, is driven by factors internal to the economic system (Romer, 1987). Long-term economic growth is influenced by economic forces and the resilience of institutions that drive capital allocation (Grossman & Helpman, 1991).

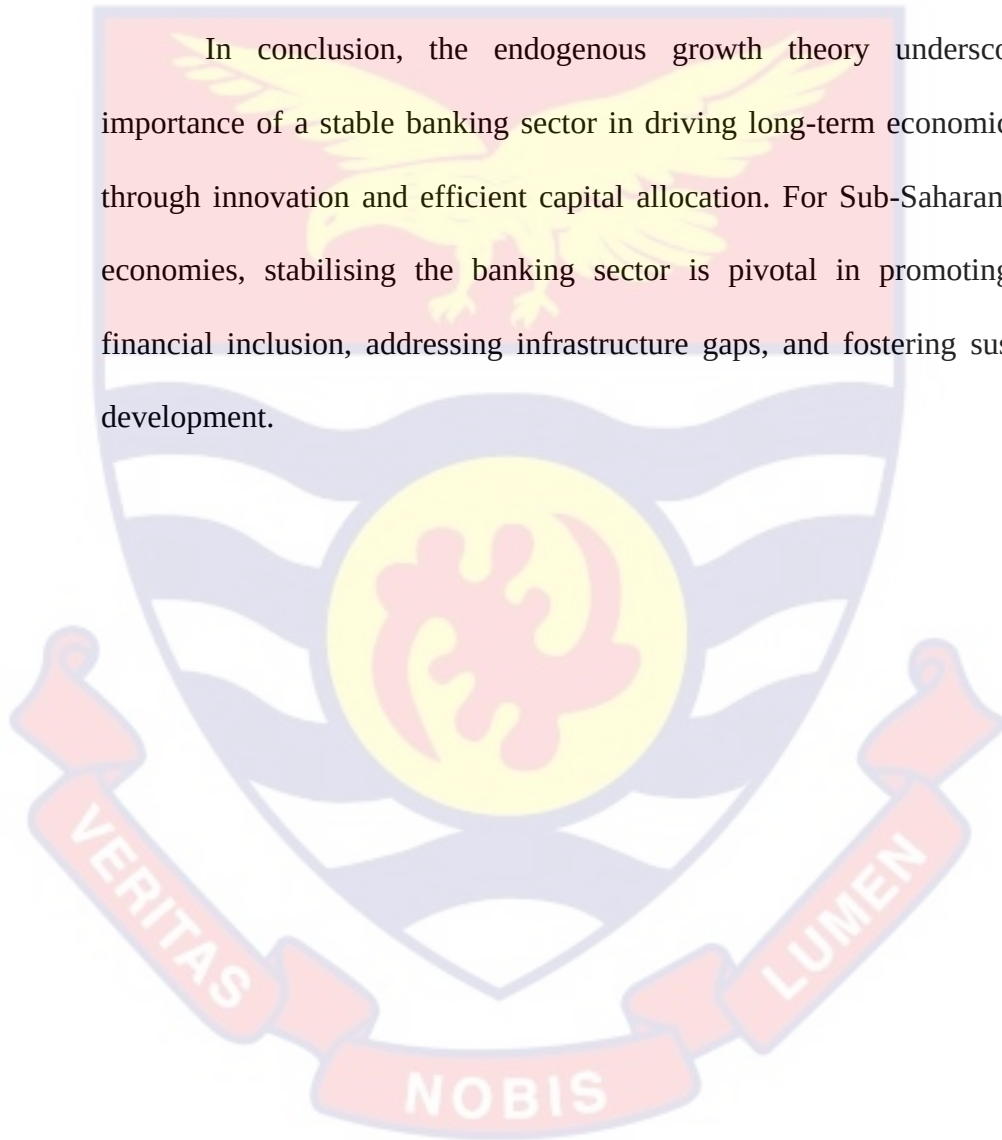
Technological advancement occurs through investments in new markets, ideas, processes, and products resulting from economic activities (Aghion & Howitt, 1992). For firms to acquire the required capital for production, a stable banking sector is essential to provide continuous capital to individuals and firms, thereby expanding their productive agenda. A robust banking sector enhances capital generation for firms, boosting the productive sector and accelerating economic growth. Stability in the banking sector allows for funding research and development (R&D) activities, which are crucial for innovation and long-term economic growth (Dwomfour, 2017).

The stability of banks plays a critical role in promoting digital financial inclusion by ensuring the availability and reliability of digital financial services. Sustainable development encompasses economic growth, social inclusion, and environmental sustainability. The endogenous growth theory suggests that innovation and efficient capital allocation by a stable banking sector are crucial for achieving sustainable development. In SSA, addressing infrastructure gaps, promoting inclusivity, and strengthening institutions are essential for sustainable development.

A stable banking sector can support the growth of SMEs by providing them with the necessary capital for innovation and expansion. Investment in R&D, facilitated by a stable banking sector, can lead to technological advancements and increased productivity, driving economic growth. Digital financial inclusion can reduce income inequalities by providing financial

services to marginalised communities. This can improve access to education, healthcare, and other essential services, promoting social inclusion and sustainable development. Banks can promote sustainable development by financing green projects and environmentally friendly technologies. Stability in the banking sector ensures the availability of long-term funding for sustainable projects, contributing to environmental sustainability.

In conclusion, the endogenous growth theory underscores the importance of a stable banking sector in driving long-term economic growth through innovation and efficient capital allocation. For Sub-Saharan African economies, stabilising the banking sector is pivotal in promoting digital financial inclusion, addressing infrastructure gaps, and fostering sustainable development.



Information Asymmetry Theory

The information asymmetry theory, developed by George Akerlof, Michael Spence, and Joseph Stiglitz, explores how imbalances in information between parties in a transaction can lead to market inefficiencies and failures. When one party has more or better information than the other, it results in suboptimal decision-making and market distortions. One key concept of the theory is adverse selection, which occurs when one party, such as a seller or lender, possesses more information about the quality or risk associated with a product or borrower. In financial markets, this imbalance can lead to lenders struggling to assess the true risk profile of borrowers, causing them to charge higher interest rates to cover potential unknown risks. This can deter low-risk borrowers from seeking loans while attracting higher-risk individuals, ultimately deteriorating the overall market quality (Akerlof, 1970).

Another crucial principle is moral hazard, which arises when one party engages in riskier behavior because they do not fully bear the consequences of their actions. In finance, this is evident when borrowers, protected by insurance or government bailouts, undertake excessive risks. In regions like Sub-Saharan Africa (SSA), where financial systems may lack robust oversight, this can lead to increased instability and inefficiency (Stiglitz & Weiss, 1981). Signaling and screening are mechanisms used to address information asymmetry. Signaling involves the informed party taking actions to reveal their quality or risk level to the less informed party. For instance, companies might issue dividends to signal their financial stability. Screening, on the other hand, involves the less informed party making efforts to obtain information, such as lenders requiring collateral or conducting credit checks to assess borrowers' creditworthiness (Spence, 1973).

The introduction of digital financial inclusion (DFI) can mitigate some of the issues related to information asymmetry in the banking sector. DFI encompasses the use of digital platforms and technologies to provide financial services to underserved populations. In Sub-Saharan Africa (SSA), DFI has the potential to significantly impact sustainable development by improving access to financial services, enhancing financial literacy, and promoting economic inclusion. Digital platforms can reduce information asymmetry by providing more transparent and accessible financial information, improving the accuracy of credit assessments, and facilitating better monitoring of borrower behavior. This can lead to more accurate risk assessments and potentially lower interest rates for borrowers. Moreover, digital financial services can streamline the process of loan applications, reduce transaction costs, and increase the efficiency of financial markets.

By improving access to financial services, DFI can contribute to economic growth and stability in SSA economies. Enhanced financial inclusion allows for greater participation in the economy, fostering entrepreneurship, and enabling individuals to invest in education, health, and other critical areas. This can lead to improved social and economic outcomes, which are essential components of sustainable development. Digital systems also facilitate better monitoring and compliance by providing real-time data and automated transaction tracking. This helps reduce moral hazard by allowing closer supervision of borrowers' behaviors and ensuring adherence to financial regulations, thus contributing to a more stable and transparent financial environment.

For policymakers, the focus should be on creating regulatory frameworks that support digital financial inclusion while addressing information asymmetry. This includes setting standards for transparency, data security, and consumer protection in digital financial services. Investing in digital infrastructure and improving internet connectivity are essential steps to expand financial inclusion and reduce information gaps. Furthermore, DFI can promote environmental sustainability by facilitating investments in green technologies and sustainable practices. For example, digital platforms can support the financing of renewable energy projects or provide farmers with access to loans for sustainable agricultural practices. In summary, the theory of asymmetry in the context of this study highlights how DFI can reduce information asymmetry, lower transaction costs, and improve access to financial services. This, in turn, can have a positive impact on sustainable development in SSA economies by promoting economic growth, social inclusion, and environmental sustainability. By addressing the information gaps and inefficiencies in the traditional banking sector, DFI can help create a more inclusive and sustainable financial system in the region.

Financial Intermediation Theory

Financial intermediation theory explores how financial intermediaries, such as banks, bridge the gap between savers and borrowers, manage risk, and contribute to economic stability and sustainable growth (Gurley & Shaw, 1960). This theory is particularly relevant in understanding how digital financial inclusion impacts the relationship between banking sector stability and sustainable development in Sub-Saharan Africa (SSA).

Financial intermediaries serve a crucial function by pooling funds from savers and directing them to borrowers who need capital for investments. This

process helps allocate resources efficiently across the economy. They manage risk through diversification and the use of financial products that help mitigate potential losses, ensuring that the financial system remains stable. They also provide liquidity by allowing savers to access their funds while providing long-term loans to borrowers, thus supporting economic activity.

Additionally, financial intermediaries play a key role in processing and analyzing information about borrowers and investment opportunities. They gather data, assess creditworthiness, and monitor financial assets to reduce information asymmetry between lenders and borrowers. Digital financial inclusion enhances the functions of financial intermediaries and addresses various challenges associated with banking sector stability and sustainable development. Digital technologies, such as mobile banking and online platforms, improve the efficiency of financial intermediation by reducing transaction costs and streamlining processes. This increased efficiency supports the stability of the banking sector by making operations more effective. Digital tools also improve risk assessment and management. By leveraging big data analytics and artificial intelligence, financial intermediaries can perform more accurate credit assessments and risk evaluations. This capability helps reduce adverse selection and supports the stability of the financial system.

Furthermore, digital financial inclusion expands access to financial services, reaching previously underserved populations, including those in remote areas. Mobile banking and digital payment systems allow individuals and businesses to engage with the financial system, promoting greater financial inclusion and economic participation. By providing transparent and accessible financial information, digital platforms reduce information

asymmetry. Real-time data on transactions and credit histories help lenders make more informed decisions, thereby mitigating the risks associated with asymmetric information. The stability of the banking sector is also supported by digital financial inclusion. Improved efficiency, expanded access, and better risk management contribute to a more stable financial system, which in turn supports sustainable development. When financial services are more widely available, individuals and businesses can invest in critical areas such as education, healthcare, and infrastructure, fostering economic growth and social progress.

In conclusion, Financial Intermediation Theory emphasises the important roles that financial intermediaries play in risk management, liquidity provision, and capital allocation. Digital financial inclusion enhances these roles by improving efficiency, expanding access, and reducing information asymmetry. For SSA, integrating digital financial technologies can strengthen banking sector stability and promote sustainable development by addressing information gaps, supporting effective risk management, and broadening economic opportunities.

Concept of Bank Stability

The concept of bank stability emphasises the importance of a stable financial system for promoting sustainable growth and development (Ntarmah, Kong, & Gyan, 2019). Bank stability refers to the ability of the financial system to absorb shocks and maintain the provision of financial services to the economy. In the context of sustainable development, the concept of bank stability is important because it enables the financial system to continuously allocate resources efficiently and promote development. The concept posits that when the banking system is unstable, it can have significant negative

effects on development. For example, a banking crisis can lead to a contraction of credit, which can impede investment and limit growth (Ntarmah, Kong, & Gyan, 2019; Piserà et al., 2022). Additionally, an unstable banking system can lead to high levels of volatility and uncertainty, which can discourage investors and undermine economic activity (Piserà et al., 2022).

The concept of bank stability seeks to understand the conditions that are necessary for a financial system to operate stably. This concept recognises that banking systems are inherently complex and subject to a wide range of risks and uncertainties. As a result, maintaining financial stability requires careful management of these risks and the design of appropriate institutional frameworks and policy tools (Salim, Dewandaru, & Nkoba, 2023). One important element of the concept of banking stability is the recognition that banking systems are prone to cycles of booms and busts. These cycles can be driven by a range of factors, including changes in the economic environment, financial innovation, and changes in regulations and policies. Understanding these cycles and the potential risks associated with them is a critical element of maintaining financial stability (Salter, & Tarko, 2019; Bindseil, 2019).

Another key element of the concept of bank stability is the importance of effective regulation and supervision of financial institutions and markets. Regulations are designed to mitigate the risks associated with financial transactions and to ensure that financial intermediaries operate safely and soundly. Supervision involves monitoring the activities of financial intermediaries and taking corrective actions when necessary (Weber, et al., 2018). Bank stability also recognises the importance of financial infrastructure, including payment systems, clearing and settlement mechanisms, and other key components of the financial system. Ensuring that

these systems are reliable, efficient, and resilient (Aduda, & Kalunda, 2012). One way in which the concept of bank stability promotes digital financial inclusion is by emphasising the importance of efficient and effective financial infrastructure. Digital financial inclusion relies on the availability of reliable and secure payment systems, which can facilitate transactions and reduce the costs associated with financial services. By promoting the development of efficient and effective payment systems, the concept of financial stability can help expand access to financial services and promote digital financial inclusion (Kelikume, 2021).

In addition, bank stability can promote sustainable development because it highlights the importance of balancing economic growth, social inclusion, and environmental sustainability. By taking into account the potential environmental and social impacts of financial transactions, policymakers, and financial institutions can design financial products and services that support sustainable development goals. For example, financial products that promote investment in renewable energy or sustainable agriculture can help to promote environmental sustainability while also providing financial benefits to investors. Finally, bank stability acknowledges the role of central banks and other policymakers in promoting financial stability. Central banks can use monetary policy tools to influence financial conditions and reduce the risks of financial instability. Other policymakers can enact regulations and policies that promote bank stability and mitigate the risks of financial crises (Salim, Dewandaru, & Nkoba, 2023).

By integrating the concept of bank stability, this work demonstrates that stable banks can provide the necessary resources, maintain investor confidence, and support long-term development projects. Effective regulation,

risk management, and robust financial infrastructure are essential for maintaining this stability. Ultimately, bank stability not only supports economic growth but also ensures that development is inclusive and environmentally sustainable.

Banking in Sub-Saharan Africa

The banking sector in Sub-Saharan Africa is noted for its contributions to individuals, firms and the regional economy as a whole. The financial sector and its development is one important aspect of the world's economy that drives the demand and supply of money and allocates resources to the other sectors of the economy (Sullivan, 2011). The banking sector is deemed to be the key institutional body that affects the development of the financial sector (Swamy, 2014). Consequently, the stability and resilience of the banking sector is important in addressing the economic challenges of the world economies (Rajhi & Hassairi, 2013). Swamy (2014) defines bank stability as the ability of banks to function well and perform their core banking activities in the face of the failure of the financial system, and it also includes the degree of resilience of the banking sector.

The World Bank (2013) asserts that a stable banking sector is in a position to finance profitable projects even in times of financial crises, and it has the capacity to ensure that asset prices conform to their true intrinsic values (Diaconu & Oanea, 2014). Forker and Ward (2012) add that a resilient banking system can withstand bank runs, the negative effect of inflation, and stock market crash while instilling confidence in the general banking public. Similarly, Mlachila and Montfort (2013) reported that a strong banking system reports low levels of non-performing loans and serves as the fulcrum on which the growth of an economy revolves. This means that a weak banking system or

an unstable banking sector performs its functions toward the growth of the economy inefficiently. It is so that the European Investment Bank (2016) asserts that the stability and growth of banking sectors in developed economies are strongly correlated to the growth of economies.

While effort is made to strengthen the banking industry there is a report of slow development of the highly concentrated banking industry within the Sub-Saharan African region. The banking sectors further dominate the financial sector by actively playing an important intermediation role and providing capital to governments, businesses, and individuals. Particularly, the lending activities of the banking industry within Sub-Saharan Africa are mostly geared toward the real estate, manufacturing, general trade, and construction sectors (Pelletier, 2014). There are cogent reasons that underpin the slower development of the banking sector of the Sub-Saharan economies. The European Investment Bank (2016) cited weak regulatory practices that fall short of international standards as the main driver of the slower pace of the banking sector development in Sub-Saharan Africa. Diaconu and Oanea (2014) also cited that the volatility of the banking environment poses much uncertainty to the extent that international investors are not induced to inject capital into the sector. The World Economic Outlook (2018) further explained that the political influence in the activities of the regional central banks poses threats to the efficient supervision of banks and the effectiveness of monetary policies.

Banks in the Sub-Saharan African region have proven to express hope and resilience to the impacts of financial crises, and this is mainly due to the limited integration of the regional banking industry into the global financial landscape. The weak integration of the banking sector of Sub-Saharan Africa

to that of the global economy makes the banking industry of the sub-region less exposed to the dangers of financial crises. In terms of performance, the banking industry within the Sub-Saharan African region has moderate capitalisation levels with a fairly good liquidity position and is quite profitable. The major problem is high levels of non-performing loans among economies within the sub-region.

Performance indicators such as the capital asset ratio (CAR), non-performing loans (NPLs), return on assets (ROA), and return on equity (ROE) of some economies for Sub-Saharan African economies for 2018. The average CAR for the Sub-Saharan African economies was 18.43% where six economies namely Ghana, Guinea, Kenya, Namibia, Nigeria, and South Africa fall below the regional average, and Botswana, Burundi, Mauritius, Rwanda, and Uganda performed above the regional average. The regional average in terms of NPLs was 16.11% and Ghana, Kenya, Mauritius, Nigeria, and South Africa have a rate more than the regional average. Furthermore, Ghana, Guinea, Mauritius, Nigeria, South Africa, and Uganda have a return on equity that is above the regional average of 20.14%. Based on return on asset, Ghana, Kenya, Namibia, Nigeria, and Uganda performed better than the regional average of 2.66%.

Embedding the concept of banking in Sub-Saharan Africa into the discussion of banking sector stability and sustainable development highlights the region's unique challenges and opportunities. By addressing regulatory weaknesses, managing risks, and promoting sustainable investments, the banking sector in Sub-Saharan Africa can significantly contribute to the achievement of sustainable development goals. This integration underscores the importance of a stable and resilient banking sector in driving long-term economic growth and development in the region.

Bank Stability and Instability in Sub-Saharan Africa

A number of studies have shown that the banking sector in Sub-Saharan African economies has offered great contributions to the financial systems and the real economies (Akinsola, Odhiambo, 2017; Fowowe, 2013 etc.). Following banking reforms in post periods of the 1990s, Misati and Nyamongo (2012) believe that the capital base of banks has significantly strengthened; risk management policies and practices of banks have been enhanced; the contribution of credit to the private sector has picked up even though it is still in the lower range. According to Ikhide (2015), most of the Sub-Saharan African banking industries have proven to be more pragmatic, and resilient to threats from global financial shocks.

