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The role of fintech in promoting financial inclusion and economic growth in Africa

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Every end marks the dawn of new beginning…

Gueffai Asmaa Khouloud...

Dedication

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Ghalem Djelti Khadidja…

Dedication

To Us…

Gueffai Asmaa Khouloud, Ghalem Djelti Khadidja

The role of fintech in promoting financial inclusion and economic growth in Africa

Abstract

This research aims to investigate the role of financial technology (fintech) in promoting financial inclusion and economic growth. It examines the synergistic interaction between these variables, drawing on both theoretical and empirical validations. The study is based on empirical validation across ten African countries. It uses a panel Auto Regressive Distributed Lag (ARDL) model over the period 2004-2021**.** Various financial and economic indicators are employed to analyse both short-term and long-term effects. The results show that fintech and financial inclusion play a significant and crucial role and are considered a key solution for boosting the economic growth of the studied countries.

Keywords: Fintech, Inclusion, Economic growth, ARDL, African countries, Economic development, Financial development.

دور التكنولوجيا المالية في تعزيز الشمول المالي والنمو الاقتصادي في افريقيا

ملخص

يهدف إطار هذا البحث إلى دراسة دور التكنولوجيا المالية في تعزيز الشمول المالي والنمو الاقتصادي وذلك من خلال دراسة التفاعل بين هذه المتغيرات، بالاعتماد على نتائج البحوث النظرية والتجريبية. كما يستند على الاقتصاد القياسي لقياس بيانات عشر دول افريقية مستعملة في التحليل. تستخدم هذه الدراسة نموذج الانحدار الذاتي التجميعي لتباطؤ التوزيع (ARDL) للبيانات على مدى الفترة 2004-2021، وذلك بالاستعانة بمؤشرات مالية واقتصادية متنوعة لتحليل التأثيرات على المدى القصير والطويل. تظهر النتائج أن التكنولوجيا المالية والشمول المالي يلعبان دورا هاما وحاسما في البلدان التي شملتها الدراسة ويعتبران حلا رئيسيا لتعزيز النمو الاقتصادي.

الكلمات المفتاحية: التكنولوجيا المالية، الشمول، النمو الاقتصادي، ARDL، إفريقيا، التنمية الاقتصادية والمالية.

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List of acronyms

Acronym	Definition
FINTECH	Financial Technology
ATMs	Automated Teller Machine
NASDAQ	National Association of Securities Dealers Automated Quotations
SSL	Secure Sockets Layer
GDP	Gross Domestic Product
CAGR	Compound Annual Growth Rate
NFC	Near Field Communication
DFS	Digital Financial Services
DFI	Digital Financial Inclusion
QR	Quick response
P2P	Peer to Peer
IMF	International Monetary Fund
AI	Artificial Intelligence
ML	Machine Learning
DeFi	Decentralised Finance
MPLS	Multi-Protocol Label Switching
IPSEC	Internet Protocol Security
M Pesa	Mobile Money
NIST	National Institute of Standards and Technology

FSB	Financial Stability Board
IIF	Institute of International Finance
AML	Anti Money Laundering
CFT	Counter Financing of Terrorism
KYC	Know Your Customer
ICC	International Chamber of Commerce
AMF	Arab Monetary Fund
CGAP	Consultative Group to Assist the Poorest
CFI	Corporate Finance Institute
POS	Point Of Sale Terminus
NFIS	National Financial Inclusion Strategies
G20	Group of Twenty
Findex	Financial Inclusion Index
OECD	Organisation for Economic Cooperation and Development Council
SMEs	Small Medium Entreprises
APIs	Applications Programming Interfaces
PCI	Payment Card Industry
DSS	Data Security Standards
CFTE	Center for Finance, Technology and Entrepreneurship
UAE	United Arab Emirates
UN	United Nations
SDGs	Sustainable Development Goals

UBA	Usage Based Insurance
FAS	Financial Access Survey
GMM	Generalized Method of Moments
ARDL	Autoregressive Distribution Lag Model
PMG	Pooled Mean group
MG	Mean group

General introduction

General Introduction

In recent decades, the world has witnessed a major transformation in the financial field thanks to financial technology (FinTech), which has combined technical innovations with traditional financial services with the aim of improving and facilitating financial transactions. These innovations range from digital payments, electronic loans, and digital insurance to the use of technologies such as Blockchain and Artificial Intelligence (AI) to improve customer interaction and financial data analysis. One of the main goals of financial technology is financial inclusion, which refers to the provision of financial services to all individuals, including marginalized groups or those unable to access traditional financial services.