Coupled with the improved stability of the banking sector within the Sub-Saharan African economies, there has been an expansion of mobile banking, moderately improved competition, and a strengthening banking regulation across economies within the sub-region (Bempong & Sy, 2015). However, the significant improvement in technology-based banking has offered new challenges to regulators and managers of banks, particularly concerning controlling and curbing banking fraud and such related activities

(International Monetary Fund, 2016). Other challenges confront the banking industry within the Sub-Saharan African sub-region and these include weak banking regulations, low-income levels, small market size, and limited competition among others (Miklaszewska, Mikołajczyk, & Pawłowska, 2012).

Furthermore, variables that serve as pointers to measuring the strength and depth of banks such as access to finance for both firms and individuals reveal that the resilience of banks in Sub-Saharan Africa remains one of the lowest in the world (European Investment Bank, 2016). Weak “banking structures in the Sub-Saharan African economies are reported to have created challenges to the growth of enterprises and economies within the sub-region” (Ngendakuroyo, 2014, p 64). There are chronic problems of high credit risk with banks, the inadequacy of physical infrastructure, and capital. Afrika and Ajumbo (2012) argue that the largely unfavourable business environment makes banking business relatively risky in Sub-Saharan Africa compared to that of advanced economies. Consequently, banks generally resort to exacerbated lending rates to boost their profitability (IMF, 2015). It is also instructive to note that bank instability in the Sub-Saharan African sub-region is a result of a host of factors discussed below.

Banking instability is the direct opposite of bank stability and for that matter, the instability of banks means bank stability from its lowest level. Bank instability is described as the inability of banks to perform their function of granting credit to market players in times of recession and financial crises (IMF, 2017). Thus, assessment of the causes of bank instability contributes to understanding how different forces interplay to affect the resilience and the ability of banks to adequately serve the financial needs of the individuals, firms, and governments (IMF, 2017).

Excessive borrowing by households and businesses is cited by the Financial Stability Report (2020) as a major contributor to banking sector instability. In particular, when the incomes and asset value of firms and households decline in times of economic repression, there is a high probability of loan payment default on the part of borrowers. This results in higher non-performing loans of banks which invariably affects their cash flows and deteriorates the strength of their balance sheet. In the long run, banks report losses and fail in their ability to support the public by providing funds for productive ventures.

Another contributor to banking instability is the excessive leverage (high gearing) within the banking sectors of Sub-Saharan African economies (World Economic Outlook, 2019). Excessive leverage raises the risk levels of banks in that they end up lacking the capability to absorb losses when the economy is hit by negative shocks. A situation of this nature compels banks to cut the amount of money they could lend to private enterprises and individuals; banks sometimes sell their assets to remain in business (Ngendakuroyo, 2014). According to Marchetti (2015), excessively leveraged banks have no other option to turn to except to shut down their operation using mergers or takeovers. Banks are therefore required to reduce the level of their leverage to a moderate level to increase their level of resilience.

Funding risk is also identified by Stigns (2015) as an important cause that drives bank instability in Sub-Saharan African economies. The Financial Stability Report (2020, p.7) has indicated that “funding risk exposes the banking system to the possibility that investors will run by withdrawing their funds from the banking sector to other sectors of the economies or different economies.” Many banks in Sub-Saharan Africa promise the return of invested

funds to depositors but they end up funding long-term projects that require many years to produce cash flows (Newiak & Awad, 2015). This tendency produces liquidity challenges to banking sectors within the Sub-Saharan Africa sub-region and banks are required to borrow at higher costs or sell their assets at sometimes lower values to meet up withdrawal needs of depositors (Beck & Maimbo, 2013).

Furthermore, the weak regulatory regime of central banks within the Sub-Saharan African economies is the driver of banking instability (World Bank, 2019). According to the World Bank (2019), central banks in Sub-Saharan African economies have weak regulatory systems compared to that of other sub-regions such as Asian economies and Western economies. Ostry, Berg, and Tsangarides (2014) argue that central banks in Sub-Saharan African economies allow for political interference in their operations and that has weakened the strength with which they supervise activities of banking activities in the respective economies. The low regulatory system has contributed to the poor asset quality base of banks and the engagement of overly risky investments by banks which run down the profitability and efficiency of banks (Cecchetti & Kharoubi, 2015). Embedding the concept of bank stability and instability in Sub-Saharan Africa into the broader discussion of banking sector stability and sustainable development, illustrate how regional banking dynamics impact the ability to achieve sustainable development goals.

Concept of Digital Financial Inclusion

Digital financial inclusion, as a concept is relatively new and multifaceted. It refers to the use of digital technologies to provide financial services for individuals who have limited access to traditional banking

services (Ozili, 2022). It is a process of ensuring that all individuals, regardless of their income level, geographic location, or social status, have access to affordable and reliable financial services that meet their needs. The concept of digital financial inclusion seeks to leverage the proliferation of digital technologies such as mobile phones, the internet, and other forms of electronic communication to increase access to financial services. The aim is to create a more inclusive financial system that reaches those who are currently excluded from the traditional banking system (Aziz, & Naima, 2021).

One of the key components of DFI is mobile banking, which allows individuals to access financial services through their mobile devices. Mobile banking enables individuals to make and receive payments, transfer money, and access credit and savings products, among other financial services (Goh, Mah, & Chay, 2022). Another important aspect of DFI is the use of digital identification systems to help individuals without formal identification documents open bank accounts and access other financial services. Digital identification can also help to reduce the cost of due diligence for financial service providers, thereby increasing the accessibility and affordability of financial services (Gelb, & Metz, 2018).

Digital financial inclusion has the potential to create significant social and economic benefits, including poverty reduction, increased economic growth, and improved financial resilience. However, there are also potential risks associated with digital financial inclusion, such as the potential for fraud, cyber-attacks, and data breaches. It also has the potential to transform the way financial services are delivered and accessed, particularly in developing countries where traditional banking services may be inaccessible or

prohibitively expensive (Sun, 2018). By leveraging digital technologies, digital financial inclusion can overcome many of the barriers that prevent people from accessing financial services, including geographical barriers, lack of formal identification, and high transaction costs. Digital financial inclusion enables people to conduct financial transactions at lower costs than traditional banking services. This is because digital financial services can be delivered remotely and do not require the same physical infrastructure as traditional banking services. This can help to reduce the cost of financial services and make them more affordable for people on low incomes.

Another advantage of digital financial inclusion is that it can help to promote financial inclusion by reaching people who are excluded from the traditional banking system. This includes people who live in rural areas, women, and low-income earners. By providing financial services to these groups, digital financial inclusion can help to reduce poverty and promote economic growth. digital financial inclusion can also help to promote financial literacy by providing people with access to financial education and training. This can help to build financial capability and empower people to make informed financial decisions. digital financial inclusion promotes financial inclusion for marginalised groups such as women, refugees, and people with disabilities (Ariyanto, Soejono, & Dewi, 2020). These groups may face additional barriers to accessing financial services, including cultural and social barriers, lack of access to formal identification documents, and discriminatory practices. By leveraging digital technologies, digital financial inclusion can overcome some of these barriers and provide financial services to these groups. Digital financial services can be designed to meet the specific needs of underserved populations, such as microfinance products that are tailored to the

needs of small business owners and farmers. This can help to promote development by providing people with the financial tools they need to grow their businesses and invest in their futures (Khera, Ogawa, & Sahay, 2022).

Digital financial inclusion help promotes financial stability by reducing the reliance on cash-based transactions. Cash-based transactions are expensive, inefficient, and can be vulnerable to fraud and theft. By promoting digital transactions, digital financial inclusion can help to reduce the use of cash and promote financial transparency and accountability (Mader, 2016). Digital financial inclusion enhances financial resilience by providing people with access to financial services that can help them to cope with unexpected shocks, such as natural disasters, economic downturns, or health crises. By providing people with access to savings and insurance products, digital financial inclusion can help to build financial resilience and reduce the impact of these shocks. The concept of digital financial inclusion is the fourth stage of the financial revolution after developing microcredit, microfinance, and financial inclusion (Wang & He, 2020). Compared to financial inclusion, digital financial inclusion places more importance on technology to broaden the accessibility to formal financial services. Initially, the term "microcredit" refers to a small loan offered by financial institutions to businesses and individuals. In the 1990s, the word "microcredit" had been replaced by "microfinance," which covers more immense scopes of financial services such as savings, mutual funds, insurance, and loans.

Another significant revolution is shifting from "microfinance" to "financial inclusion". Financial inclusion is a concept that seeks to guarantee that formal financial services are accessible to all people. However, microcredit, microfinance, and financial inclusion initiatives are manual

and field-based operations (Hassan, Le, Hoque, 2021). Thus, it limits the effectiveness of helping the poor. Lately, ICT has led financial inclusion to advance to the fourth stage: digital financial inclusion. This radical innovation has the potential to transform the lives of those at the bottom of the economic ladder. Digital financial inclusion aims to eradicate obstruction to encourage individuals' participation in the financial services offered by financial institutions and benefiting from it. Due to fast technological advances, cell phones, and social media have a very high penetration rate in today's internationally linked economy.

Many nations across the globe have a tremendous potential to enhance their countries' economic development and financial stability by embracing financial inclusion via mobile payment systems (Almarashdah, et al., 2021: Dawei, Anzi, & Gen, 2018: Vo, Nguyen, & Van, 2021). Overall, digital financial inclusion is an important development in the financial sector, which has the potential to create a more inclusive and equitable financial system for all. Digital financial inclusion serves as a key enabler of banking sector stability and sustainable development.

By expanding access to financial services, reducing costs, and promoting economic empowerment, digital financial inclusion strengthens the resilience of the banking sector and supports broader development goals. Addressing the associated challenges and leveraging technological advancements ensures that the benefits of digital financial inclusion contribute effectively to a stable and sustainable financial system.

The Role of Digital Financial Inclusion in Meeting the Sustainable Development

Ozili (2023) illustrates that the key aim of digital financial inclusion is to provide formal financial services to the poor, rural, and underprivileged or unbanked people, which has a long-run impact on banking stability and sustainable development. The inclusion of people in formal financial services helps banks to generate deposits and consequently benefits the government by generating higher tax revenue (Manyika et al., 2016). Such types of financial services are delivered via smart mobile phones, personal computers, or laptops, which need an internet connection (Manyika et al., 2016). According to Gomber, Koch, and Siering (2017), digital financial service includes innovative financial products, finance-related software, and a great way of interacting and communicating with customers provided by FinTech and other finance-related service providers (BigTech firms). They can transform people from cash-based to cashless transactions where they need a mobile phone, one of which is owned by almost 50% of people in developing countries (World Bank Group 2018).

A recent study by Klapper, Miller, and Hess (2020) shows that through digital financial inclusion, informal business institutions can be registered as formal business institutions and help the government to collect taxes more easily by enforcing laws since in the database all the records are available and there is no way to escape payment. More tax collection contributes to the national revenue sector and eventually makes the country's economic growth stable. Digital financial inclusion, when provided responsibly and sustainably in a well-regulated environment, not only drives growth but also enables faster progress toward many of the other sustainable

development goals. In their study, Siddik and Kabiraj (2020) show the impact of digital finance and proper implementation of digital financial inclusion can spur sustainable growth by eradicating poverty. Poverty is more visible among rural and underprivileged people, who are usually neglected in most developed societies, which hinders the ultimate financial growth of any country. These types of deprived people can be included in formal financial services by implementing digital financial inclusion properly.

But, globally only 33% of all adults have financial knowledge that is, they understand at least three out of four main financial literacy issues, such as knowledge of inflation, interest rates, risk diversification, and compounding interest, which are essential for decision-making in financial affairs (Klapper and Lusardi 2020). Moreover, through the proper application of digital financial inclusion, the gender gap in financial inclusion can be minimised. In most of the developing economies, women are still lagging in terms of having a formal bank account. In this regard, the study of Sioson and Kim (2019) shows that digital financial inclusion plays a significant role in reducing the gender gap in financial services, moreover, inclusive finance brings banking stability and sustainability. However, to fully realise these benefits, challenges such as infrastructure gaps, regulatory needs, and financial literacy must be addressed. Integrating digital financial inclusion into broader strategies for sustainable development can create a more inclusive, resilient, and equitable financial system.

Concept and Dimensions of Sustainable Development

The concept of sustainable development denotes a way of meeting the needs of the present without compromising the ability of future generations to meet their own needs (Daly, 1990). In other words, it involves creating a

balance between economic growth, social well-being, and environmental protection to ensure that we can continue to thrive without depleting the planet's resources. Sustainable development recognises that our natural resources are finite and that we need to use them in a way that is both responsible and equitable. It emphasises the importance of long-term thinking and planning to ensure that economic growth and social progress are sustainable over time (Beckerman, 2017; Zikic, 2018).

Sustainable development also involves recognising the interdependence of economic, social, and environmental factors. For example, a healthy environment is necessary for human health and well-being, and a strong economy is needed to invest in and protect the environment. Social well-being is also interconnected with both economic and environmental factors, as individuals and communities rely on economic opportunities and a healthy environment to thrive. It also emphasises the need for equity and fairness. This means that everyone should have equal opportunities to participate in and benefit from economic, social, and environmental progress (Adams, 2017; Schlüter, 2018; Rosca, Reedy, & Bendul, 2018). Sustainable development also involves addressing social and economic inequalities that may prevent certain groups from accessing the same opportunities and benefits as others (Rusca, 2019). There are three main components to sustainable development: economic, social, and environmental (Tomislav, 2018; Purvis, Mao, & Robinson, 2019).

The economic component focuses on the creation of a strong and stable economy that can support the well-being of individuals and communities. This involves promoting economic growth and development that is sustainable over the long term, and that does not compromise the ability of

future generations to meet their own needs. It also involves promoting sustainable production and consumption patterns and investing in clean technologies and renewable energy sources. The social component of sustainable development also directs attention to ensuring that people have access to basic services such as healthcare, education, and housing and that they can participate fully in society. It also involves promoting social equity and reducing inequality by providing opportunities for all individuals to participate in economic, social, and political decision-making processes. This includes promoting gender equality, promoting the rights of marginalised groups, and ensuring that everyone has access to basic human rights (Alola, 2019; Kurniawan, & Managi, 2018; Ratnawati, 2020; Lubchenco, 2019).

The environmental component centers on protecting natural resources and minimising the impact of human activities on the planet. This involves promoting conservation and sustainable use of natural resources, reducing greenhouse gas emissions, and promoting renewable energy sources. It also involves reducing waste and pollution, protecting biodiversity and ecosystems, and promoting sustainable agriculture and land use practices. In the context of digital financial inclusion and banking stability, the concept of sustainable development involves ensuring that digital financial services are accessible, affordable, and reliable for all members of society, while also promoting stability and resilience in the financial system (Holden, Linnerud, & Banister, 2017; Kasztelan, 2017; Van-Huis, & Oonincx, 2017).

However, it is important to ensure that digital financial inclusion is sustainable, meaning that it is not just a short-term solution but also a long-term one. This requires addressing issues such as the cost of digital financial services, the availability of reliable infrastructure, and the need for financial

education to ensure that users can effectively utilise these services. In addition, sustainable development in the context of digital financial inclusion also requires promoting banking stability. This means ensuring that the financial system is resilient and able to withstand shocks, such as economic downturns or financial crises. This can involve measures such as strengthening financial regulations, promoting transparency in financial reporting, and encouraging responsible lending practices (George, Merrill, & Schillebeeckx, 2021; Wielki, 2020).

Sustainable development is a global agenda that recognises that the challenges we face, such as climate change, poverty, and inequality, are interconnected and require collective action. The United Nations' Sustainable Development Goals (SDGs) provide a framework for action, with 17 goals and 169 targets aimed at achieving sustainable development by 2030. It requires measuring progress towards sustainable development goals and targets (Arora, & Mishra, 2019). This involves monitoring and reporting on social, economic, and environmental indicators to track progress and identify areas for improvement. Sustainable development is a dynamic and evolving concept that requires ongoing adaptation to changing circumstances and new challenges. This requires continuous learning and improvement, and a willingness to embrace new ideas and approaches (Bexell, & Jönsson, 2017; Husted, et al., 2021).

The concept of sustainable development is a holistic approach that takes into account a range of economic, social, and environmental factors. By promoting access to financial services, promoting banking stability, and addressing issues such as affordability, infrastructure, and financial education, we can help to build a more sustainable and equitable system. This alignment

with sustainable development principles helps to build a more inclusive, equitable, and resilient financial system that benefits all members of society.

Banking Sector Stability and Sustainable Development

On the argument of sustainability and financial stability, Schmidt-Traub and Shah (2015) maintain that the global financial sector will be at the center of humanity's attempt to accomplish Sustainable Development. Existing studies show that finance plays a key role in achieving sustainable development goals because financial institutions can provide credit and other tailored financial services, such as green loans and green investment to fund the realisation of sustainable development goals (Barua, 2020; Ozili, 2021; Bertheau and Lindner, 2022). But for this to happen, there is a need to safeguard the financing of sustainable development by ensuring there is a stable financial system (Bordon and Schmitz, 2015). In a stable financial system, financial institutions such as banks will have incentives to expand their activities to non-core banking activities such as financing sustainable development goals. They will have incentives to allocate credit to activities and projects geared towards sustainable development as a way to show their support for the realisation of sustainable development and as a revenue diversification mechanism.

Conversely, when the financial system is unstable or during financial crises, there will be difficulty in the mobilisation of financial resources for sustainable development, difficulty in the disbursement of funds for sustainable development, and difficulty in accessing new financial resources and financial instruments to fund the realisation of the sustainable development goals. More importantly, if the financial system is unstable, financial institutions will prefer to focus more on their survival and focus on

their core business. They will reduce the financing of noncore banking activities, such as financing the realisation of the SDGs when the risks to financial stability are high. The reduction in financing the realisation of the sustainable development goals Ozili and Iorember (2023) Financial stability and sustainable development would delay the realisation of the sustainable development goals, implying that financial system fragility reduces the level of sustainable development.

Consequently, the risks to financial stability should be taken into account in financing sustainable development because a stable financial system can provide an incentive for financial institutions and investors to fund and invest in SDG activities while an unstable financial system could be used as an excuse for postponing investment in sustainable development (Bordon and Schmitz, 2015). Financial institutions can use recurring financial crises as an excuse to postpone or delay the financing of sustainable development activities. Furthermore, the central bank's involvement in financial stability governance may provide an opportunity for the central bank to pressure regulated financial institutions to support sustainability by decarbonising their balance sheet and allocating tailored credit to specific sustainable development projects or activities (Fabris, 2020; Battiston et al, 2021; D'Orazio and Popoyan, 2022). This further suggests that financial stability can have a positive impact on sustainable development through regulatory pressure or action. Therefore, we predict a positive and significant relationship between financial stability and sustainable development.

Empirical Review

This aspect of the study examines the empirical views on the linkage between banking sector stability, digital financial inclusion, and sustainable

development. Ntarmah, Kong, and Gyan (2019) investigated the relationship between banking system stability and economic sustainability in 37 developing economies during the period from 2000 to 2016. The researchers employed panel data models, specifically fixed effects and random effects models, to analyze the data. The Hausman test of endogeneity indicated that the fixed effects model was the most appropriate for all estimations. The findings suggest that stronger and more stable banking systems (as indicated by higher z-scores) positively influence economic sustainability in developing economies, but higher regulatory capital and excessive bank credit may have negative effects, with variations observed between BRICS and non-BRICS as well as Asian and non-Asian economies. This study underscores the importance of a balanced approach to banking regulation to foster sustainable development without stifling economic growth.