Fintech plays a crucial role in promoting financial inclusion by providing accessible and affordable financial services to underserved populations, such as those in remote areas or with limited banking access. Where financial technology provides banking services such, microloans, and digital payment solutions that empower individuals and small businesses to participate in the economy. This increased access to financial services not only enhances individual livelihoods but also stimulates economic growth by fostering entrepreneurship, improving savings rates, and enabling more efficient resource allocation. Overall, fintech serves as a catalyst for economic development by bridging gaps in the traditional financial system and driving inclusive growth.

Indeed, fintech, or financial technology, has rapidly transformed the landscape of finance, enabling new opportunities for investment and contributing to greater financial stability in many countries. Financial stability refers to the health of a country's financial system, which includes ensuring that financial institutions and markets are resilient to shocks and that there is broad access to financial services for the population. Fintech plays an essential role in enhancing financial stability in both developed and developing countries. As countries continue to integrate fintech into their financial systems, its role in fostering stability and growth will only expand. Indeed, we can also say that crises are the main driver and key catalyst for innovation. That why we recall the COVID-19 crisis, which has reinforced the need to increase digital financial inclusion. It involves the use of cost-effective digital means to reach financially excluded and currently underserved populations through a range of formal financial services that fit their needs and are responsibly delivered at an affordable cost to customers and sustainable to service providers. Furthermore, access to financial services also makes daily life

easier, helping families and businesses plan for everything from long-term goals to unexpected emergencies.

Over the past decades, Africa with its fast-growing population and some of the world's fastest expanding economies, offers a huge market opportunity for financial technologies, which is establishing a path towards financial inclusion and economic growth. The continent represents the second rapidly expanding banking and payment market globally, and the implementation of fintech in Africa has emerged as a transformative force, addressing the continent unique financial challenges and fostering economic inclusion. Moreover, many leveraging innovations such as mobile money platforms, digital payment systems, and blockchain technology, among these technologies we can find one of the most leading fintech model in Africa, Kenya with the M-Pesa with 28 million clients, as an innovative digital service launched in 2007. While fintech has demonstrated significant potential to bridge financial gaps and stimulate economic activity, its implementation also requires addressing challenges such as regulatory frameworks, infrastructure limitations, and consumer protection. In light of this, implementing fintech ought to present remarkable opportunities in Africa for achieving greater financial inclusion and sustainable economic growth.

Among others, the landscape of fintech in Algeria is the result of a multitude of economic, regulatory, and technological conditions that define the context within which policies are to be implemented. Algeria's economy, which has traditionally been dominated by hydrocarbons, has a strong push at this time for diversification, and fintech is viewed as one of those areas with real potential for growth and innovative development. Many of the people are either unbanked or poorly banked, which gives a good chance for fintech solutions to serve them through promoting financial inclusion. The regulatory framework evolves as the Bank of Algeria develops structures to accommodate innovations in fintech, maintained by ensuring financial stability and consumer stability. Clearly, the government has expressed its predisposition for foreign investment and collaboration among countries in a bid to boost their local fintech ecosystems. Additionally, this arises, for example, creating consumer awareness and overcoming worries related to data privacy and cybersecurity may likely bring in increased fintech solution adoption in Algeria. Finally, continued dialogue between government, financial institutions, start-ups, and consumers will be very important for successful integration within the country's financial landscape.

The traditional financial system faces several challenges, including limited access for underserved populations, high transaction costs, and inefficiency in service delivery. Many people in rural or remote areas lack access to banking services, while others face long wait times and complicated procedures to access credit or loans (challenges in bureaucracy), also traditional banks face difficulties in adapting to rapid technological changes and providing innovative services. It can be added that Algeria faces challenges related to its heavy dependence on the oil and gas sector, which makes it vulnerable to fluctuations in global energy prices. The shift towards the use of financial technology can contribute to diversifying the economy, by promoting digital entrepreneurship and increasing investment in new sectors such as technology and electronic financial services.

A. Statement of the Problem

This comprehensive approach ensures a thorough understanding of the interplay between fintech technology, financial inclusion, and economic growth which lead us to our research problematic:

Is digital financial inclusion beneficial to promote economic growth for African countries over the period 2004-2021?

B. Hypotheses

In order to answer this question, we are going to test the following hypothesis:

Fintech has a significant positive impact in promoting financial inclusion and growth in the studied countries.

This general statement can be decomposed into three hypotheses:

H_1: ATMs in underserved and rural areas has a positive impact on financial inclusion and growth.

H_2: Access to credit significantly boost financial inclusion and economic growth.

H_3: Financial development (FDI) contributes positively to financial inclusion and economic growth.

C. Significance of the Research

The significance of researching "the role of financial technology in promoting financial inclusion and economic growth" lies in its capacity to promote sustainable economic growth and reduce systemic gaps in access to financial services by looking at how fintech solutions can empower marginalized groups, such low-income people, this study reveals creative strategies that make it easier for people to obtain necessary financial instruments, which in turn

promotes economic participation. Policymakers and financial institutions may improve financial literacy, produce customized financial products, and establish inclusive ecosystems by understanding the effects of fintech. The study also adds to the larger conversation on how technology might break down conventional boundaries in the financial industry, which will ultimately result in more resilient economies that are better able to handle difficulties and seize development opportunities. This topic is essential for influencing future financial policies and practices aimed at inclusive development in the rapidly shifting digital landscape.

D. Objective of the Research

The study aims to identify the key solutions that contribute to financial inclusion and evaluate their effectiveness in reaching the unbanked and underbanked and examine how fintech innovations can enhance access to financial services for underserved populations and analyse their impact on economic growth. The research will explore the economic benefits of financial inclusion, including increased entrepreneurial activities, job creation, and poverty reduction. This study seeks to provide valuable insights and recommendations for policymakers, financial institutions, and technology developers to foster a more inclusive and prosperous financial ecosystem.

Besides, we aim to investigate how access to fintech solutions influences financial behaviours such as saving, borrowing, spending, and investing using fintech solutions which provide a better understanding of personal finance management by giving users real-time insights into their financial actions. However this enhanced understanding is critical for encouraging educated decision-making, which leads to improved financial management practices. Finally, to analyse how fintech innovations, have significantly enhanced financial inclusion by providing accessible, affordable, and user-friendly financial services to underserved populations and breaking down traditional barriers to accessing banking services, such as distance from physical bank branches, high fees, and a lack of required documentation and help people understanding how exactly deal with them.

E. Research methodology

In the theoretical part of the research, a descriptive approach is employed to explore the fundamental concepts and frameworks relevant to fintech, financial inclusion, and economic growth. This section begins by defining key terms such as financial inclusion, fintech, and economic growth, along with their interrelationship. It explores a variety of pertinent ideas, such as economic growth theories and the Financial Access theory, to provide readers an

overview of how fintech could improve financial inclusion and boost the economy. This section's synthesis of the body of literature not only demonstrates the topic's significance but also identifies the gaps that the empirical study will fill. Indeed, the empirical section employs a quantitative and analytical approach to determine the effects of fintech on financial inclusion and economic growth. This part outlines the research design, data collection methods, and analytical techniques using EViews 14.

F. Reason for choosing the topic

* Subjective reasons

- Our personal interest in technology and its modern applications in various fields, especially financial technology, which is a key topic in our specialization: we are curious to explore how digital tools impact the economy and financial services.

- Our desire to understand the impact of technology on our daily lives: as financial technology is rapidly evolving and directly impacting daily life, we are curious to understand how digital financial tools can change the way we manage money, whether through electronic payments, accessing loans, or investing.

* Objective reasons

- Local challenges and global trends: Algeria faces significant challenges in achieving financial inclusion due to geographic, social, and economic constraints. However, financial technology (fintech) provides solutions to these challenges. By studying this topic, one can analyse how technological solutions interact with the Algerian context.

- Keeping up with global trends: on a global scale, technology-driven financial inclusion has become a key tool in the development of the digital economy, making this topic highly relevant in the current context.

- Spreading the culture of financial technology to achieve financial inclusion.

G. Research limitations

Every research faces some limitations, in this research on fintech, financial inclusion and economic growth in ten African countries using the ARDL model from 2004-2021, several challenges need to be considered. The important issue is the availability of data, as data usually not complete across countries, especially in the recent years 2022 and 2023.