Again, Boachie, Aawaar, and Domeher (2021) focused on analysing the relationship between financial inclusion, banking stability, and economic growth in 18 sub-Saharan African countries over 10-year period. They used panel system generalised method of moments for regression analysis and found that economic growth drives banking stability, and financial inclusion positively influences the stability of banks and economic growth. However, bank capital regulation negatively influences banking stability in sub-Saharan African countries. Thus, the study found that a growing economy is associated with a more stable banking system, and that financial inclusion can help make banks more stable and can also promote economic growth. However, too much bank capital regulation can actually make banks less stable. Their findings highlight the dual role of financial inclusion in promoting both

economic growth and banking stability, while cautioning against overly restrictive regulatory measures.

Archer and Idun (2023) investigated the relationship between banks' financial outreach, financial innovation, and sustainable development in 34 African economies over 10-year period. They employed the two-step system generalised method of moments technique for analysis and found that financial outreach has a significant but mixed impact on sustainable development, depending on the specific indicator used. Financial innovation, on the other hand, was found to have a significant negative relationship with sustainable development in Africa. The study recommends collaboration between governments, policymakers, and financial service providers to ensure fair and attractive loan interest rates for disadvantaged individuals and vulnerable businesses to promote consumption and economic growth. The study suggests that while extending financial services can be beneficial, there is a need for careful management of financial innovations to avoid adverse outcomes for sustainable development.

The study by Ozili and Iorember (2023) examined the impact of financial stability on sustainable development across 26 countries from 2011 to 2018. They utilised a unique financial stability index, sustainable development index, and four Sustainable Development Goals (SDG) indicators, employing the system GMM method for analysis. The findings revealed that financial stability had a significant but context-dependent effect on sustainable development, with a negative impact observed in Asian countries. Additionally, the study highlighted variations in the impact of financial stability on specific SDGs, suggesting that the relationship between financial stability and sustainable development is influenced by the

measurement approach and the economic context of the countries studied. This study highlights the context-dependent nature of the relationship between financial stability and sustainable development, suggesting the need for tailored strategies that consider regional economic conditions.

Additionally, Wahab et al. (2022) focused on evaluating the impact of financial stability on consumption-based carbon emissions in BRICS countries, considering factors such as renewable energy, technological innovation, economic growth, industry value-added, and international trade from 1995 to 2018. They employed the spatial Durbin model with spatial time-fixed effect technique to account for cross-border spillover effects. The findings revealed that financial stability, technological innovation, economic growth, and imports contributed to higher consumption-based carbon emissions, while renewable energy and exports had a mitigating effect. In the context of cross-border spillover, renewable energy showed a positive influence, while economic growth and bilateral exports had a negative impact on consumption-based carbon emissions. This study links financial stability with environmental sustainability, showing the need for integrating environmental considerations into financial policies.

Using panel data for 30 Chinese provinces from 2011 to 2020, Khan et al. (2023) examined the impact of digital financial inclusion on household carbon emissions. Their findings demonstrated a significant and robust mitigation effect of digital financial inclusion on household carbon emissions, with the impact being influenced by the breadth of coverage and the degree of digitisation. Notably, this effect was more pronounced in central and western regions, northern areas with high winter heating demand, and urban areas. The study also identified that digital financial inclusion reduces household carbon

emissions primarily through changes in electricity and natural gas consumption, providing insights for decision-makers on addressing carbon emission mitigation in Chinese households. The study highlights the environmental benefits of digital financial inclusion, supporting its role in promoting sustainable development.

Chinoda and Kapingura (2023) used a new measure of digital financial inclusion along with z-score, Herfindahl–Hirschman Index (HHI), and non-performing loans as data variables to investigate the impact of digital financial inclusion and bank competition on bank stability in Sub-Saharan Africa from 2014 to 2020. The findings indicated that digital financial inclusion had a significant positive relationship with bank stability (z-score) and a negative relationship with non-performing loans. Additionally, bank competition (HHI) had a significant negative effect on bank stability, aligning with the competition-fragility view. The study suggests that policymakers should focus on enhancing digital financial literacy, which contributes to bank stability, and explore ways to improve bank competition to reduce non-performing loans and enhance overall bank stability. The study also underscores the importance of digital financial inclusion in enhancing bank stability, suggesting that policymakers should focus on promoting digital financial literacy.

The study by Banna and Alam (2021) investigated the impact of digital financial inclusion (DFI) on banking stability and sustainable economic development in seven emerging Asian countries from 2011 to 2018, with a focus on the aftermath of the 2007-2009 Global Financial Crisis (GFC). Their findings suggested that DFI plays a positive role in promoting banking stability and contributes to an inclusive and sustainable economic development framework. The study emphasises that an integrated digital

financial system not only ensures banking stability but also supports economic sustainability, ultimately contributing to the achievement of Sustainable Development Goals (SDGs) by 2030.

Frimpong et al. (2023) investigated the role of economic freedom in the relationship between financial inclusion and stability in sub-Saharan African economies. Using the System General Method of Moment and data from 39 sub-Saharan African countries between 2004 and 2017, the study found that financial inclusion had a positive impact on financial stability in these economies. Importantly, the results highlighted that financial inclusion is most effective in enhancing financial stability in economies with a high level of economic freedom, particularly in terms of financial and business freedom. The study suggests that policymakers should promote greater economic freedom by reducing administrative requirements, minimising bureaucracy costs, and creating startup-friendly licensing regulations to facilitate the positive relationship between financial inclusion and stability.

Study by Jima and Makoni (2023) aimed to address the lack of consensus in the literature regarding the relationships between financial inclusion, financial stability, and economic growth in Sub-Saharan African (SSA) countries. Using panel data from 26 SSA economies, they constructed a composite index for financial inclusion and conducted autoregressive distributed lags (ARDL) cointegration tests to examine short- and long-run relationships. The findings indicated the existence of both short-run and long-run relationships between these variables, with Granger causality tests revealing various causal links, including two-way causalities and joint uni-directional causalities. This suggests the need for a comprehensive approach in

polycymaking to promote financial inclusion for achieving sustainable economic growth in the region.

Zheng et al. (2023) explored the relationship between digital financial inclusion, environmental performance, and the impact of the COVID-19 pandemic in highly polluted economies. Using 2SLS, GMM approaches, and panel quantile regression, they found that both digital financial inclusion and the COVID-19 pandemic had a negative impact on CO₂ emissions. As a result, the study suggests that highly polluted economies should promote financial inclusion and align environmental policies with financial inclusion strategies to achieve environmental sustainability goals. This study supports the environmental benefits of digital financial inclusion and highlights its role in promoting environmental sustainability in the context of the COVID-19 pandemic.

Gap Identified

The existing literature on sustainable development and its measurement often relies heavily on traditional economic indicators such as GDP per capita and real output growth. However, this narrow approach does not fully capture the multifaceted nature of sustainable development, which includes economic, social, and environmental dimensions. According to Tomislav (2018), sustainable development should be measured using three broad proxies: economic, social, and environmental. These proxies offer a more holistic view of a country's progress toward sustainability and can highlight potential trade-offs between economic growth and social or environmental well-being. By employing these broader measures, researchers can gain a more comprehensive understanding of the complex interactions and dependencies involved in sustainable development. Despite the recognition of

the importance of these broader proxies, much of the existing literature still focuses predominantly on economic indicators. This gap suggests a need for studies that integrate social and environmental factors into their analysis of sustainable development.

In addition to the traditional economic indicators, this study utilised comprehensive proxies for banking sector stability, such as the bank z-score and bank credit-to-deposit ratio. These indicators provide a more detailed assessment of the banking sector's health and stability, which is crucial for understanding its role in sustainable development. Furthermore, this study introduced digital financial inclusion (DFI) to capture the overall effect of banking sector stability on sustainable development. By including DFI, the study acknowledges the significant impact that digital financial services can have on enhancing financial accessibility and inclusion, which are critical components of sustainable development.

Conceptual Framework

Figure 1, shows how banking sector stability and digital financial inclusion affect sustainable development in SSA economies. Additionally, Figure 1 shows the interaction role played by digital financial inclusion in the relationship between banking sector stability and sustainable development in SSA economies. Finally, Figure 1 shows the direct link between the control variables (inflation rate, quality education, reduced inequalities, real interest rate, research and development) and the dependent variables (sustainable development).

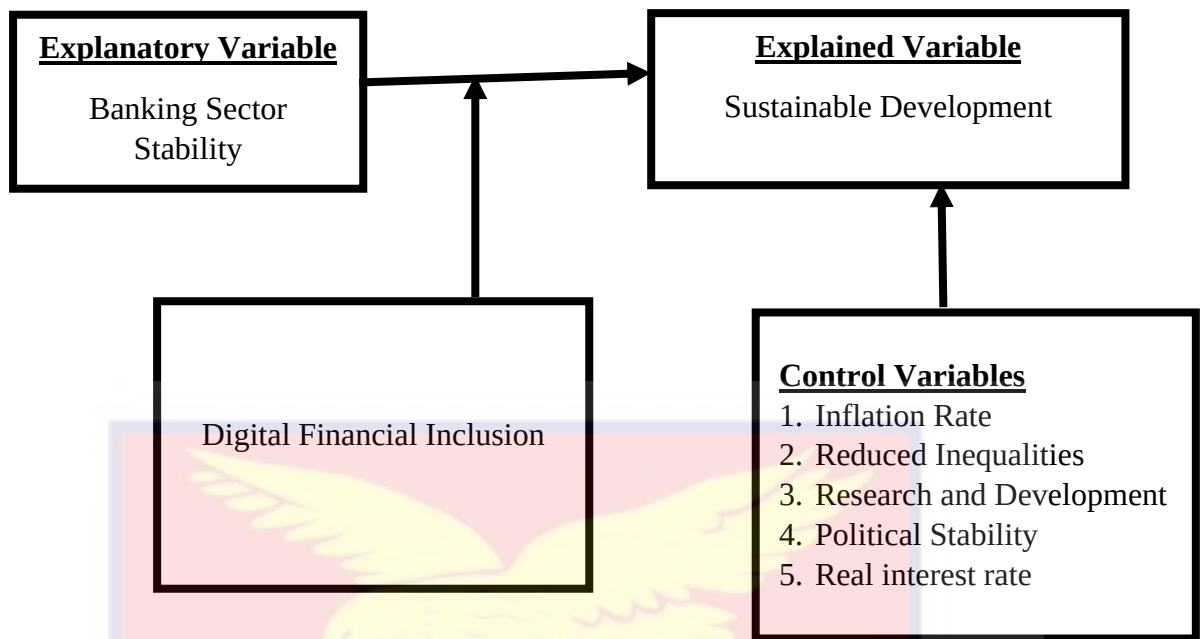


Figure 1: Conceptual framework
Source: Author's Construct

Chapter Summary

This chapter reviewed the literature based on the objectives and research questions. The first section explored the theoretical models underpinning the study and these theories included: technology acceptance model, systemic risk theory, and triple bottom theory. The second section also examined concepts such as sustainable development and its dimensions, banking sector stability and its' determinants, and the relationship between the concepts. Finally, the last section focused on empirical literature and conceptual framework of the relationship between the constructs of the study.

CHAPTER THREE

RESEARCH METHODS

Introduction

This chapter outlines the systematic procedures employed to explain the role of banking sector stability and digital financial inclusion in enhancing the achievement of sustainable development. The chapter articulates how the researcher went about this study and the logic behind each method used. Specifically, this chapter presents the research paradigm, research design, research approach, sources and measurement of variables, model specification and justification, and the estimation techniques.

Research Paradigm

Every researcher is guided by certain beliefs, values, and a view of the world (Adjei, 2015). These guiding principles are often referred to as paradigms or philosophical assumptions that inform the researcher's perspective before undertaking a study. Research philosophy, is defined by Saunders, Lewis, and Thornhill (2016), as a system of beliefs and assumptions about knowledge development. Depending on these beliefs, researchers may gravitate toward a qualitative, quantitative, or mixed-methods approach (Creswell & Creswell, 2018). Social science research draws from five major philosophical perspectives: positivism, critical realism, interpretivism, post-positivism, and pragmatism (Saunders et al., 2016).

In this study, the chosen approach is post-positivism. As defined by Saunders et al. (2016), post-positivism is a philosophical approach that aims to scientifically investigate issues while acknowledging the role of subjectivity and value judgments in the construction of knowledge. Post-positivists emphasise the generation of facts influenced by human interpretation. It

utilises existing theories to formulate hypothesis, which is then rigorously tested, either confirming or refuting it. Post-positivism allows for the coexistence of objective reality and subjectivity, aiming for universal truth in social sciences study (Saunders et al., 2016; Sekaran & Bougie, 2016).

Research Design

Research design entails a set of arrangements made to collect and analyze data in a manner that aligns with the research purpose (Potwarka et al., 2019). It serves as a systematic framework that integrates various components, such as structure, strategies, and methods, to ensure effective inquiry and control over diversity (Williams, 2007; Zikmund, 2000). According to Young and Javalgi (2007), research design can be seen as a master plan that outlines the process and methods for obtaining and analysing the necessary information. Zikmund et al. (2012), underscores that it involves aspects of data collection, measurement, and analysis. A well-defined research design entails promptly identifying the research problem, selecting and organising research objectives, defining concepts and issues, and thoroughly documenting research ideas (Zikmund, 2000). Akhtar (2016) highlights that research design entails a systematic approach to economically collect, analyse, and interpret the appropriate information using a well-defined procedure.

This study employed explanatory research design due to its alignment with scientific research, which aims to establish cause and effect relationships among constructs such as banking sector stability and digital financial inclusion (independent variables), and sustainable development (dependent variable). Explanatory studies elucidate the nature and direction of relationships between variables, (Zikmund, Carr, Babin, and Griffin, 2013). Potwarka et al. (2019) further assert that explanatory research design is based

on the premises of the positivist research paradigm, seeking to establish cause-and-effect relationships. Explanatory research design primarily aims to explain why events occur and predict future occurrences (Potgieter et al., 2019; Malhotra, 2015). The decision to employ an explanatory research design is driven by the desire to understand the logic behind the cause-and-effect relationships among the variables of interest.

Research Approach

According to Creswell and Creswell (2018), there are three approaches to research: qualitative, quantitative, and mixed methods. Additionally, Saunders et al. (2016) highlight three key differences between quantitative and qualitative research methods. Firstly, quantitative research allows researchers to isolate and define variables, establishing relationships between them to form research hypotheses. In contrast, qualitative research does not focus on variable isolation and definition. Secondly, quantitative research emphasises objectivity in data collection and analysis processes, while subjectivity is often introduced in qualitative research. Lastly, employing the quantitative approach in a study provides a foundation for validity and generalisability of results regarding the behavior of the selected variables. Considering the purpose of this study, its specific objectives, hypotheses, and the nature of the secondary data to be analysed, a quantitative research approach was employed. Creswell (2014) explains that the quantitative approach seeks to explain phenomena by collecting numerical data and analysing them using mathematically based methods (in particular statistics).

Additionally, utilising the quantitative research approach allows for the generalisation of results from the sample to the countries from which the data was collected.

Data Sources

The main variables used in this study include banking sector stability, digital financial inclusion, and sustainable development. Banking sector stability was assessed using the z-score and bank credit as a percentage bank deposit. The study utilised annual panel data covering the period from 2012 to 2021. The data for this study was obtained from two sources: Global Financial Development Indicators (GFDI) and the World Development Indicators (WDI) provided by the World Bank. Due to data limitations, the study focused on selected countries within the Sub-Saharan African region. The chosen countries included Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Congo DR, Cote d'Ivoire, Eswatini, Ethiopia, Kenya, Lesotho, Ghana, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Uganda, Zambia, and Zimbabwe. In total, the dataset comprised 28 countries, and the data covered a period of 10 years.

The selection of data sources and countries was driven by the availability of relevant data and the focus of the study on the Sub-Saharan African region. The Global Financial Development Indicators and World Development Indicators are reputable sources that provide comprehensive data on various economic and financial indicators. By utilising panel data from multiple countries over a significant time span, the study aimed to capture variations and trends in banking sector stability, digital financial inclusion, and sustainable development within the selected region.

Measurement of Variables

The variables examined in this study include sustainable development (SD) as the dependent variable, and banking system stability and digital financial inclusion as independent variables. Sustainable development was operationalised using adjusted net savings (ANS), which captures the environmental, economic, and social dimensions of SD. Specifically, carbon dioxide emissions (CO₂), Gross National Income (GNI), and Government Expenditure on Education (GEE) were used as proxies for these dimensions, respectively. Banking sector stability was measured using two indicators: Banking system z-scores (BSZ) and Bank credit as a percentage of bank deposits (BCD). These indicators provide insights into the stability and functioning of the banking system. Digital financial inclusion, on the other hand, was assessed by account ownership with mobile money service provider. This indicator serves as a proxy for the level of digital financial inclusion within the studied countries.

Additionally, the study incorporated control variables to account for other factors that could influence sustainable development. These control variables were selected based on their relevance in existing literature on sustainable development, their suitability for national and global analysis, and the availability of data within the specified sample period. By including control variables, the study aimed to isolate the specific effects of banking system stability and digital financial inclusion on sustainable development, while accounting for potential confounding factors. These variables include inflation rate, reduced inequalities, real interest rate, research and development policy and political stability. The selection of measurement indicators and control variables was guided by the need to capture and analyze key

dimensions of sustainable development and their relationships with banking system stability and digital financial inclusion. The chosen indicators and variables have been widely used and accepted in previous studies, ensuring consistency and comparability with existing research (Sen, 2013; Strezov et al., 2017; Romero & Linares, 2018; Cassely et al., 2020; Koirala and Pradhan 2020). This is shown in Table 1:

Table 1: Data Source and Measurement of Variables

Variables	Type	Measurement / Proxy	Data Source
Explained/Dependent Variables:			
Variables: Sustainable development Economic Sustainability Social Sustainability Environmental Sustainability	Continuous	4 Proxies Adjusted Net Savings (ans) Gross National Income per capita US\$ (gni) Government Expenditure on Education, total % of government expenditure (GEE) CO2 Emissions (kg per US\$ of GDP)	Global Financial Development Indicators (GFDI)
Explanatory/Independent Variables: Banking Sector Stability	Continuous	2 Proxies Bank Z-Score (BZS) Bank Credit as a percentage of deposit (BCD)	World Development Indicators (WDI)
Moderating Variable: Digital Financial Inclusion	Continuous	1 Proxy Account ownership with financial institution or mobile money service provider	World Development Indicators (WDI)
Control Variables:			
Inflation Rate Research and Development Political Stability Reduced Inequalities Real Interest Rate	Continuous	5 proxies Inflation, GDP Deflator (annual %) Research and Development Expenditure (rnd) Political Stability and Absence of Violence/Terrorism: Percentile Rank (PS) Gini index	World Development Indicators (WDI)

Source: Author's Construct (2023)

Endogeneity Test

The study analysed the endogeneity of the explanatory variables in Table 2. The endogeneity analyses were conducted on bank z-score, bank credit to deposit, and account ownership with mobile money service provider. The STATA command "estat endog" was employed to examine endogeneity, with the null hypothesis being that the variables are exogenous and unrelated to the model's error term. The endogeneity of the variables was then assessed using the Durbin Wu-Hausman (DWH) test. The p-value was evaluated at the significant threshold of 0.05. The rejection of the null hypothesis denotes the existence of endogeneity. The DWH tests' findings suggested that the null hypothesis should be disproved, proving that all explanatory variables in the model are endogenous.

Table 2: Durbin Wu- Hausman (DWH) Test Results

Null hypothesis (H0): Variables are exogenous

Variables	DWH test	DWH Test	Test Results
	Coefficient	P-value	
Bank Z-Score	51.4224	0.0000	Rejected at 5% significance level
Bank credit to deposit	18.5182	0.0306	Rejected at 5% significance level
Account ownership with mobile money service provider	43.2934	0.0010	Rejected at 5% significance level

Source: Author's Construct (2023)

***, **, * represent 1%, 5% and 10% significant levels respectively

Model Specification

Baseline model

$$Y_{it} = a_i + Y_{it-1} + \beta X_{it} + \varepsilon_{it} \quad (1)$$

$$e_{it} = a_i + \varepsilon_{it}$$

where;

i refers to the country ($i = 1, 2, 3, \dots, 28$);

t refers to time period from (2012 to 2021) ($t = 1, 2, 3, \dots, 10$)

Y_{it} is the dependent variable

Y_{it-1} is the lag of the dependent variable.

a_i is the intercept

X_{it} is the vector of independent variables (regressors, control variables and intervening variables)

ε_{it} is the error term assumed to be serially uncorrelated.

The equation for the error term e_{it} specifies that the error term is a function of the time-invariant individual effect and the idiosyncratic error term ε_{it} .

Thus,

$$SD_{it} = \beta_0 + \beta_1 SD_{it-1} + \beta_2 BZS_{it} + \beta_3 AMMS_{it} + \sum_{h=1}^n \beta_h Z_{it+h} \mu_{it} + \varepsilon_{it}$$

$$SD_{it} = \beta_0 + \beta_1 SD_{it-1} + \beta_2 BCD_{it} + \beta_3 IFS_{it} + \sum_{h=1}^n \beta_h Z_{it+h} \mu_{it} + \varepsilon_{it} \quad (2)$$

where;

SD_{it} is Sustainable development (explained variable) measured by Adjusted Net

Savings for each country i at time t .

SD_{it-1} denotes the lag of the explained variable.

$AMMS_{it}$ represents account ownership with financial institution or mobile money service provider for each country i at time t .

$\sum_{h=i}^n \beta_h Z_{it}$ represents the summation of the control variables (inflation, research and development, reduced inequalities, political stability and real interest rate).

BZS denotes Bank Z-Score

BCD denotes Bank credit to deposit

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_h$ are the coefficient

μ denotes the unobserved country-specific effect

ε_{it} also denotes the error term

Model 1 (answers objective 1 and 2)

$$SD_{it} = \beta_0 + \beta_1 SD_{it-1} + \beta_2 l_n BZS_{it} + \beta_3 l_n BCD_{it} + \beta_4 l_n AMMS_{it} + \sum_{h=i}^n \beta_h l_n Z_{it} + \varepsilon_{it} \quad (3)$$

where;

- SD_{it} represents Sustainable development (explained variable) measured by Adjusted Net Savings for each country i in sub-Saharan Africa at time t .
- SD_{it-1} represents the lag of the explained variable.
- $l_n BZS_{it}$ represents the natural log of Bank Z-score for each country i at time t .
- $l_n BCD_{it}$ represents the natural log of Bank credit to deposit for each country i at time t .
- $l_n AMMS_{it}$ represents the natural log account ownership with financial institution or mobile money service provider for each country i at time t .

- $\sum_{h=i}^n \beta_h l_n Z_{it}$ represents the summation of natural log of control variables (inflation, research and development, reduced inequalities, political stability and real interest rate).
- $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_h$ are the coefficient
- ε_{it} also denotes the error term.

To eliminate country-specific effects, we take the first differences of eqn. (1)

$$SD_{it} - SD_{it-1} = \beta_0 + \beta_1 (SD_{it-1} - SD_{it-2}) + \beta_2 l_n (BZS_{it} - BZS_{it-1}) + \beta_3 l_n (BCD_{it} - BCD_{it-1}) + \beta_4 l_n (AMMS_{it} - AMMS_{it-1}) + (\sum_{h=i}^n \beta_h Z_{it} - \sum_{h=i}^n \beta_h Z_{it-1}) + \varepsilon_{it} - \varepsilon_{it-1} \quad (4)$$

where;

$SD_{it} - SD_{it-1} = \Delta SD_{it}$ and this definition applies to all explanatory variables as well. Similarly, $\varepsilon_{it} - \varepsilon_{it-1} = \Delta \varepsilon_{it}$.

Model 2: The moderating role of digital financial inclusion in the Relationship between banking sector stability and sustainable development

This model focuses on the third objective of this study to examine the moderating effects of digital financial inclusion on the relationship between banking sector stability and sustainable development in SSA economies). Banking sector stability and digital financial inclusion were interacted, and the interaction variables was entered into the model as a separate independent variable. If the coefficient of the interaction variables is positive and significant, it indicates that digital financial inclusion improves the effect of banking sector stability and sustainable development.

Model 2 (answers objective 3)

$$SD_{it} = \beta_0 + \beta_1 SD_{it-1} + \beta_2 l_n BZS_{it} + \beta_3 l_n AMMS_{it} + \beta_4 l_n (BZS * AMMS)_{it} + \sum_{h=i}^n \beta_h Z_{it} + \mu_{it} + \varepsilon_{it} \quad (5)$$

$$SD_{it} = \beta_0 + \beta_1 SD_{it-1} + \beta_2 l_n BCD_{it} + \beta_3 l_n AMMS_{it} + \beta_4 l_n (BCD * AMMS)_{it} + \sum_{h=1}^n \beta_h Z_{it} + \mu_{it} + \varepsilon_{it} \quad (6)$$

where;

- SD_{it} denotes Sustainable development (explained variable) measured by Adjusted Net Savings for each country i at time t .
- SD_{it-1} denotes the lag of the explanatory variable.
- $l_n BZS_{it}$ represents the natural log of Bank Z-score for each country i at time t .
- $l_n BCD_{it}$ represents the natural log of Bank credit to deposit for each country i at time t .
- $l_n AMMS_{it}$ represents the natural log of account ownership with financial institution or mobile money service provider for each country i at time t .
- $\sum_{h=1}^n \beta_h Z_{it}$ represents the summation of natural log of control variables (inflation, research and development, reduced inequalities, political stability and real interest rate)
- $l_n (BZS * AMMS)_{it}$ denotes the interacting term of the natural log of the bank z-score and the natural log of account ownership with financial institution or mobile money service provider for each country i at time t .
- $l_n (BCD * AMMS)_{it}$ denotes the interacting term of the natural log of the bank credit to deposit and the natural log of account ownership with financial institution or mobile money service provider for each country i at time t .
- $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_h$ are the coefficient

- μ_{it} denotes the unobserved country-specific effect
- ε_{it} also denotes the error term.

To eliminate country-specific effects, we take the first differences of eqn. (3) and eqn. (4)

$$SD_{it} - SD_{it-1} = \beta_o + \beta_1 (SD_{it-1} - SD_{it-2}) + \beta_2 l_n (BZS_{it} - BZS_{it-1}) + \beta_3 l_n (AMMS_{it} - AMMS_{it-1}) + \beta_{4\Delta} l_n (BZS * AMMS_{it})_{it} + \left(\sum_{h=i}^n \beta_h Z_{it} - \sum_{h=i}^n \beta_h Z_{it-1} \right) + \varepsilon_{it} - \varepsilon_{it-1} \quad (7)$$

$$SD_{it} - SD_{it-1} = \beta_o + \beta_1 (SD_{it-1} - SD_{it-2}) + \beta_2 l_n (BCD_{it} - BCD_{it-1}) + \beta_3 l_n (AMMS_{it} - AMMS_{it-1}) + \beta_{4\Delta} l_n (BCD * AMMS_{it})_{it} + \left(\sum_{h=i}^n \beta_h Z_{it} - \sum_{h=i}^n \beta_h Z_{it-1} \right) + \varepsilon_{it} - \varepsilon_{it-1} \quad (8)$$

where;

$SD_{it} - SD_{it-1} = \Delta SD_{it}$ and this definition applies to all explanatory variables as well. Similarly, $\varepsilon_{it} - \varepsilon_{it-1} = \Delta \varepsilon_{it}$, $\beta_4 l_n (BZS_{it} - BZS_{it-1} * AMMS_{it} - AMMS_{it-1}) = \beta_{4\Delta} l_n (BZS * AMMS)_{it}$ and $\beta_4 l_n (BCD_{it} - BCD_{it-1}) + \beta_4 l_n (AMMS_{it} - AMMS_{it-1}) = \beta_{4\Delta} l_n (BCD * AMMS)_{it}$

Estimation Technique

The two-step System Generalised Method of Moments by Roodman (2009) was employed to investigate the relationship among the variables. The two-step System GMM extends the approach used by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). The approach by Arellano and Bond (1991) makes use of the lagged levels of the explanatory variables and the first difference of the variables to deal with issues of unobservable simultaneity bias and country-specific effects. Arellano

and Bover (1995) later observed that Arellano and Bond's (1991) technique would result in erroneous conclusions when the series have time-persistent problems. Additionally, Blundell and Bond (1998) contend that if the instruments utilised in the traditional first-difference GMM are not strong enough, then there is the possibility of the results of the within groups being biased. The System GM, therefore, originated as a remedy to the problems posed by the approaches of the earlier scholars.

The System GMM combines both the level of the residuals and the difference of the disturbance term as well as additional instruments in the levels equations (Odhiambo, 2020). It consists of one-step and two-step System GMM. The latter has been confirmed to be more efficient and robust to heteroscedasticity and autocorrelation (Obuobi et al., 2021). The choice of the two-step System GMM is motivated by the following justifications which have received massive support from earlier works (Fosu & Abass, 2019; Agyei, Marfo-Yiadom, Ansong, & Idun, 2020; Abeka, Andoh, Gatsi, & Kawor, 2021, Acher & Idun, 2023). The estimator is suitable to use when the cross-sectional data (the number of countries) is significantly more than the time series data (the number of periods). The countries of interest for this current paper are 28 while the period is 10 years. Moreover, the technique deals with the proliferation of instrumental variables as well as controlling for the persistence of the dependent variables. The argument for persistence in the dependent variables is that the previous year's sustainable development tends to influence that of the current year. Adding to this, Agyei et al. (2020) contend that if the correlation between the regressand and its lag exceeds 0.80, then the former is persistent. In this study, the correlation between sustainable development (SD) and its lag (L.SD) is 0.821.

Additionally, the technique tends to account for the possible endogeneity problem or bias resulting from the potential reverse causality between the explained and explanatory variables and time-invariant omitted variables and account for it using instrumental variables (Tchamyou, 2020; Agyei et al., 2021). Lastly, it controls for the problem of unobserved heterogeneity and reduces the overidentification of instruments and cross-sectional dependence (Agyei et al., 2020). The general system GMM equation is specified as follows;

$$SD_{it} = \beta_o + \beta_1 SD_{it-1} + \sum_{h=1}^n \beta_h Z_{it-1} + \mu_i + \delta_t + \varepsilon_{it} \dots\dots\dots(1)$$

$$SD_{it} - SD_{it-1} = \beta_1 (SD_{it-1} - SD_{it-2}) + \sum_{h=1}^n \beta_h (Z_{it-1} - Z_{it-2}) + \delta_{it} - \delta_{it-1} + \varepsilon_{it} - \varepsilon_{it-1} \dots\dots\dots(2)$$

where:

SD_{it} represents the explained variable

SD_{it-1} is the lagged value of the explained for each country i at time t .

$SD_{it} - SD_{it-1}$ represents the change in SD over time.

$SD_{it-1} - SD_{it-2}$ represents the change in lagged SD over time.

Z_{it-1} denotes a set of explanatory variables for each country i at time t .

$Z_{it-1} - Z_{it-2}$ denotes change in explanatory variables over time.

β_o, β_1 and β_h are coefficients to be estimated.

μ_i represents the individual specific fixed effects.

δ_t represents time-specific effects.

ε_{it} is the error term.

Aside GMM, the researcher could have equally employed other panel estimation techniques such as pooled ordinary least square (POLS), pooled mean group (PMG), two-stage least square (2SLS), and fixed and random effect. However, GMM has been disclosed to have some advantages over

these estimators. The POLS is not the best method because it does not account for heterogeneity among panels (Hill, Griffiths & Lim, 2012) and violates one of the assumptions of the traditional linear regression model. The PMG as a cointegration model estimates the long-run relationship among variables. Though it uses lags of the variables because of its autoregressive nature (Pesaran, Shin & Smith, 1999), it requires panel models with more time series observations than cross-sectional which may not be appropriate for this study. Concerning fixed and random effects, the assumption of the current value of the dependent variable being completely independent of its past values is unrealistic which leads to endogeneity arising from unobservable heterogeneity (Gujarati & Porter, 2009; Bell & Jones, 2015). The GMM technique is superior over 2SLS in the sense that the instrumental variable estimates are retrieved from lagged values which eliminate the need for an external instrument as required in 2SLS (Roodman, 2006).

Diagnostics tests on the models assessing the effect of banking sector stability, digital financial inclusion and sustainable development of SSA economies

The two-step system GMM necessitate some diagnostic tests to be conducted. This study conducted the Difference in Hansen Test (DHT), Sargan test of overidentification and Arellano–Bond test for serial correlation. It is expected that the null hypotheses of these test should not be rejected with the exception of first-order serial correlation in first differences (AR (1)). From Table 6, the first diagnostic test is the AR1 test, which tests for autocorrelation of order 1. The p-value for the AR1 test is 0.000945, which is less than 0.05. This means that there is significant autocorrelation of order 1 in the residuals of the model. Autocorrelation is a problem because it can lead to biased

estimates of the regression coefficients. The second diagnostic test is the AR2 test, which tests for autocorrelation of order 2. The p-value for the AR2 test is 0.539, which is greater than 0.05. This means that there is no significant autocorrelation of order 2 in the residuals of the model. The third diagnostic test is the Hansen-J test, which tests for overidentification. The p-value for the Hansen-J test is 0.928, which is greater than 0.05. This means that the number of instruments is not greater than the number of parameters, so the problem of instrument proliferation is not a concern.

Also, from Table 7 the first diagnostic test is the AR1 test, which tests for autocorrelation of order 1. The p-value for the AR1 test is 0.0332, which is less than 0.05. This means that there is significant autocorrelation of order 1 in the residuals of the model. Autocorrelation is a problem because it can lead to biased estimates of the regression coefficients. The second diagnostic test is the AR2 test, which tests for autocorrelation of order 2. The p-value for the AR2 test is 0.423, which is greater than 0.05. This means that there is no significant autocorrelation of order 2 in the residuals of the model. The third diagnostic test is the Hansen-J test, which tests for overidentification. The p-value for the Hansen-J test is 0.987, which is greater than 0.05. This means that the number of instruments is not greater than the number of parameters, so the problem of instrument proliferation is not a concern. Overall, the results of the diagnostic tests suggest that the models are valid.

Chapter Summary

This chapter explained in detail the methodology followed in carrying out the research. The research paradigm of the study, research approach, research design, data sources and analysis procedure, empirical model specification and estimation, were thoroughly discussed. The positivist

research paradigm was used as the theoretical foundation of the study. The quantitative research approach was employed for the study. Explanatory research design was adopted to ensure objectivity in the research process.



CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The results obtained from the empirical analysis are presented and discussed in this chapter. First, descriptive statistics on all the variables are discussed to give an overview of banking sector stability, digital financial inclusion, and sustainable development of SSA economies. The chapter then presents a correlation matrix that helps to avoid the issues of multicollinearity in the empirical specification. Subsequently, the chapter presents a formal discussion of the various models estimated in the study. The latter is systematically achieved by following the respective objectives of the study.

Descriptive Statistics

Before any empirical analysis and discussion can be conducted, Idrees (2018) advocated that the descriptive information of the various indicators employed in the study should be displayed to help the researcher know the distribution of the data. Specifically, for this study, the mean, standard deviation, and minimum and maximum values were presented in Table 3. The results from the table show that sustainable development which is measured as ANS depicted an average of 3.294 percent of Gross National Income (GNI) within minimum and maximum values of -45.265% and 35.955% respectively. The rate of volatility is 11.616 which is an indication that the level of development in the Sub-Saharan African continent is widely dispersed with some of the countries being more developed than others as some nations recorded negative ANS. This negative value implies that the current generations themselves are not fully meeting their needs and as such are not preserving any resource for the future generation.

On the various dimensions of sustainable development, it is seen from Table 3 that the environmental dimension which is measured with CO₂ emissions (kg per US\$ of GDP) had a mean value of 0.311kg with 0.236 standard deviations and a minimum and maximum values of 0.062kg and 1.495kg respectively. It is further observed that the economic sustainability (GNI per capita (US\$)) recorded an average value of \$1753.078 lying within a range of \$261.948 and \$11208.346 with 1981.667 standard deviations. This is an indication that for the sampled countries, the per capita income is low and highly dispersed which could to some extent be due to the fact that most of countries are low income nations with higher population growth rate. The social dimension which is mainly concern about investment in education (human capital) averaged 17.563% of total expenditure which lies within a boundary of 5.131–37.521%. This implies that the expenditure the governments of SSA economies incur on education is very low since the average value is even lesser than half of the maximum value. This means that as some of the countries within SSA region are putting initiatives in place to advocate the need for formal education, others are still lagging behind and probably prioritising on other sectors.

Table 3: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ANS	545	3.294	11.606	-45.265	35.955
co2	500	.311	.236	.062	1.495
Gni	402	1753.078	1981.667	261.948	11208.346
Gee	515	17.563	4.744	5.131	37.521
Bzs	513	13.884	5.559	2.731	38.683
Bcd	514	75.961	22.881	23.317	136.271
Amms	527	12.699	15.734	.072	73.5
Inf	510	10.608	31.563	-16.762	604.946
Ps	530	32.449	21.876	.529	90.566
Rnd	535	.308	.093	.005	.898
Gini	535	43.435	3.181	29.8	64.8
RIR	530	7.698	11.084	-81.132	52.437

Source: Amoako Mensah (2023)

***, **, * represent 1%, 5% and 10% significant levels respectively

SD denotes sustainable development, co2 represents environmental dimension, gni represents economic dimension, gee denotes social dimension, bzs and bcd are the first and second measures of banking sector stability respectively, amms account ownership with mobile money service provider, INF is inflation, rnd denotes research and development, gini is Gini index used to measure reduced income inequalities, ps is political stability and RIR denotes real interest rate.

Regarding the independent variables, the first indicator for banking sector stability (BSS) which is bank z-score (BZS) had an average value of 13.884 with 2.731 and 38.683 as the lowest and highest values respectively. A low mean value of 13.884% for the bank z-score (BZS) suggests that the banking sector is not stable. The BZS is a measure of a bank's ability to withstand financial shocks. A low BZS indicates that a bank has less capital and reserves to absorb losses, making it more vulnerable to financial instability. The fact that the lowest BZS value is 2.731 and the highest is 38.683 suggests that there is a wide range of stability among banks in the sector. This could be a sign of underlying problems in the sector, such as excessive risk-taking or inadequate capital levels. A more stable banking sector would have a narrower range of BZS values. This would indicate that

banks are more evenly matched in terms of their financial strength. A higher value of the bank z-score generally indicates a healthier and more stable banking sector, while a lower value suggests potential financial distress.