H. Literature review

Due to the quick development of digital solutions and their potential to revolutionize established financial environments, the relationship between financial technology (fintech) and financial inclusion has attracted a lot of attention recently. Access to financial services continues to be a major obstacle for marginalized groups, especially in developing nations, as long as economic inequities exist globally. Fintech, which offers innovative instruments that let people and small businesses participate in the financial ecosystem, has emerged as a promising way to close this gap.

This literature review seeks to explore the multifaceted role of fintech in promoting financial inclusion and fostering economic growth by examining existing research and theoretical frameworks. Many authors highlight how crucial fintech is to promote financial inclusion:

- Mihasonirina A., & Kangni K. (2012): explored the impact of mobile phone rollout on economic growth in a sample of African countries from 1988 to 2007 using The System Generalized Method of Moments (GMM), the results confirm that mobile phone development contributes significantly to economic growth in African countries. In addition, financial inclusion, measured by the number of deposits and loans per head, appears to be one of the channels of transmission from mobile phone development to growth, while being itself independently correlated with economic growth. It also shows that in countries where such financial services are available, the correlation among financial inclusion, mobile phone diffusion, and growth is stronger. Finally mobile phone diffusion has the potential to boost financial inclusion by easing the provision of cost-effective financial services to the poor and the nonpoor, given the low coverage of banks in African countries.
- Mohammed Jasim Mohammed (2020): conduct a study about the role of fintech in promoting financial inclusion in the Golf and Arab countries between 2014-2018 applying the ARDL model. The study was based on the hypothesis that financial technology does not play an effective role in achieving financial inclusion. Through the results of the regression analysis of financial inclusion indicators, it was concluded to reject the study hypothesis and accept the alternative hypothesis, which states that financial technology plays an effective role in achieving financial inclusion through its approved indicators (FIATM, FICBB, FIMSCP, FILCP), the individual financial inclusion indicators (FIATM, FICBB, FIMSCP, FILCP) are important indicators that provide a clear picture of financial inclusion in the countries of the study sample. Financial technology, through the mobile cellular subscribers (MCS) index, plays an effective role in achieving financial inclusion through the four indicators. Fintech through the account ownership with mobile phone

(AOF) indicator plays an effective role in achieving financial inclusion through the four indicators.

- Muntaj Abida, Sima Mohsen Alawi Al-Obaidi (2022): used ARDL model to explore research on the Impact of Financial Technology on Improving the Level of Financial Inclusion In Iraq over the period 2010q1-2020q4 by adopting a model with an independent and dependent variable, as the dependent variable represents bank deposits and their ratio to GDP, while the independent variable represents the rate of ATMs per 100,000 adults, The study results revealed a short-term, long-term and significant relationship between the number of ATMs and the total bank deposits relative to the GDP. The outcomes demonstrate the development of financial technology in Iraq faces a number of difficulties and challenges, including the absence of legislative and legal frameworks specific to information and communication technology, weak infrastructure, and low spending on research, this situation will reduce the importance of financial technology and its role in delivering financial services, thus hindering the achievement of economic growth in the country.
- Garidi R. and Karama S. (2022) utilized a descriptive analytical approach, in cooperating study variables and a case study method, to investigate the role of financial technology (fintech) in promoting financial inclusion in Algeria during the period from 2010 to 2018. The research aimed to assess the influence of fintech tools, specifically automated teller machines (ATMs) and interbank payment cards, on financial inclusion. The findings revealed that electronic payment cards significantly contributed to improve financial inclusion, whereas ATMs showed no notable impact in this regard.
- Haider M. Kareem, L.Mustafa.A Salam and Qusay Ali Dheyab (2023) aim to clarify the role and importance of the financial technology variable as a very important modern basic instrument in the banking business, the research sample was selected from Iraq over the period 2022, The statistical results have proven that there is a correlation and effect between the study variables, which led to the acceptance of the alternative hypothesis, confirming the existence of an effect between financial technology and the idea of enhancing financial inclusion during the quarantine and epidemic crises and financial services contributes to achieving high quality banking services.
- Khaled Obaid Ahmed Al- Obaidi and Guerrara Samia (2023): carry out a study on financial technology's relationship with the strategy of financial inclusion and its impact on economic development in Algeria and Iraq in the period of 2023 which revealed that

financial technology used by commercial banks is regarded as one of the most crucial elements enhancing the financial inclusion plan and subsequently fostering economic growth through the bank's contribution to the gross domestic product, which requires more attention and application because of its positive effects on economic development.