The second indicator which is bank credit as a percent of bank deposit (BCD) recorded a mean value of 75.961% with a minimum value of 23.317% and highest value of 136.271%. A high BCD ratio indicates that banks are lending a large portion of their deposits. This can be a sign of a healthy banking sector, as it means that banks are providing credit to businesses and consumers, which can help to stimulate development. However, a high BCD ratio can also be a sign of risk, as it means that banks are more exposed to losses if borrowers' default on their loans. A low BCD ratio indicates that banks are not lending as much of their deposits. This can be a sign of a weak banking sector, as it means that banks are not providing as much credit to businesses and consumers. However, a low BCD ratio can also be a sign of caution, as it means that banks are taking on less risk. A mean value of 75.961% suggests that, on average, the banks have extended credit amounting to approximately 75.961% of their total deposits. This indicates that a significant portion of the funds held by the banks is being utilised for lending purposes. A higher BCD ratio generally implies that the bank has a larger loan portfolio relative to its deposit base.

A mean value of 75.961% suggests that, on average, banks have extended credit amounting to approximately 75.961% of their total deposits. This indicates that a significant portion of the funds held by the banks is being utilised for lending purposes. A higher BCD ratio generally implies that the bank has a larger loan portfolio relative to its deposit base. The minimum value of 23.317% also suggests that there are instances where the bank credit

is relatively low compared to the deposits. This could indicate a more conservative lending approach or potentially lower demand for loans. A higher value of 136.271% for the bank credit as a percent of bank deposit (BCD) would indicate that, on average, the banks have extended credit significantly exceeding their total deposits. This suggests that the banks have a loan portfolio that is substantially larger than their deposit base. A BCD ratio above 100% implies that banks have extended credit that exceeds the funds available in their deposit accounts. This situation can arise due to various factors such as borrowing from other sources, leveraging, or relying on interbank borrowing to supplement their lending activities.

While a higher BCD ratio can indicate that banks are actively lending and expanding their loan portfolio, it also raises concerns about their liquidity and potential risks. Banks with a high BCD ratio may have a greater dependency on external sources of funding, which could make them more vulnerable to liquidity pressures in times of financial stress. A BCD ratio of 136.271% suggests a relatively high level of exposure to loans compared to the deposit base. This may raise concerns about the bank's ability to manage liquidity and potential risks associated with loan defaults or economic downturns.

Digital financial inclusion (DFI), measured by the percentage of the population with an account at a financial institution or mobile money service provider, averaged 12.699% across Sub-Saharan Africa. This suggests that only a small portion of the population in the region has access to formal financial services, highlighting a significant gap in financial inclusion. The wide range of 0.072% to 73.5% indicates substantial variability in DFI across countries within the region. Some countries have achieved relatively high

levels of financial inclusion, with over 70% of the population having an account, while others have almost negligible levels of inclusion, with less than 1% of the population covered. The standard deviation of 15.734% further illustrates this variation, showing that there is considerable disparity within countries as well. This could mean that certain regions within SSA may have much higher levels of financial inclusion than others, leading to significant inequalities in access to financial services.

Relative to the control variables, the results revealed that the rate of inflation averaged 10.608%. This means that, on average, prices are increasing by 10.608% over a specific period indicating that prices are rising at a relatively moderate pace. This signifies that the inflation rate in some of the countries has relatively been on the decrease since some recorded a negative value. However, the range of -16.762-604.946% shows that there is a great deal of variation in inflation rates across countries, with some countries experiencing deflation (falling prices) and others experiencing extremely high inflation. The standard deviation of 31.563% indicates that there is a lot of variation in inflation rates within countries, with some individuals experiencing much higher inflation rates than others. Gini index which measures reduced income inequalities had an average figure of 43.435% of GDP between a range of 29.8% and 64.8% of GDP.

A high Gini index indicates that the distribution of income is very unequal, with a small number of people earning a very high percentage of income and a large number of people earning a very low percentage of income. A low Gini index indicates that the distribution of income is more equal, with a smaller difference between the incomes of the rich and the poor. An average Gini index of 43.435% of GDP indicates that income inequality is

relatively high in Sub-Saharan African continent. The range of 29.8% to 64.8% of GDP shows that there is a significant variation in income inequality across countries. Expenditure on research and development recorded an average value of 0.308% of government expenditure between a range of 0.005-0.898% with 0.093% standard deviations.

It means that, on average, governments spend 0.308% of their total expenditure on research and development. However, there is a wide range of variation in this spending, from 0.005% to 0.898%. This variation is likely due to a number of factors, including the level of economic development of the country, the government's priorities, and the availability of resources. The standard deviation of 0.093 indicates that there is a relatively small amount of variation in the spending on research and development within countries. This suggests that, once a country has decided to invest in research and development, it tends to invest a relatively consistent amount. The high average spending on research and development is a positive sign, as it suggests that governments are investing in the future. However, the wide range of variation suggests that there is still room for improvement. Governments should strive to increase their spending on research and development, as this can lead to economic growth, innovation, and improved lives for citizens.

Political stability had an average of 32.449% with a wide range of 0.529–90.566% and standard deviation of 21.876%. The average political stability of 32.449% indicates that most countries are in a state of moderate political stability. However, there is a wide range of political stability, with some countries being very stable (90.566%) and others being very unstable (0.529%). The standard deviation of 21.876% indicates that there is a

significant amount of variation in political stability from country to country. Finally, real interest rate averaged 7.698% with a minimum and maximum values of -81.132% and 52.437% respectively. This means that, on average, investors in Sub-Saharan Africa were rewarded for lending money over the period of time of the study. However, the standard deviation is 11.084%, meaning that there are lot of variation in the real interest rate in Sub-Saharan Africa.

The descriptive statistics reveal that, there is a wide variation in the levels of sustainable development, banking sector stability and digital financial inclusion across countries in Sub-Saharan Africa. This suggests that there is no single "best" model for sustainable development in the region, and that different countries need to tailor their approaches to their specific circumstances.

Panel Unit Root Test

Table 4: Fisher-type unit-root test for panel dataset

Variables	Inverse chi-square statistics	P-value (Inv. chi-sq stats)	Inverse normal statistics	P-value (Inv. norm. stats)
Lnans	85.8644	0.0038	-2.2109	0.0135
lnco2	414.5838	0.0000	-16.9341	0.0000
Lngni	118.8554	0.0000	-2.2070	0.0137
Lngee	245.3549	0.0000	-8.5387	0.0000
Lnbzs	99.1953	0.0003	-4.0120	0.0000
lnbcd	487.1694	0.0000	-18.0026	0.0000
lnamms	88.4567	0.0037	-0.3477	0.0040
lnINF	320.4100	0.0000	-12.0434	0.0000
lnrnd	189.0428	0.0000	-10.0601	0.0000
Lnini	608.5671	0.0000	-21.2664	0.0000
lnPS	147.4936	0.0000	-4.7069	0.0000
lnRIR	213.1996	0.0000	-8.5052	0.0000

Source: Amoako Mensah (2023)

***, **, * represent 1%, 5% and 10% significant levels respectively

Note: Lnans denotes sustainable development, lnco2 represents environmental dimension, lngni represents economic dimension, lngee denotes social dimension, lnbzs and lnbcd are the measures of banking sector stability respectively, lnammms denotes account ownership with mobile money service provider, lnINF is inflation, lnrnd denotes research and development,

Ingini is Gini index used to measure reduced income inequalities, lnPS is political stability and RIR denotes real interest rate.

Table 4, shows the results of Fisher-type unit root test for a panel of 28 countries. The null hypothesis is that all panels contain unit roots, which means that they are non-stationary. The alternative hypothesis is that at least one panel is stationary. For each variable listed, there are two test statistics (inverse chi-square and inverse normal) along with their corresponding p-values. In all cases, the p-values associated with both types of test statistics are very close to zero (typically less than 0.05 or even 0.01). This indicates strong evidence against the null hypothesis of unit roots, suggesting that the variables are stationary at 0.05.

Correlation Analysis

The correlation matrix for the variables used in this study is presented in Table 5. A thorough examination of the table reveals that there is a strong positive connection (0.870) between the dependent variable (lnans) and its lag which is even more than the threshold of 0.80, making it suitable to employ the System GMM (Tchamyou, 2020). This high correlation coefficient suggests that the level of persistency in the dependent variable is very high. The individual sustainability dimensions exhibited weak correlation with the composite sustainability measure. Albeit the weak correlation, they had positive connection except the social dimension that had inverse association. Additionally, a cursory observation of the correlation matrix unveils that there is generally weak correlation among all the variables used in the study with the exception of digital financial inclusion which exhibited moderate association with both the environmental dimension and the first indicator for stability (lnbzs), thus, 0.268 and 0.181 respectively. These associations among the variables do not pose any problem of multicollinearity since they

are all lesser than 0.90 as suggested by Adam (2016).



Table 5: Pairwise correlations

Variables	lnans	lngni	lngee	lnco2	lnbzs	lnbcd	lnifs	lnINF	lnrnd	lngini	lnPS	lnRIR	
Lnans	1.000												
L. Lnans	0.870* (0.000)	1.000											
Lngni	0.144* (0.001)	-0.187* (0.000)	1.000										
Lngee	-0.059 (0.161)	-0.119* (0.016)	-0.093* (0.027)	1.000									
lnco2	0.139* (0.001)	-0.130* (0.009)	0.552* (0.000)	-0.019 (0.656)	1.000								
lnbzs	0.012 (0.773)	0.090 (0.070)	-0.181* (0.000)	0.114* (0.007)	-0.088* (0.038)	1.000							
lnbcd	-0.032 (0.456)	-0.032 (0.525)	0.032 (0.447)	0.067 (0.114)	0.017 (0.689)	0.458* (0.000)	1.000						
Lnamms	0.116* (0.000)	0.015 (0.361)	0.041* (0.000)	-0.218* (0.000)	0.312* (0.000)	-0.024 (0.565)	-0.017 (0.384)	1.000					
lnINF	-0.089* (0.042)	-0.132* (0.011)	0.054 (0.222)	0.079 (0.072)	-0.030 (0.494)	-0.044 (0.318)	-0.144* (0.001)	-0.126* (0.004)	1.000				
Lnrnd	0.018 (0.666)	0.026 (0.596)	0.075 (0.075)	-0.065 (0.126)	0.197* (0.000)	0.023 (0.583)	0.126* (0.003)	0.164* (0.000)	-0.106* (0.016)	1.000			
Lngini	-0.044 (0.298)	-0.137* (0.005)	0.124* (0.003)	0.022 (0.609)	0.169* (0.000)	-0.152* (0.000)	-0.098* (0.020)	0.045 (0.283)	0.043 (0.329)	0.030 (0.474)	1.000		
lnPS	0.072 (0.088)	-0.223* (0.000)	0.131* (0.002)	0.058 (0.170)	0.203* (0.000)	-0.086* (0.042)	0.118* (0.005)	0.039 (0.351)	-0.051 (0.244)	0.035 (0.403)	0.147* (0.000)	1.000	
lnRIR	0.140* (0.002)	0.125* (0.017)	0.027 (0.548)	-0.057 (0.207)	0.101* (0.024)	0.139* (0.002)	0.142* (0.001)	0.037 (0.408)	-0.206* (0.000)	0.033 (0.462)	0.042 (0.351)	0.101* (0.024)	1.000

Source: Amoako Mensah (2023)

***, **, * represent 1%, 5% and 10% significant levels respectively

Note: lnans denotes sustainable development, lnco2 represents environmental dimension, lngni represents economic dimension, lngee denotes social dimension, lnbzs and lnbcd are the measures of banking sector stability respectively, lnamms denotes account ownership with mobile money service provider, lnINF is inflation, lnrnd denotes research and development, lngini is Gini index used to measure reduced income inequalities, lnPS is political stability and lnRIR denotes real interest rate.

System GMM results on the relationship among banking sector stability, digital financial inclusion and sustainable development in SSA.

This subsection presents and discusses the empirical results related to the objectives of the study. The findings are detailed in Tables 6 and 7. Table 6 displays the results of the separate effects of banking sector stability and digital financial inclusion on the sustainable development of SSA economies. Meanwhile, Table 7 provides insights into the moderating role of digital financial inclusion in the relationship between banking sector stability and sustainable development. The results from both Tables 6 and 7 reveal that the lags of the dependent variables significantly influence their current values across all models, with a 1% significance level. This suggests that an economy's level of sustainable development is heavily influenced by its previous levels. In other words, the sustainable development achieved by an economy is not solely a result of current efforts but is deeply rooted in its historical trajectory. Past investments, policies, and societal values play a crucial role in shaping the conditions necessary for sustainable development, making it a cumulative process that builds upon itself over time. This finding is consistent with Liu, Zhang, Hafeez, and Ullah (2022), who argue that past economic and environmental performance significantly impacts current outcomes.

Table 6: Separate effects of Banking sector stability and Digital Financial Inclusion on Sustainable Development of SSA Economies

	(Model 1) Lnans	(Model 2) lnCO2	(Model 3) lngni	(Model 4) Lngee
L.lnans	0.319*** (0.0778)			
L.lnCO2		-0.0930*** (0.0291)		
L.lngni			0.832*** (0.0484)	
L.lngee				0.563*** (0.195)
Lnbzs	0.725** (0.317)	0.079*** (0.0527)	0.219*** (0.0692)	-0.575* (0.299)
lnBCD	-0.354** (0.164)	-0.162*** (0.0532)	0.210*** (0.0448)	-2.001* (1.142)
Lnamms	0.0859** (0.0426)	0.0323** (0.0164)	0.0415*** (0.0109)	0.295*** (0.0655)
Control				
lnINF	0.564*** (0.105)	-0.0507*** (0.00821)	-0.0565*** (0.0155)	0.553** (0.203)
Lnrnd	0.313*** (0.0897)	-0.0595 (0.0450)	-0.0759 (0.0513)	0.291*** (0.0767)
Lngini	0.891 (0.841)	0.428** (0.198)	-1.547*** (0.324)	-1.071** (0.496)
lnPS	0.177 (0.125)	-0.119** (0.0453)	0.168*** (0.0400)	-0.0648 (0.192)
lnRIR	0.151*** (0.0511)	-0.0384* (0.0222)	0.0242 (0.0231)	0.102** (0.0390)
Constant	-5.645 (3.443)	-1.662** (0.751)	5.804*** (1.223)	6.848*** (2.248)
Diagnostics				
Observations	234	410	417	427
No. of instruments	40	41	44	22
AR1 (p-value)	0.000945	0.000497	0.0615	0.0101
AR2 (p-value)	0.539	0.807	0.654	0.653
Hansen-J (p-value)	0.928	0.823	0.975	0.499

Source: Amoako Mensah (2023)

* p<0.10, ** p<0.05, *** p<0.0 significant levels respectively, standard errors in parentheses

Note: Lnans denotes sustainable development, lnCO2 represents environmental dimension, lngni represents economic dimension, Lngee denotes social dimension, L.lnans denotes lag of overall sustainability, L.lnCO2 denotes lag of environmental sustainability, L.lngni denotes lag of economic sustainability, L.lngee denotes lag of social sustainability, Lnbzs and lnbcd are the measures of banking sector stability respectively, Lnamms denotes account ownership with mobile money service provider, lnINF is inflation, Lnrnd denotes research and development, lngini is Gini index used to measure reduced income inequalities, lnPS is political stability and lnRIR denotes real interest rate.

Banking Sector Stability and Sustainable Development

In assessing the effect of banking sector stability on sustainable development, two measures of banking sector stability were utilised, as different indicators may have distinct influences on sustainability. The results from column 1 of Table 6 indicate both positive and inverse relationships between the two variables used to measure stability. In column 1 of Model 1, it is observed that a 1% increase in the bank z-score would result in a 0.725% increase in sustainable development in the sampled SSA economies. The positive relationship between the bank z-score and sustainable development can be attributed to the fact that a more stable banking sector is better equipped to support sustainable development. A stable banking sector is less likely to experience financial crises, which can have devastating effects on the economy (Ntarmah et al., 2019). Jayakumar et al. (2018) argue that a higher z-score indicates greater financial stability in the banking sector, enabling it to confidently invest in projects that may have lower financial returns but are more beneficial to the economy.

Thus, a bank with a high z-score may be more likely to invest in renewable energy projects or initiatives that promote social inclusion. Additionally, when investors trust the financial system, they are more willing to invest in projects and businesses aligned with sustainable development goals. Banks with a higher z-score are also less likely to engage in risky lending practices, which is consistent with the findings of Ntarmah et al. (2019), who noted that risky lending can negatively impact the environment and community, such as by financing companies that pollute or engage in unethical practices, contributing to climate change and social problems.

On the other hand, column 1 of Model 1 reveals that bank stability, as measured by bank credit as a percentage of deposit (lnbcd), has a negative relationship with sustainable development at the 5% significance level. The coefficient of bank credit as a percentage of deposit is -0.354, indicating that a 1% increase in this measure is associated with a 0.354% decrease in sustainable development in the sampled SSA economies. The negative relationship arises because a high ratio of bank credit to deposits suggests that banks are lending more than they hold in deposits, which can lead to problems such as decreased loan quality, increased default risk, and reduced liquidity in the banking system. These issues negatively impact sustainable development.

Moreover, banks with high credit-to-deposit ratios are less likely to lend to small businesses and entrepreneurs, as these borrowers are perceived as riskier. This is in line with Ozili and Iorember (2023), who argue that small businesses and entrepreneurs are often engines of sustainable development, as they are more likely to invest in innovative and environmentally friendly technologies. Regarding the dimensions of sustainable development, findings from Model 2 show that bank stability has both positive and negative significant influences on carbon dioxide (CO₂) emissions. The significant positive connection suggests that a 1% increase in the bank z-score corresponds to a 0.079% increase in CO₂ emissions. This positive influence can be explained by several factors related to the operations of banks and their impact on the SSA economy. Wahab et al. (2022) highlight that when banks are stable, they are more likely to lend to businesses and projects that stimulate economic activity, which can lead to increased energy consumption and, subsequently, higher CO₂ emissions. Industries may expand their production

and transportation networks, contributing to a rise in CO₂ emissions as they meet growing demand.

Additionally, most banks in SSA prioritise financial stability and profitability over environmental considerations, potentially financing projects that are not environmentally friendly, leading to higher CO₂ emissions (Odhiambo, 2020). Furthermore, banks often finance large-scale infrastructure projects, essential for economic development in developing regions, but these projects may not prioritise environmental sustainability, leading to increased CO₂ emissions (Zheng et al., 2023). The stability of the banking sector enables such projects to secure financing, potentially contributing to higher emissions. Governments may also prioritise rapid infrastructure development to meet immediate economic needs, leading to the construction of emission-intensive infrastructure, supported by bank financing (Safi et al., 2021).

In contrast, Model 2 also reveals that bank stability measured by bank credit as a percentage of deposit has a significant negative relationship with sustainable development at the 5% significance level. The coefficient is -0.162, indicating that a 1% increase in this measure is associated with a 0.162% decrease in sustainable development. This negative relationship occurs because banks with higher deposit ratios maintain greater liquidity and lower risk exposure, allowing them to manage assets more effectively and reducing the need for risky loans. Consequently, these banks are less likely to finance carbon-intensive, high-risk projects that contribute to higher CO₂ emissions (Nasreen, Anwar, & Ozturk, 2017).

Furthermore, the findings from Model 3 show that banking sector stability positively influences economic sustainability. In many SSA countries, access to credit is crucial for economic growth and development. When banks operate in a stable environment and maintain a higher percentage of credit relative to deposits, they are better positioned to provide financing to businesses and economies. This enhanced access to credit stimulates economic activities, fosters entrepreneurship, and contributes to economic sustainability by creating jobs and supporting small and medium-sized enterprises (SMEs). Additionally, stable banks with sufficient credit availability can prioritise lending to key sectors that drive economic sustainability in SSA, such as agriculture, renewable energy, and infrastructure development, which often require substantial financing for sustainable development initiatives (Pradhan et al., 2018; Boachie, Aawaar, & Domeher, 2021).

The relationship between banking sector stability and social sustainability is captured in Model 4, where the results show that banking sector stability negatively influences social sustainability. This suggests that stable banks may inadvertently contribute to income inequality by prioritising lending to established and financially secure borrowers, potentially exacerbating income disparities.

This negatively impacts social sustainability by widening the wealth gap and reducing social cohesion, contradicting the findings of Nizam et al. (2019).

Moreover, highly stable banks may be less inclined to support social safety nets, including lending to governments for social programs. Reduced investment in social safety nets can negatively affect governments' ability to provide essential services, such as healthcare, education, and social assistance, which are critical components of social sustainability (Ziolo, Filipiak, Bąk, & Cheba, 2019).

In light of these findings, the study rejects the null hypothesis that banking sector stability does not significantly contribute to sustainable development in SSA economies during the period under consideration. It concludes that banking sector stability has a significant effect on sustainable development in SSA economies.

Digital Financial Inclusion and Sustainable Development

In addressing the influence of digital financial inclusion (DFI) on sustainable development, the results from all models (Models 1 to 4 in Table 6) demonstrate that DFI significantly and positively influences sustainable development and its various dimensions. Several factors contribute to this positive relationship. First, the positive coefficient (0.0859) in Model 1 suggests that higher levels of digital financial inclusion are associated with higher overall sustainable development (measured by Inans). This implies that Sub-Saharan Africa (SSA) regions with greater access to financial services through accounts with financial institutions or mobile money providers tend to experience higher sustainability.

This is because digital financial inclusion promotes economic growth by increasing access to financial services for underserved populations. When individuals and businesses, particularly in underserved or remote areas, gain access to formal financial systems, they can save, invest, and access credit more easily. This fosters economic growth, leading to income generation, job creation, and poverty reduction, all of which contribute to sustainable development (Banna & Alam, 2021). Chinoda and Kapingura (2023) also support this view, arguing that digital financial services enhance efficiency in financial transactions and improve productivity across various economic sectors, which leads to resource optimisation and economic sustainability.

In Model 2, the positive coefficient (0.0323) suggests that higher levels of digital financial inclusion are also associated with higher environmental sustainability (measured by $\ln CO_2$). This indicates that SSA regions with greater digital financial inclusion may adopt more environmentally friendly practices. As more people gain access to financial services, there is an increased potential for investments in green and sustainable technologies and projects. Digital financial tools enable individuals and businesses to manage resources more efficiently, reducing resource waste and lowering environmental footprints. Additionally, increased access to digital financial services can reduce the reliance on paper and physical transactions by facilitating online bill payments and electronic transactions, which in turn helps to reduce pollution and other environmental hazards (Korkpoe & Nyarku, 2013; Banna & Alam, 2021).

Model 3's positive coefficient (0.0415) indicates that higher levels of digital financial inclusion are associated with higher economic sustainability. This suggests that SSA regions with greater access to financial services through formal accounts tend to have stronger and more sustainable economies. Digital financial inclusion enhances financial resilience, enabling countries and businesses to better withstand economic shocks. This resilience fosters more stable and sustainable economic outcomes (Matekenya, Moyo, & Jeke, 2021; Jima & Makoni, 2023). Finally, the positive coefficient of 0.295 in Model 4, which is statistically significant at the 1% level, indicates a strong positive relationship between DFI and social sustainability. This suggests that countries with higher levels of digital financial inclusion tend to have higher levels of social sustainability. Digital financial inclusion empowers marginalised and vulnerable populations, including rural communities in SSA economies, by enabling them to participate in economic activities, access education and healthcare, and make informed financial decisions. This empowerment reduces inequalities and enhances overall well-being, contributing significantly to social sustainability (Aduda & Kalunda, 2012; Soyemi, Olowofela, & Yunusa, 2020; Hussain, Gul, & Ullah, 2023).

In light of these findings, the study rejects the null hypothesis that digital financial inclusion does not significantly contribute to sustainable development in SSA economies for the period under consideration. The study concludes that digital financial inclusion has a significant and positive effect on sustainable development in SSA economies, driving economic, environmental, and social sustainability.

Results of the control variables for the models in Table 6, assessing the separate effects of banking sector stability, digital financial inclusion and sustainable development in SSA Economies

The models in Table 6 controlled for five macroeconomic variables consisting of inflation, real interest rate, political stability, reduced inequality and research and development. The findings from Model 1 of Table 6 reveal that inflation has positive influence on sustainable development and a mixed relationship with the individual dimensions across the models. In model 1, inflation has a positive coefficient of 0.564, meaning that 1% increase in inflation is associated with 0.564% increase in sustainable development while keeping other variables constant. The positive nexus between inflation and sustainable development implies that as inflation rate increases, sustainable development (measured with adjusted net savings) rises. This means that moderate inflation stimulates economic activity and investment in the selected SSA regions. Investors and businesses may have positive expectations about the future when inflation is on the rise (Rahman, 2022). This optimism can lead to increased investments in sustainable projects and initiatives, further contributing to sustainable development. This is in line with study by Koirala and Pradhan, (2020) who posited that businesses investment may lead to economic growth, job creation, and improved living standards, all of which contribute to sustainable development.

Additionally, model 2 has a negative coefficient of -0.0507 indicating that, in this model, 1% increase in inflation is associated with 0.0507% decrease in environmental sustainability while keeping other variables constant. Thus, the negative coefficient of -0.0507 indicates that higher

inflation is associated with lower carbon dioxide emissions ($\ln CO_2$). One possible reason for this is that during periods of economic instability or recession, which often coincide with low inflation, industrial production and energy consumption may decrease. This, in turn, leads to lower CO_2 emissions. Again, governments may implement policies to reduce inflation, such as controlling money supply and interest rates. These policies can also include measures to promote cleaner and more energy-efficient technologies, which could lead to reduced CO_2 emissions in SSA regions (Setyadharma et al., 2021; Akal, 2023; Khan et al., 2022).

The negative coefficient of -0.0565 in model 3 suggests that higher inflation is associated with lower economic sustainability. Spangenberg, (2005) posits that inflation erodes the purchasing power of consumers and reduces the real value of income. As a result, households, businesses and economies may have less disposable income, which can lead to decreased economic activity and lower national income. Also, high and unpredictable inflation rates can create uncertainty in the economy. This uncertainty can lead to reduced investments and capital flows, ultimately impacting the overall national income negatively. This is consistent with the study by Attacks, (2019), Girdzijauskas et al., (2022) and Croitoru, (2023) who argued that decline in national income negatively impacts economic sustainability by limiting resources available for investment in sustainable development projects and initiatives. Furthermore, the positive coefficient of 0.553 in model 4 indicates that higher inflation is associated with higher social sustainability. This relationship might be due to the fact that moderate inflation can be indicative of a growing economy. This is consistent with the study

Chandrakant and Rajesh, (2023) who argued that economic growth often contributes to social sustainability through increased education, employment opportunities, income generation, and poverty reduction. Thus, when more people have access to employment and improved living standards, it positively influences social sustainability.

It was again discovered that research and development has a positive coefficient (0.313) in model 1 of Table 6. The positive coefficient suggests that higher investments in research and development is associated with higher sustainable development in the selected SSA regions. This relationship indicates that research and development activities may contribute to innovations and technologies, and practices that promote sustainability. Economies investing in research and development may develop more efficient and environmentally friendly products which positively impact overall sustainability (Ozili, 2022).

Furthermore, the negative coefficient (-0.0595) in model 2 implies that higher research and development investments are associated with lower carbon dioxide emissions. This suggests that economies or industries focusing on research and development are more likely to adopt cleaner technologies and practices, which can help to reduce carbon dioxide emissions leading to environmental sustainability (Rosen, 2019; Han et al., 2023; Li & Jiang, 2020; Petrović, & Lobanov, 2020).

Similarly, the negative coefficient (-0.0759) in model 3 also indicates that increased research and development investments are associated with lower economic sustainability. This might seem counterintuitive, but it suggests that in the short term, research and development investments may

divert resources from other income-generating activities. While there might be a short-term economic trade-off, research and development investments may have long-term economic benefits. This agree with the study of Sarpong et al., (2023); Fang Liu, and Putra, (2022); and Dai et al., (2022) who posited that development of new technologies and products through research and development may lead to increased productivity, competitiveness, and economic diversification, ultimately contributing to higher economic sustainability.

Furthermore, research and development had a positive coefficient (0.291), indicating that higher research and development investments are associated with higher social sustainability. This suggests that research and development activities may lead to societal benefits, such as job creation, improved healthcare, and enhanced education, which are integral to social sustainability. This is in line with the study by Dicuonzo et al., (2022); Mensah, (2019) who posited that innovations stemming from research and development may lead to improved education and healthcare outcomes, positively impacting social sustainability by enhancing the well-being and quality of life for communities.

Reduced income inequality had a positive coefficient (0.891) with overall sustainability. A positive coefficient suggests that higher efforts to reduce income inequality are associated with higher sustainable development. This is consistent with the findings of Seo, Kim, and Lee, (2020) who posits that policies or actions aimed at reducing income inequality may have positive spill-over effects on overall sustainable development. This is because inequality may lead to social unrest and instability, which can hinder

sustainable development. Efforts to reduce income inequality often involve policies that promote more inclusive economic growth. When income is distributed more equitably across society, it can lead to increased access to resources, education, and opportunities for marginalised groups contributing to a more stable and sustainable development path (Wilkinson & Pickett, 2010; Li et al., 2023; Roy et al., 2018; Shaheen, 2014).

Similarly, reduced income inequality had a positive coefficient (0.428) with CO₂ emission suggesting that higher efforts to reduce income inequality is associated with higher environmental sustainability. This is consistent with the findings of Asongu, and Vo, (2020) that societies with reduced income inequality are more capable of implementing environmentally friendly policies and practices. Thus, SSA economies with reduced income inequality may be more willing to invest in environmentally sustainable technologies and practices including renewable energy adoption, environmental regulations, and conservation efforts (Mushta et al., 2020; Kusumawardani, & Dewi, 2020; Tanchangya, & Ayoungman, 2022).

The negative coefficient (-1.547) between reduced income inequality and economic sustainability implies that higher efforts to reduce income inequality is associated with lower gross national income. In the study by Ullah et al. (2021), they alluded that policies aimed at income redistribution may impact economic performance in the short term in most SSA economies. While there may be short-term economic trade-offs, efforts to reduce income inequality may contribute to long-term economic stability and sustainability. By reducing income disparities, societies can enhance social cohesion, reduce economic disparities, and create a more robust and sustainable economic

foundation (Menyelim et al., 2021; Shaheen, 2014; Genevey, Pachauri, & Tubiana, 2013).

Finally, the negative coefficient (-1.071) in model 4 indicates that higher efforts to reduce income inequality is associated with lower social sustainability. This is consistent with the findings of Cuesta, Madrigal, and Pecorari, (2022) who posited that policies focused solely on income redistribution could have unintended consequences on certain social aspects of development. Income inequality reduction efforts can be complex and multifaceted. In some cases, policies may not address all dimensions of social sustainability effectively. Unintended consequences, such as potential disincentives for economic productivity, could lead to short-term negative impacts on certain social indicators (Hussain et al., 2023; Dabla-Norris et al., 2015).

The coefficient of political stability as a control variable in the four models above provides insights into the relationship between political stability and sustainable development and its dimensions. The positive coefficient (0.177) in model 1 suggests that higher levels of political stability is associated with higher overall sustainable development. This implies that countries or SSA regions with stable political environments tend to have more conducive conditions for sustainable development. Khan and Farooq, (2019); Handoyo and Fitriyah, (2018) alluded that political stability often leads to consistent and predictable policy environments. Governments in politically stable regions can implement long-term sustainable development policies without the interruptions and uncertainties that may arise in politically unstable areas.

Additionally, the negative coefficient (-0.119) in model 2 implies that

higher political stability is associated with lower environmental sustainability. This result may seem counterintuitive, but it suggests that regions with high political stability may also have higher industrialisation and carbon emissions. Politically stable regions therefore, may attract more industrial investments and activities, which may lead to increased carbon dioxide emissions. Stable governance may as well facilitate economic growth, but it may not always prioritise strict environmental regulations (Adebayo et al., 2022; Mughal et al., 2022). Also, the positive coefficient (0.168) in model 3 indicates that higher political stability is associated with higher gross national income, contributing to economic sustainability. Stable political environments can attract investments, promote business growth, and encourage economic development. Political stability is often seen as a key factor in attracting foreign investments. When investors perceive a region as politically stable, they are more likely to invest in businesses and projects, stimulating economic growth and contributing to economic sustainability (Okafor, 2017). Finally, the negative coefficient (-0.0648) in model 4 suggests that higher political stability is associated with lower social sustainability. This result may imply that in politically stable SSA regions, there could be much focus on economic development at the expense of certain social indicators. In some cases, governments in politically stable SSA regions may prioritise economic growth and stability over social welfare programs. While this can lead to economic sustainability, it might not address social sustainability effectively (Khan, & Farooq, 2019; Radu, 2015).

Real interest rates had a positive coefficient (0.151) in model 1 suggesting that higher real interest rates are associated with higher sustainable

development. This implies that SSA regions with higher real interest rates are likely to experience more sustainable development. Higher real interest rates may incentivise individuals and businesses to save and invest their money in productive activities. This increased savings and investment may lead to economic growth, job creation, and poverty reduction, contributing to sustainable development (Mehrotra & Sergeyev, 2021). Again, higher real interest rates can be used as a tool to control inflation. When central banks increase interest rates to combat inflation, it can create a more stable economic environment, which is conducive to sustainable development. In regions with higher real interest rates, financial institutions may offer more attractive savings and investment products, promoting financial inclusion and access to capital for sustainable projects (Advisors, 2012).

On environmental sustainability, the negative coefficient (-0.0384) implies that higher real interest rates are associated with lower environmental sustainability. This result may seem counterintuitive, but it suggests that SSA regions with higher real interest rates may engage in more carbon-intensive economic activities, this may increase the cost of financing sustainable and environmentally friendly projects. This may lead to reduced investment in green technologies and practices, resulting in higher carbon emissions. In regions with higher real interest rates, there may be a greater focus on economic growth, which can lead to increased industrialisation and higher carbon emissions (Schmidt et al., 2019; Basiago, 1998).

Additionally, the positive coefficient (0.0242) in model 3 indicates that higher real interest rates are associated with higher gross national income, contributing to economic sustainability. Thus, higher interest rates can

encourage saving and investment, which can stimulate economic growth (Bylund & Jonsson, 2020; Futtwiler, 2017). Also, higher real interest rates can encourage capital formation and the accumulation of productive assets, which can drive economic sustainability by increasing productivity and income levels. Real interest rates can be used to control inflation, which is crucial for economic stability and sustainability. Controlling inflation can lead to a more predictable economic environment, facilitating economic growth (Beteta Vejarano, & Swinkels, 2023; Hauner & Kumar, 2006).

Finally, the positive coefficient (0.102) in model 4 suggests that higher real interest rates are associated with higher social sustainability. This result may imply that regions with higher real interest rates may have more resources available for social programs and well-being. Higher real interest rates may reflect a region's fiscal capacity to invest in social programs and infrastructure, contributing to social sustainability. In regions with higher real interest rates, financial institutions may be more willing to lend to individuals and businesses, potentially leading to greater access to credit and economic opportunities, which may positively impact social sustainability (Soehaditama, 2023; Bylund & Jonsson, 2020).

The moderating effects of digital financial inclusion on the relationship between banking sector stability and sustainable development in SSA economies.

Table 7 illustrates the moderating role of digital financial inclusion in the relationship between banking sector stability and sustainable development in SSA economies. The objective was accomplished by interacting each of the proxies of banking sector stability with digital financial inclusion to get two

additional interacting variables (Bzsamms and Bcdamms). To experience the presence of a moderating effect in a given model, Jose (2013) proposed that the coefficient of the interaction variables must be statistically significant. Table 7 presents results on the moderating role of digital financial inclusion in the relationship between banking sector stability and sustainable development.

Table 7: The role of digital financial inclusion in the relationship between banking sector stability and sustainable development of SSA Economies

	(Model 5) Lnans	(Model 6) lnCO2	(Model 7) Lngni	(Model 8) Lngee
L.lnans	0.437*** (0.0619)			
L.lnCO2		-0.564*** (0.0580)		
L.lngni			0.891*** (0.0190)	
L.lngee				-0.136*** (0.0654)
Lnbzs	-1.147*** (0.367)	-0.287* (0.167)	-0.207** (0.0837)	-3.041** (1.370)
lnBCD	0.417* (0.235)	-0.138*** (0.0471)	0.257*** (0.0588)	-0.739*** (0.264)
Bzsamms	0.526*** (0.126)	0.310*** (0.0757)	0.0403** (0.0500)	1.028** (0.434)
Bcdamms	-0.556** (0.230)	0.167*** (0.0590)	0.165*** (0.0391)	-0.605** (0.268)
Lnamms	0.980** (0.975)	-1.514*** (0.270)	-0.759*** (0.249)	-0.256 (1.354)
Control				
lnINF	0.0852* (0.0473)	0.00208 (0.0129)	0.0393* (0.0201)	-0.686*** (0.243)
Lnrnd	0.378*** (0.0777)	0.0217 (0.0521)	0.0489 (0.0400)	1.457*** (0.361)
Lngini	-4.301***	0.290***	-0.221	-1.623

	(1.142)	(0.103)	(0.164)	(2.003)
lnPS	0.133 (0.172)	-0.0318 (0.0300)	0.0127 (0.0192)	0.223 (0.248)
lnRIR	-0.243** (0.0980)	-0.0209* (0.0115)	0.00537 (0.0197)	-0.00552 (0.263)
Constant	20.66*** (4.161)	-0.165 (0.517)	2.010*** (0.563)	20.12** (7.910)
Diagnostics				
Observations	234	410	417	427
No. of instruments	38	49	58	26
AR1 (p-value)	0.0332	0.000299	0.014	0.00776
AR2 (p-value)	0.423	0.616	0.354	0.978
Hansen-J (p-value)	0.987	0.991	1.000	0.867

Source: Amoako Mensah (2023)

* p<0.10, ** p<0.05, *** p<0.01 significant levels respectively, standard errors in parentheses
 Note: lnans denotes sustainable development, lnCO2 represents environmental dimension, lngni represents economic dimension, lngee denotes social dimension, L.lnans denotes lag of overall sustainability, L.lnCO2 denotes lag of environmental sustainability, L.lngni denotes lag of economic sustainability, L.lngee denotes lag of social sustainability, lnbsz and lnbcd are the measures of banking sector stability respectively, lnams denotes account ownership with mobile money service provider, lnINF is inflation, lnrd denotes research and development, lngini is Gini index used to measure reduced income inequalities, lnPS is political stability and lnRIR denotes real interest rate.