- Souaad Moussaoui, Mohamed Tagerout (2023) explored the role of fintech in financial inclusion in Algeria in the period of 2012-2022. by using the descriptive approach, the study concluded that indicators of financial inclusion have relation with fintech and during the analysis, it was noted that financial inclusion increased with the increase in the number of ATMs.
- Nadjet Ouis, Djelloul Cherifi and Youcef Souar (2023) applied a study on measuring the dynamic impact of the Financial Inclusion on Economic Growth adopting an econometric approach with the ARDL model during the period 2004-2018 in Algeria. It aims to measure this relationship using the following variables loans, deposits, number of bank branches, for financial inclusion and the GDP per capita for the economic growth. The results reveal a positive and significant long-term relationship between financial inclusion indicators and economic growth, but for deposits there's a negative relationship on economic growth in the long run.
- Meshesha Demie Jima, Patricia Lindelwa Makoni (2023) examine the relationship between financial inclusion and economic growth in panel of 26 sub-Saharan African countries over the 2000-2019 period. They used an ARDL approach and Granger non-causality test, using number of accounts per 1000 adults, ATMs, number of branches per 1000 km2, geographic spreads of ATMs, branches of commercial banks per 100,000 adults, credit to the private sector as a percentage of GDP, in order to measure the financial inclusion and GDP per capita for the economic growth. The study revealed that financial inclusion and economic growth share a long-run relationship and the absence of short-run relationship between the variables.

- Soha N. Jameel and Namir A. Al-Saigh (2024) : apply a study about the contributions of digital financial diversity to the quality of financial inclusion, an analytical study of Arab countries between 2011-2022 using the ARDL model showed that there is a significant relationship between the indicators of financial digitalization and financial inclusion, represented by the quality dimension and the models that were tested and based on the global financial inclusion database The Global Findex Database 2021.

- Obed Kipkemboi Tiony (2024): this research examines the impact of financial technology (fin-tech) innovation on financial inclusion and economic growth in Kenya, using descriptive statistics. The study aims to analyse how fin-tech innovations, such as mobile money, digital banking, and block chain technology, have enhanced financial inclusion, which conclude that Fintech innovations have significantly impacted financial inclusion in Kenya by increasing accessibility, affordability, and usage of financial services. Mobile money platforms like M-Pesa have been particularly effective in providing financial services to the unbanked population, while digital banking and blockchain technology also contribute to this trend, albeit to a lesser extent. Economic growth has been positively influenced by fintech through the development of SMEs, job creation, and contributions to GDP growth. SMEs have benefited from easier access to credit and financial services, enabling them to expand and contribute to the economy.
- Bamaze Tchakpi (2024): apply a study on 13 ECOWAS countries to analyse the effect of fintech on financial inclusion and the role played by institutional quality in the ECOWAS zone over the period 2000-2017 using the Generalised Least Squares (GLS) method, the results show that in the ECOWAS zone, fintech instruments such as mobile phones and the internet are significant. Institutional variables such as the level of corruption and the quality of regulation are also significant. Fintech and institutional quality therefore boost financial inclusion in the ECOWAS region. However, there is a negative effect between mobile telephony and savings mobilisation due to the low use of mobile telephony to carry out financial transactions in the community improving accessibility, affordability, and usage of financial services.
- Kardoussi Maroua (2024): used descriptive analytical model to examine the role of fintech in financial inclusion in Algeria from 2014 - 2024. The study demonstrated the role of financial technology CIB-TPE-ATM-E payment in enhancing financial inclusion by clarifying the technology specific to the financial and investment sector that is currently available, such as digital payments and investment management. The study found that there is efficiency in financial technology techniques in the Americas and Europe, but Algeria suffers from slow development in financial technology, which has made it difficult to achieve financial inclusion due to a lack of awareness in financial services and a lack of confidence in the financial system so the digital infrastructure must be improved and communications.

- Massinissa Ameziane (2024) This study aims to highlight the pivotal role of fintech and in fostering economic development within the MENA region through financial inclusion for triennial (3-years interval) data for the periods 2014, 2017 and 2020, by using theoretical and case study analysis in addition to an empirical study applying fixed effect, random effect and pooled OLS methods, and he used the variables, digital financial inclusion measured by made or received digital payments, GDP per capita growth, inflation, population growth, trade, and gross capital formation % GDP. The results found that investment in infrastructure and technology leads to higher production and increased economic growth, through enhancing digital financial inclusion.