The results revealed that in Table 6 (without moderating variables), banking sector stability measured by bank z-score has varying coefficients across the models and dimensions of sustainability. It is positive and significant in Models 1, 2, and 3, but negative and significant in Model 4, indicating mixed impacts on sustainable development across different dimensions. But in Table 7 (with moderating variables), the introduction of interaction variables modifies the coefficients for bank z-score in all models and dimensions of sustainability. In model 1 of Table 6, the coefficient of bank z-score is 0.725, suggesting that 1% increase in banking sector stability is associated with 0.725% increase in sustainable development. In this case, banking sector stability appears to have a positive impact on sustainable

development. However, in model 1 of Table 7, which includes the interaction term, the coefficient of bank z-score changed to -1.147. This suggests that when interaction term is introduced, the relationship between banking sector stability and sustainable development becomes negative, with a magnitude of -1.147. This suggests that in the presence of the interaction variables, banking sector stability has a negative effect on sustainable development, particularly in SSA countries with higher levels of digital financial inclusion and banking sector stability. Arthur, Williams, and Delfabbro, (2016) alluded that when people have access to digital financial services, they are more likely to engage in financial speculation, such as buying and selling assets in the hope of making a profit. This can lead to increased volatility in financial markets, which can destabilise the banking sector and have negative consequences for sustainable development. Additionally, high digital financial inclusion can lead to increased financial risk-taking. When people have access to digital financial services, they are more likely to take on more financial risk, such as borrowing money to invest in risky assets. This can lead to financial problems for individuals and businesses, which can have negative consequences for sustainable development (Marcelin et al., 2022; Banna & Alam, 2021; Chinoda & Kapingura, 2023).

On the other hand, in Table 6 (without moderating variables) bank credit as a percentage of deposit had a varying coefficient across the models and dimensions of sustainable development. It is negative and significant in models 1, 2, and 3, suggesting that a higher bank credit-to-deposit ratio is associated with lower sustainable development in these models. However, in model 4, the coefficient is significantly negative, indicating a stronger

negative effect on social sustainability. In Table 7 (with moderating variables), the introduction of interaction variables modifies the coefficients for bank credit as a percentage of deposit in all models and dimensions of sustainability. For instance, in model 1 of Table 6, the coefficient of bank credit as a percentage of deposit is -0.354, suggesting that a 1% increase in the bank credit-to-deposit ratio is associated with 0.354% decrease in sustainable development. In this case, a higher bank credit-to-deposit ratio appears to have a negative impact on sustainable development. However, in Model 1 of Table 7, which includes the moderating variables, the coefficient of bank credit as a percentage of deposit changed to 0.417. This suggests that a stable banking sector and digital financial inclusion can facilitate efficient allocation of credit to sectors that have the potential to generate positive economic and social outcomes. When banks have confidence in their ability to recover loans and borrowers have access to digital financial tools, it becomes more likely that credit is used for investments in sectors such as infrastructure, agriculture, and small and medium-sized enterprises (SMEs). These investments can drive economic growth, create jobs, and reduce poverty, contributing to overall sustainable development. This may help to boost economic growth and sustainable development (Tay, Tai, & Tan, 2022). Also, when the banking sector is stable, banks in SSA regions will be more willing to lend money to businesses and individuals. This can help to ensure that there is enough credit available to support economic growth and sustainable development (Mukalayi & Inglesi-Lotz, 2023).

Furthermore, in Table 6 (without moderating variables), the impact of digital financial inclusion on sustainable development varies across different

models and sustainability dimensions. Specifically, DFI has a positive and significant coefficient in models 1, 2, and 3, indicating a beneficial effect on overall sustainable development and specific dimensions like economic and environmental sustainability. However, in model 4, DFI exhibits a negative and significant impact on social sustainability, suggesting that while financial inclusion may improve certain aspects of sustainability, it could have mixed effects on social dimensions.

When moderating variables are introduced in Table 7, the coefficients of digital financial inclusion change across all models. For example, in model 1 of Table 6, the coefficient for DFI is 0.0859, indicating that a 1% increase in financial inclusion is associated with a 0.0859% increase in sustainable development. This suggests a positive effect of DFI on sustainability. However, in model 5 of Table 7, which includes interaction variables, the coefficient of DFI increases to 0.980. This significant increase suggests that when accounting for the moderating effects of banking sector stability, the positive impact of DFI on sustainable development is amplified. This indicates that digital financial inclusion, particularly when combined with stable banking conditions, significantly enhances sustainable development.

The increase from 0.0859 to 0.980 in the coefficient of DFI underscores the importance of considering moderating factors. It implies that digital financial inclusion has a stronger positive effect on sustainable development when it interacts with banking sector stability. This aligns with the findings of Chinoda and Kapingura (2023), who suggest that financial inclusion, when coupled with a stable banking environment, effectively contributes to reducing poverty and inequality. In SSA countries, improved

access to digital financial services facilitates savings, investment, and credit access, fostering a more inclusive and dynamic investment ecosystem. Thus, the moderating variables highlight the enhanced role of DFI in promoting sustainable development when integrated with banking sector stability. Again, in Table 6 (without moderating variables), inflation has varying coefficients across models and dimensions of sustainability. For example, in model 1, the coefficient is 0.564, indicating that 1% increase in inflation is associated with a 0.564% increase in sustainable development. In Table 7 (with moderating variables), the introduction of interaction variables modifies the coefficients of inflation in all models and dimensions of sustainability. For instance, in model 1 of Table 6, inflation has a positive coefficient of 0.564, suggesting a positive relationship between inflation and sustainable development. However, when the interaction variables are introduced in model 1 of Table 7, the coefficient of inflation decreases to 0.0852. This indicates that SSA countries with robust financial stability and inclusion, policymakers may have better tools and mechanisms to counteract the negative consequences of inflation. This includes implementing tighter monetary policies to control inflation rates, designing fiscal policies that support economic stability, and adopting measures to protect vulnerable populations from the adverse impacts of inflation. Consequently, the positive effect of inflation on sustainable development becomes less pronounced because these countries can mitigate its adverse effects. Additionally, countries with good financial systems and inclusion, there is likely a greater diversity of economic activities. This diversification can act as a buffer against inflation's negative impacts. Thus, sectors less sensitive to inflation may continue to thrive, helping to maintain

economic stability. As a result, the positive effect of inflation on sustainable development becomes weaker in these diversified economies. Specifically, the decrease in the coefficient of inflation suggests that a stable banking sector can help to mitigate the negative effects of inflation by providing businesses and individuals with access to credit and stabilise financial markets. When the banking sector is stable, banks are more likely to be willing to lend money to businesses and individuals, which can help to keep prices under control (Dany-Knedlik, 2018; Gonçalves & Salles, 2008).

In model 1 of Table 6, research and development has a positive coefficient of 0.313, suggesting a positive relationship between research and development and sustainable development. However, with the introduction of interaction variables in model 1 of Table 7, the coefficient of research and development increases to 0.378. This indicates that when considering the moderating variable, the positive effect of research and development on sustainable development becomes stronger. The changes in coefficients for research and development suggests that the presence of moderating variables modifies the relationship between research and development and various dimensions of sustainable development. Specifically, the increase in the coefficient of research and development from 0.313 to 0.378 suggests that in SSA countries with financial stability and inclusion, there may be greater access to funding sources for research and development projects. Additionally, these countries may have policies and mechanisms in place to encourage private sector investment in R&D. As a result, a larger share of resources can be allocated to R&D initiatives, leading to more significant contributions to sustainable development. Again, SSA countries with financial stability and

inclusion are more likely to have well-functioning financial markets, which can facilitate the commercialisation of research findings and innovations. Moreover, financial inclusion may ensure that a broader spectrum of entrepreneurs and innovators can access financing to develop and scale up their R&D-based initiatives. This leads to a more robust connection between R&D activities, innovation, economic growth, and ultimately, sustainable development (Sarpong et al., 2023; Thi & Thu, 2023).

Furthermore, in model 1 of Table 6, reduced income inequality has a positive coefficient of 0.891, suggesting a positive relationship between reduced income inequality and sustainable development. However, with the introduction of interaction variables in model 1 of Table 7, the coefficient of reduced income inequality becomes negative, indicating that when considering the moderating variable, the positive effect of reduced income inequality on sustainable development turns negative. Specifically, the change from a positive coefficient of 0.891 to a negative coefficient suggests that sustainable development involves trade-offs between various dimensions, such as economic, social, and environmental aspects. In SSA economies increased efforts to reduce income inequality may require redistributive policies that divert resources from other areas of development. These trade-offs can result in a negative relationship between reduced income inequality and sustainable development when accounting for the allocation of resources and their impact on different dimensions of sustainability.

Also, in model 1 of Table 6, political stability has a positive coefficient of 0.177, suggesting a positive relationship between political stability and sustainable development. However, when the interaction variables are

introduced, the coefficient of political stability changed to 0.133. The changes in coefficients for political stability suggest that the presence of moderating variables alters the relationship between political stability and various dimensions of sustainable development. Specifically, the decrease in the coefficient when interaction variables is included suggests that in countries with stable banking sectors, the resilience and robustness of the financial system become pivotal for economic growth and stability. Additionally, when moderating variables like digital financial inclusion and banking sector stability are considered, governments and policymakers may redirect resources and attention to address these specific factors. This shift in focus can potentially reduce the emphasis on political stability as the primary driver of sustainable development. Therefore, the coefficient for political stability may decrease as its relative importance diminishes in the presence of these other variables. This increased focus on financial sector resilience can overshadow the impact of political stability, especially when evaluating its contribution to sustainable development. Consequently, the coefficient for political stability may decrease as its effect is attenuated by the stronger influence of banking sector stability on sustainable development.

Finally, in model 1 of Table 6, real interest rate has a positive coefficient of 0.151, suggesting a positive relationship between real interest rate and sustainable development. However, when the interaction variables are introduced, the coefficient of real interest rate becomes negative (-0.243). The changes in coefficients of real interest rate between suggest that the presence of moderating variable significantly changes the relationship between real interest rate and various dimensions of sustainable development. Specifically,

the change from a positive coefficient to a negative coefficient indicates that real interest rates may affect investment decisions and capital flows within an economy. In SSA economies, higher real interest rates can attract foreign capital, leading to currency appreciation and potentially harming domestic industries. The presence of moderating variables signal that in certain situations, such capital flows and their consequences for economic stability and sustainability outweigh any potential positive effects of higher interest rates.

In light of these findings, the study rejects the null hypothesis that there is no moderating effect of digital financial inclusion on the relationship between banking sector stability and sustainable development in SSA economies for the period under consideration and concludes that there is no moderating effect of digital financial inclusion on the relationship between banking sector stability and sustainable development in SSA economies.

Chapter Summary

This study aimed at analysing the effect of banking sector stability, digital financial inclusion, and sustainable development in SSA economies. The study estimated the panel unit root test for each of the variables. Three main hypotheses are tested using the System Generalised Method of Moments (System-GMM). The purpose of the study is categorised into three objectives:

The first objective considered the effect of banking sector stability on sustainable development in SSA economies. From Table 6, the study rejects the null hypothesis that banking sector stability does not significantly contribute to sustainable development in SSA economies for the period under consideration and concludes that there is a significant effect of banking sector

stability on sustainable development in SSA economies.

The second objective also showed in Table 6, examined the effect of digital financial inclusion on sustainable development in SSA economies. The results reject the null hypothesis that digital financial inclusion does not significantly contribute to sustainable development in SSA economies for the period under consideration and concludes that there is a significant effect of digital financial inclusion on sustainable development in SSA economies.

Finally, Tables 7 indicates that the coefficients of each banking sector stability variable with digital financial inclusion moderating the relationship between banking sector stability and sustainable development in SSA economies. All the interaction terms are statistically significant at 5% significance level each. Therefore, the study rejects the null hypothesis that there is no moderating effect of digital financial inclusion on the relationship between banking sector stability and sustainable development in SSA economies for the period under consideration and concludes that there is no moderating effect of digital financial inclusion on the relationship between banking sector stability and sustainable development in SSA economies.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the major findings obtained from conducting the entire study. The chapter also presents a summary of key findings, conclusions, policy recommendations as well as the suggestions for further research.

Summary of Key Findings

Several insightful and significant results that have good implications emerged from the findings of this study. The first objective of the study was to analyze the effect of banking sector stability on sustainable development in SSA economies. The second objective examined the effect of digital financial inclusion on sustainable development whilst the third objective examined the moderating effects of digital financial inclusion on the relationship between banking sector stability and sustainable development in SSA economies. The summary of the findings on these objectives are summarised in the table below:

Table 8: Summary of Results on the Hypothesis

Hypotheses	Confirmation
H ₀ : Banking sector stability does not significantly contribute to sustainable development in SSA economies.	Rejected
H ₀ : Digital financial inclusion does not significantly influence sustainable development in SSA economies.	Rejected
H ₀ : There is no moderating effect of digital financial inclusion on the relationship between banking sector stability and sustainable development in SSA economies.	Rejected

Source: Amoako Mensah (2023)

From the results on the first objective, a strong evidence is found that banking sector stability contribute to sustainable development of the sample of

SSA economies. This implies that a stable banking sector is better equipped to support growth and sustainable development, because a stable banking sector is less likely to experience financial crises, which can have a devastating impact on the economy contributing to overall sustainability of SSA economies.

Also, based on the second objective, the study found strong evidence to support the notion that digital financial inclusion has a significant and positive effect on sustainable development in SSA economies. In summary, higher levels of digital financial inclusion were associated with increased sustainability across multiple dimensions, including economic, environmental, and social aspects. This indicates that digital financial inclusion plays a crucial role in fostering economic growth, environmental sustainability, and social sustainability, ultimately contributing to the overall sustainable development of SSA economies.

Results on the third objective indicated that digital financial inclusion gives support to banking sector stability to contribute more to sustainable development of SSA economies. This is because the introduction of the interaction term between banking credit as a percentage of deposit and digital financial inclusion modified the relationship. In this case, a higher banking credit-to-deposit ratio, when combined with high-quality digital financial inclusion, had a positive and significant impact on sustainable development. This suggests that in the presence of both stable banking practices and high-quality digital financial inclusion, the allocation of credit to sectors that drive sustainable development is more efficient and beneficial. The study further examined the specific roles played by each of the five control variables in

the relationship between banking sector stability and sustainable development of SSA economies. The results of the study indicate that inflation, research and development, reduced income inequality, political stability, and real interest rate can modify the relationship between banking sector stability and sustainable development in SSA economies.

Conclusions

The study's findings emphasise the critical role of both banking sector stability and digital financial inclusion in promoting sustainable development in SSA economies. Moreover, it underscores the potential synergistic effects when these factors are combined effectively. First, there is strong evidence to suggest that a stable banking sector positively contributes to the sustainable development of Sub-Saharan African (SSA) economies. The study also found strong evidence supporting the idea that digital financial inclusion has a significant and positive impact on sustainable development in SSA economies. Moreover, third finding suggests that digital financial inclusion enhances the contribution of banking sector stability to sustainable development. Finally, the study examined the roles of the five control variables (inflation, research and development, reduced income inequality, political stability, and real interest rate) in the relationship between banking sector stability and sustainable development in SSA economies. It was discovered that these variables can modify the relationship, indicating the importance of considering these factors in policy and decision-making.

Recommendations

Drawing from the findings and conclusion of the study, a number of recommendations are presented:

First, ministries of finance, central banks, policy makers and economic planning agencies in the respective SSA regions should strengthen regulatory framework for the banking sector to ensure its stability, because requiring banks to maintain adequate capital buffers, liquidity reserves and risk management practices, and by implementing effective supervision and monitoring systems can prevent financial crises.

Second, financial regulatory authorities should invest in digital infrastructure and technology to expand access to financial services, especially in underserved areas to enhance digital financial inclusion. Additionally, Authorities should invest in financial education to improve individuals' and businesses understanding of financial products and services, so that people can make better financial decisions and use digital financial services more effectively.

Furthermore, digital financial inclusion should be promoted by providing subsidies and other incentives to financial institutions that offer digital financial services, which can help reduce the cost of digital financial services and make them more accessible to people in SSA economies. Again, Authorities should encourage collaborations between banks and digital financial service providers to create innovative and inclusive financial products, and provide incentives for financial institutions to prioritise lending to sectors that contribute to sustainable development, such as renewable energy, agriculture, and small and medium-sized enterprises (SMEs).

Finally, Authorities should manage inflation through prudent monetary policy to ensure price stability and mitigate its adverse effects on sustainable development, since this can help ensure that the benefits of economic growth

are more evenly distributed. Authorities should increase investments in research and development to foster innovation and technological advancement, which can drive economic growth and sustainability. Authorities should implement policies aimed at reducing income inequality so that the benefits of economic growth are more evenly distributed.

Authorities should promote political stability and good governance to create a conducive environment for investment and economic development. Authorities should adjust real interest rates as needed to encourage savings and investment while considering their impact on inflation and economic growth.

Area for Further Research

Future research can extend the findings of this study by examining how digital financial inclusion (DFI) influences the relationship between banking sector stability and sustainable development in other emerging economies beyond Sub-Saharan Africa (SSA). Emerging markets, such as those in Asia, Latin America, and Eastern Europe, present unique financial ecosystems and developmental challenges that may yield different insights into the interplay between DFI, banking stability, and sustainability. By analyzing these relationships in various economic contexts, researchers can identify region-specific patterns, challenges, and opportunities. This broader scope of analysis could lead to the development of more globally relevant frameworks and policies that support sustainable development through enhanced financial inclusion and banking sector resilience.

Another valuable area for future research is the examination of specific stability measures, such as regulatory capital ratios and the level of non-

performing loans (NPLs), and their impact on sustainable development. These indicators are critical for assessing the health and stability of the banking sector, and understanding how they interact with digital financial inclusion could offer deeper insights into the mechanisms that drive sustainability. For instance, researchers could explore whether higher regulatory capital (which reflects a bank's ability to absorb losses) or lower levels of NPLs (which indicate healthier loan portfolios) contribute to sustainable development goals. Additionally, studies could investigate how these stability measures, when integrated with digital financial inclusion initiatives, could further enhance economic, social, and environmental sustainability in emerging economies.

Finally, future studies should also consider conducting country-specific research to provide more individualised policy recommendations that align with the unique developmental circumstances of each country. While regional analyses offer valuable insights, they may overlook the nuances and specific challenges faced by individual nations. By focusing on country-specific dynamics, such as local regulatory environments, cultural attitudes towards financial services, and specific economic conditions, researchers can develop more tailored strategies for promoting sustainable development. This approach would allow policymakers to implement more precise and effective interventions, addressing the distinct needs of their economies while leveraging digital financial inclusion and banking sector stability. Country-specific studies could also explore how local innovations in financial inclusion and regulatory practices contribute to sustainability, providing valuable lessons that could be adapted and applied in other contexts.

REFERENCES

- Adam A. M (2016) Statistics for business research: a guide for non statistician. Global research publishers, Accra, Ghana
- Adebayo, T. S. (2022). Renewable energy consumption and environmental sustainability in Canada: does political stability make a difference?. *Environmental Science and Pollution Research*, 29(40), 61307-61322.
- Adebayo, T. S., Saint Akadiri, S., Uhunamure, S. E., Altuntaş, M., & Shale, K. (2022). Does political stability contribute to environmental sustainability? Evidence from the most politically stable economies. *Heliyon*, 8(12), 51-67.
- Aduda, J., & Kalunda, E. (2012). Financial inclusion and financial sector stability with reference to Kenya: A review of literature. *Journal of Applied Finance and Banking*, 2(6), 95-101.
- Advisors, D. C. C. (2012). Sustainable investing. Establishing Long-Term Value and Performance.
- Akal, A. Y. (2023). Inflation and Reinforced Concrete Materials: An Investigation of Economic and Environmental Effects. *Sustainability*, 15(9), 76-87.
- Appelt, S. (2017). The impact of R&D investment on economic performance: A review of the econometric evidence. mimeo.
- Archer, C., & Idun, A. A. A. (2023). Financial outreach, financial innovation, and sustainable development in Africa. *Environmental Science and Pollution Research*, 15(9), 1-23.
- Arellano M, Bond S (1991) Some tests of specification for panel data: Monte

Carlo evidence and an application to employment equations. *Rev Econ Stud* 58(2):277–297

Arellano M, Bover O (1995) Another look at the instrumental variable estimation of error-components models. *J Econs* 68(1):29–51

Arthur, J. N., Williams, R. J., & Delfabbro, P. H. (2016). The conceptual and empirical relationship between gambling, investing, and speculation. *Journal of behavioral addictions*, 5(4), 580-591.

Asongu, S. A., & Vo, X. V. (2020). The effect of finance on inequality in Sub-Saharan Africa: avoidable CO2 emissions thresholds. *Environmental Science and Pollution Research*, 27(26), 32707-32718.

Attacks, E. S. (2019). Statement by Subir Gokarn, Executive Director for Sri Lanka and Mahinda Siriwardana, Alternate Executive Director May 13, 2019.

Banna, H., & Alam, M. R. (2021). Does digital financial inclusion matter for bank risk-taking? Evidence from the dual-banking system. *Journal of Islamic Monetary Economics and Finance*, 7(2), 401-430.

Banna, H., & Alam, M. R. (2021). Is digital financial inclusion good for bank stability and sustainable economic development? Evidence from emerging Asia (No. 1242). ADBI Working Paper Series.

Banna, H., Hassan, M. K., & Alam, M. R. (2020). Digital financial inclusion, Islamic banking stability and sustainable economic growth. *Islamic perspective for sustainable financial system*, 131-152.

Basiago, A. D. (1998). Economic, social, and environmental sustainability in development theory and urban planning practice. *Environmentalist*, 19, 145-161.

- Beteta, Vejarano, G., & Swinkels, L. (2023). Social, Sustainability, and Sustainability-Linked Bonds. Available at SSRN 4420618.
- Blundell R, Bond S (1998) Initial conditions and moment restrictions in dynamic panel data models. *J Econom* 87(1):115–143
- Boachie, R., Aawaar, G., & Domeher, D. (2021). Relationship between financial inclusion, banking stability and economic growth: A dynamic panel approach. *Journal of Economic and Administrative Sciences*, (ahead-of-print).
- Bylund, E., & Jonsson, M. (2020). How does climate change affect the long-run real interest rate. *Economic Commentaries*, 11, 90-108.
- Chandrakant, R., & Rajesh, R. (2023). Social sustainability, corporate governance, and sustainability performances: an empirical study of the effects. *Journal of Ambient Intelligence and Humanised Computing*, 14(7), 9131-9143.
- Chang, S. H., & Huang, L. C. (2010). The nexus of finance and GDP growth: Do real interest rates matter?. *Japan and the World Economy*, 22(4), 235-242.
- Chinoda, T., & Kapingura, F. M. (2023). The impact of digital financial inclusion and bank competition on bank stability in sub-Saharan Africa. *Economies*, 11(1), 15-36.
- Croitoru, L. (2023). How Inflation is a Policy Nowadays. *Transylvanian Review of Administrative Sciences*, 19(68), 5-19.
- Cuesta, J., Madrigal, L., & Pecorari, N. (2022). Social Sustainability, Poverty, and Income: An Empirical Exploration. World Bank.
- Dabla-Norris, M. E., Kochhar, M. K., Suphaphiphat, M. N., Ricka, M. F., &

- Tsounta, M. E. (2015). Causes and consequences of income inequality: A global perspective. International Monetary Fund.
- Dai, D., Fan, Y., Wang, G., & Xie, J. (2022). Digital economy, R&D investment, and regional green innovation analysis based on provincial panel data. *Sustainability*, 14(11), 65-88.
- Dany-Knedlik, G. (2018). A sustainable development of inflation in euro area requires continuously improving labor market. *DIW Weekly Report*, 8(43), 429-437.
- Dicuonzo, G., Donofrio, F., Ranaldo, S., & Dell'Atti, V. (2022). The effect of innovation on environmental, social and governance (ESG) practices. *Meditari Accountancy Research*, 30(4), 1191-1209.
- Essel-Gaisey, F., & Chiang, T. F. (2022). Turning the Tide on Environmental Poverty in Ghana: Does Financial Inclusion Matter? *Sustainable Production and Consumption*.
- Fang, W., Liu, Z., & Putra, A. R. S. (2022). Role of research and development in green economic growth through renewable energy development: empirical evidence from South Asia. *Renewable Energy*, 194, 1142-1152.
- Frimpong, S., Yusuf, M. A., Boateng, E., Ankomah, K., & Abeka, M. J. (2023). Financial inclusion, economic freedom and financial stability in sub-Saharan Africa. *Thunderbird International Business Review*, 65(4), 429-441.
- Futtwiler, S. T. (2017). Interest rates and fiscal sustainability. *Journal of Economic Issues*, 41(4), 1003-1042.
- Genevey, R., Pachauri, R. K., & Tubiana, L. (2013). Reducing inequalities: a sustainable development challenge. *The Energy and Resources*

Institute (TERI) 85(1-2), 32-38.

Girdzijauskas, S., Streimikiene, D., Griesiene, I., Mikalauskiene, A., &

Kyriakopoulos, G. L. (2022). New approach to inflation phenomena to ensure sustainable economic growth. *Sustainability*, 14(1), 518-612.

Gonçalves, C. E. S., & Salles, J. M. (2008). Inflation targeting in emerging economies: What do the data say?. *Journal of Development Economics*, 85(1-2), 312-318.

Hall, B. H., & Lerner, J. (2010). The financing of R&D and innovation. In *Handbook of the Economics of Innovation* (Vol. 1, pp. 609-639). North-Holland.

Han, L. M., You, J. Q., Meng, J. N., Fu, Y. L., & Wu, S. L. (2023). Empirical analysis of R&D spending, transport infrastructure development and CO2 emissions in China. *Frontiers in Environmental Science*, 11, 351.

Handoyo, S., & Fitriyah, F. K. (2018). Control of corruption, regulatory quality, political stability and environmental sustainability: a cross-national analysis. *Journal of Accounting Auditing and Business*, 1(2), 28-38.

Hauner, D., & Kumar, M. (2006). Fiscal Policy and Interest Rates: How Sustainable is the 'New Economy'? 83(4-6), 12-18.

Henry Ntarmah, A., Kong, Y., & Kobina Gyan, M. (2019). Banking system stability and economic sustainability: A panel data analysis of the effect of banking system stability on sustainability of some selected developing countries. *Quant Financ Econ*, 3, 709-38.

Higgins, R. C. (1981). Sustainable growth under inflation. *Financial management*, 36-40.

Hussain, H. I., Kamarudin, F., Anwar, N. A. M., Ali, M., Turner, J. J., & Somasundram, S. A. (2023). Does income inequality influence the role of a sharing economy in promoting sustainable economic growth? Fresh evidence from emerging markets. *Journal of Innovation & Knowledge*, 8(2), 100348.

Hussain, S., Gul, R., & Ullah, S. (2023). Role of financial inclusion and ICT for sustainable economic development in developing countries. *Technological Forecasting and Social Change*, 194, 122725.

Jayakumar, M., Pradhan, R. P., Dash, S., Maradana, R. P., & Gaurav, K. (2018). Banking competition, banking stability, and economic growth: Are feedback effects at work?. *Journal of Economics and Business*, 96, 15-41.

Jima, M. D., & Makoni, P. L. (2023). Causality between financial inclusion, financial stability and economic growth in sub-Saharan Africa. *Sustainability*, 15(2), 11-52.

Khan, I., Tan, D., Azam, W., & Hassan, S. T. (2022). Alternate energy sources and environmental quality: The impact of inflation dynamics. *Gondwana Research*, 106, 51-63.

Khan, K., Luo, T., Ullah, S., Rasheed, H. M. W., & Li, P. H. (2023). Does digital financial inclusion affect CO2 emissions? Evidence from 76 emerging markets and developing economies (EMDE's). *Journal of Cleaner Production*, 138313.

Khan, R. E. A., & Farooq, S. (2019). Corruption, political instability and sustainable development: the interlinkages. *Journal of Quantitative Methods*, 3(1), 57-84.

Koirala, B. S., & Pradhan, G. (2020). Determinants of sustainable development: Evidence from 12 Asian countries. *Sustainable Development*, 28(1), 39-45.

Korkpoe, C. H., & Nyarku, K. M. (2013). Building an organisational culture that promotes innovation in IT firms: A conceptual framework. *International Journal of Strategic Information Technology and Applications (IJSITA)*, 4(1), 1-14.

Kuijs, L., & Wang, T. (2006). Pattern of growth: Moving to sustainability and reducing inequality. *China & World Economy*, 14(1), 1-14.

Kusumawardani, D., & Dewi, A. K. (2020). The effect of income inequality on carbon dioxide emissions: a case study of Indonesia. *Heliyon*, 6(8).

Leal Filho, W., Azeiteiro, U., Alves, F., Pace, P., Mifsud, M., Brandli, L., & Disterheft, A. (2018). Reinvigorating the sustainable development research agenda: the role of the sustainable development goals (SDG). *International Journal of Sustainable Development & World Ecology*, 25(2), 131-142.

Lee, K. H., Min, B., & Yook, K. H. (2015). The impacts of carbon (CO₂) emissions and environmental research and development (R&D) investment on firm performance. *International Journal of Production Economics*, 167, 1-11.

Li, M., Liu, J., Chen, Y., & Yang, Z. (2023). Can sustainable development strategy reduce income inequality in resource-based regions? A natural resource dependence perspective. *Resources Policy*, 81, 103330.

Li, R., & Jiang, R. (2020). Investigating effect of R&D investment on decoupling environmental pressure from economic growth in the global top six carbon dioxide emitters. *Science of The Total Environment*, 728, 138845.

Environment, 740, 140053.

Machasio, I. N. (2020). COVID-19 and digital financial inclusion in Africa.

Malik, A. H., Jais, M. B., Md Isa, A. H., & Rehman, A. U. (2022). Role of social sustainability for financial inclusion and stability among Asian countries. *International Journal of Social Economics*, 49(9), 1324-1348.

Marcelin, I., Sun, W., Teclezion, M., & Junarsin, E. (2022). Financial inclusion and bank risk-taking: The effect of information sharing. *Finance Research Letters*, 50, 103182.

Matekenya, W., Moyo, C., & Jeke, L. (2021). Financial inclusion and human development: Evidence from Sub-Saharan Africa. *Development Southern Africa*, 38(5), 683-700.

Mehrotra, N. R., & Sergeyev, D. (2021). Debt sustainability in a low interest rate world. *Journal of Monetary Economics*, 124, S1-S18.

Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent social sciences*, 5(1), 1653531.

Menyelim, C. M., Babajide, A. A., Omarkhanlen, A. E., & Ehikioya, B. I. (2021). Financial inclusion, income inequality and sustainable economic growth in sub-Saharan African countries. *Sustainability*, 13(4), 17-80.

Mhlanga, D. (2022). COVID-19 and digital financial inclusion: Policies and innovation that can accelerate financial inclusion in a post-COVID world through fintech. *African Journal of Development Studies*, 2022(si2), 79.

- Mughal, N., Wen, J., Zhang, Q., Pekergin, Z. B., Ramos-Meza, C. S., & Pelaez-Diaz, G. (2022). Economic, social, and political determinants of environmental sustainability: Panel data evidence from NEXT eleven economies. *Energy & Environment*, 0958305X221124224.
- Mukalayi, N. M., & Inglesi-Lotz, R. (2023). Digital financial inclusion and energy and environment: global positioning of sub-Saharan African countries. *Renewable and Sustainable Energy Reviews*, 173, 113069.
- Musarat, M. A., Alaloul, W. S., Liew, M. S., Maqsoom, A., & Qureshi, A. H. (2021). The effect of inflation rate on CO2 emission: a framework for Malaysian construction industry. *Sustainability*, 13(3), 1562.
- Mushta, A., Chen, Z., Ud Din, N., Ahmad, B., & Zhang, X. (2020). Income inequality, innovation and carbon emission: perspectives on sustainable growth. *Economic research-Ekonomska istraživanja*, 33(1), 769-787.
- Nasreen, S., Anwar, S., & Ozturk, I. (2017). Financial stability, energy consumption and environmental quality: Evidence from South Asian economies. *Renewable and sustainable energy reviews*, 67, 1105-1122.
- Nizam, E., Ng, A., Dewandaru, G., Nagayev, R., & Nkoba, M. A. (2019). The impact of social and environmental sustainability on financial performance: A global analysis of the banking sector. *Journal of Multinational Financial Management*, 49, 35-53.
- Odhiambo, N. M. (2020). Financial development, income inequality and carbon emissions in Sub-Saharan African countries: a panel data analysis. *Energy Exploration & Exploitation*, 38(5), 1914-1931.
- Okafor, G. (2017). The impact of political instability on the economic growth

of ECOWAS member countries. *Defence and Peace Economics*, 28(2), 208-229.

Ozili, P. K. (2022). Sustainability and sustainable development research around the world. *Managing Global Transitions*.

Ozili, P. K., & Iorember, P. T. (2023). Financial stability and sustainable development. *International Journal of Finance & Economics*.

Petrović, P., & Lobanov, M. M. (2020). The impact of R&D expenditures on CO2 emissions: evidence from sixteen OECD countries. *Journal of Cleaner Production*, 248, 119-187.

Radu, M. (2015). Political stability-a condition for sustainable growth in Romania?. *Procedia Economics and Finance*, 30, 751-757.

Rahman, S. U., Faisal, F., Sami, F., Ali, A., Chander, R., & Amin, M. Y. (2022). Investigating the Nexus Between Inflation, Financial Development, and Carbon Emission: Empirical Evidence from FARDL and Frequency Domain Approach. *Journal of the Knowledge Economy*, 33(2), 1-27.

Roodman D (2009) How to do xtabond2: an introduction to difference and system GMM in Stata. *Stata J* 9(1):86–136

Roodman, D. (2006) How to do xtabond2: an introduction to ‘difference’and ‘system’GMM. *Stata Center for Global Development Working Paper*, 103

Rosen, M. A. (2019). Advances in sustainable development research. *European Journal of Sustainable Development Research*, 3(2), 1-3.

Roy, J., Tscharket, P., Waisman, H., Abdul Halim, S., Antwi-Agyei, P., Dasgupta, P. & Suarez Rodriguez, A. G. (2018). Sustainable

development, poverty eradication and reducing inequalities.

Rubio, O. B., Roldán, M. D. C. D., & Esteve, V. (2007). Deficit sustainability and inflation in EMU: An analysis from the fiscal theory of the price level. In XIV Encuentro de Economía Pública: políticas públicas y reformas fiscales (p. 63).

Safi, A., Chen, Y., Wahab, S., Ali, S., Yi, X., & Imran, M. (2021). Financial instability and consumption-based carbon emission in E-7 countries: The role of trade and economic growth. *Sustainable Production and Consumption*, 27, 383-391.

Sarpong, D., Boakye, D., Ofosu, G., & Botchie, D. (2023). The three pointers of research and development (R&D) for growth-boosting sustainable innovation system. *Technovation*, 122, 102581.

Schmidt, T. S., Steffen, B., Egli, F., Pahle, M., Tietjen, O., & Edenhofer, O. (2019). Adverse effects of rising interest rates on sustainable energy transitions. *Nature Sustainability*, 2(9), 879-885.

Seo, H. J., Kim, H., & Lee, Y. S. (2020). The dynamic relationship between inequality and sustainable economic growth. *Sustainability*, 12(14), 5740.

Setyadharma, A., Oktavilia, S., Wahyuningrum, I. F. S., Nikensari, S. I., & Saputra, A. M. (2021). Does Inflation Reduce Air Pollution? Evidence from Indonesia. In *E3S Web of Conferences* (Vol. 317, p. 01068). EDP Sciences.

Shaheen, F. (2014). Reducing economic inequality as a Sustainable Development Goal: Measuring up the options for beyond 2015.

Soehaditama, J. P. (2023). Sustainability in Bank: Deposits, Investment and

Interest Rate. *Formosa Journal of Sustainable Research*, 2(5), 1069-1078.

Soyemi, K. A., Olowofela, O. E., & Yunusa, L. A. (2020). Financial inclusion and sustainable development in Nigeria. *Journal of Economics and Management*, (39), 105-131.

Spangenberg, J. H. (2005). Economic sustainability of the economy: concepts and indicators. *International journal of sustainable development*, 8(1-2), 47-64.

Tanchangya, P., & Ayoungman, F. Z. (2022). Poverty, income inequality and carbon emission (CO₂e) in Bangladesh: evidence from ARDL and NARDL model.

Tay, L. Y., Tai, H. T., & Tan, G. S. (2022). Digital financial inclusion: A gateway to sustainable development. *Heliyon*.

Thi, T. V. V., & Thu, T. D. T. (2023). Does R&D Always Support Sustainable Growth? Evidence from an Emerging Economy. In *International Conference on Emerging Challenges: Strategic Adaptation in The World of Uncertainties (ICECH 2022)* (pp. 360-373). Atlantis Press.

Torre, B., Cantero, M., & Sanfilippo, S. (2021). Sustainable banking, market power, and efficiency: Effects on banks' profitability and risk. *Sustainability*, 13(3), 1298.

Ullah, A., Kui, Z., Ullah, S., Pinglu, C., & Khan, S. (2021). Sustainable utilisation of financial and institutional resources in reducing income inequality and poverty. *Sustainability*, 13(3), 1038.

Wahab, S., Imran, M., Safi, A., Wahab, Z., & Kirikkaleli, D. (2022). Role of financial stability, technological innovation, and renewable energy in

achieving sustainable development goals in BRICS countries.

Environmental Science and Pollution Research, 29(32), 48827-48838.

Wang, C., Cardon, P. W., Liu, J., & Madni, G. R. (2020). Social and economic factors responsible for environmental performance: A global analysis. Plos one, 15(8), e0237597.

Wilkinson, R., & Pickett, K. (2010). The impact of income inequalities on sustainable development in London. A report for the London Sustainable Development Commission.

Zheng, S., Sheng, B., Ghafoor, A., Ashraf, A. A., & Qamri, G. M. (2023). Investigating the environmental externalities of digital financial inclusion and the COVID-19 pandemic: an environmental sustainability perspective. Environmental Science and Pollution Research, 1-10.

Ziolo, M., Filipiak, B. Z., Bąk, I., & Cheba, K. (2019). How to design more sustainable financial systems: The roles of environmental, social, and governance factors in the decision-making process. Sustainability, 11(20), 56-74.

APPENDICES

A list of sample of 28 SSA economies selected for the study.

Sub-Saharan Africa

Angola	Burundi
Benin	Burkina Faso
Botswana	Cote d'ivoire
Cameroon	Democratic Republic of Congo,
Ethiopia	Ghana
Kenya	Lesotho
Madagascar	Malawi
Eswatini	Mali
Mozambique	Mauritania
Mauritius	Niger
Rwanda	Senegal
Sierra Leone	Nigeria
Uganda	South Africa
Zambia	Zimbabwe