I. Research structure

The framework of this research comprehensively and systematically goes into the study of the effects of fintech on financial inclusions and economic growth in Algeria and a few other select African nations. In the first chapter, we deal in detail with the historical development, definition, and scope of Fintech, which will incorporate a critical analysis of services offered, their roles, modern technologies, and the concomitant risks associated with its implementation, including cybersecurity threats and regulatory challenges. Chapter II embodies the conceptual underpinning for financial inclusion through a critical approach of concepts, theories, and principles in addition to the barriers that impede access to financial services. In the same chapter, a cutting-edge study highlights the strategic role that fintech plays in promoting financial inclusion and economic growth by illustrating a few successful examples of some fintech initiatives. Chapter III explores the quantitative analysis of the economic and financial environment and discuss the adoption of fintech and its impact on different levels of development in selected countries. This chapter, therefore, presents a detailed research methodology, sample selection, results, and discussions of findings and intends to draw empirical evidence on how fintech, financial inclusion, and economic growth are related.

Chapter I :

Theoretical and Conceptual Framework of Fintech

Introduction

The financial world has experienced significant transformation over recent years, due to the introduction of financial technologies. This chapter highlights the theoretical and conceptual framework of these financial technologies, it starts with exploring the historical development of fintech tracing its origins and evolution from traditional banking systems to the digital ecosystems, defining fintech as integration of modern technology into the financial services. It also addresses the main types of services offered by fintech that facilitated online transactions from early digital payment systems to today's revolutionary technologies.

The chapter also highlights the major types of services offered by fintech to facilitate online transactions from early digital payment systems to the modern-day revolutionary technologies, thereby highlighting how these innovations have altered the face of finance by creating opportunities for consumers and businesses to manage their finances, transact, and access financial services.

Furthermore, the chapter investigate the fundamental and specific role behind fintech adoption, including financial inclusion to customer experience. In addition to these opportunities, it introduces the key challenges and risks associated with the emergence of financial technology such as cybersecurity, data privacy and the need for regulatory framework in order to achieve a balance between the desired objectives through fintech and the risks to be avoided while fostering innovation.

This chapter present a structured and comprehensive approach for examining all the key concepts of the implementation of technology in financial system across the world which serves as a foundational exploration of fintech navigating the dynamic and rapidly advancing fintech ecosystem.

1. Introduction to fintech

Fintech, which stands for financial technology, is a rapidly growing sector which represents the intersection of finance and digital services, it aims to offer new and accessible financial solutions for all members of society. This industry contributes in reshaping the traditional financial landscape and illustrating how the financial services are designed, delivered and consumed. Fintech is more than innovative tools, it's game-changer for our life style and the way we interact with the finance world.

1.1. The emergence of financial technology

Finance and technology have a close and interconnected relationship, throughout history, we have witnessed significant developments in the field of finance thanks to technology and its advancement to improve financial operations efficiency and enhance trade, especially in the early ages, this evolution was evident in the transition of money from coins to paper currency and then to digital forms, as well as the emergence of counters and automated systems and this relationship did not emerge suddenly but was the result of a series of historical developments aimed at improving financial operations, increasing efficiency, and expanding access to financial services.

To understand the origins and evolution of financial technology, it is essential to explore the historical stages that contributed to its emergence and how it became a pivotal factor in developing the modern financial system.

1.1.1 The First Phase of Fintech Development: The Early Seeds of the Digital Revolution (1967-1987)

The period between 1967 and 1987 witnessed new beginnings and advancements in the field of financial technology, where the foundations for a digital infrastructure were laid, serving as a catalyst and facilitator for financial transactions. This phase started in 1967 with the introduction of the first Automated Teller Machine (ATM) by Barclays bank, allowing customers to withdraw cash anytime and anywhere, also Followed by the establishment of National Association of Securities Dealers Automated Quotations (NASDAQ) in the US in 1971, it is the first digital stock exchange in the world (Massinissa, 2020)**,** around the same time, the first transatlantic cable was laid this cable was not just a means of communication but a lifeline for global financial markets, it enabled the rapid transmission of financial data, enhancing the inter-connectedness of financial markets worldwide and paving the way for the dawn of financial globalisation, this period also saw the invention of tools like mainframe

computers and early operating systems, which made it easier to provide banking services and run ATMs (Barberis, Arner, & Buckley, 2016).

1.1.2 Period 1987-2000: Expansion of Digital Technology in the Financial Sector

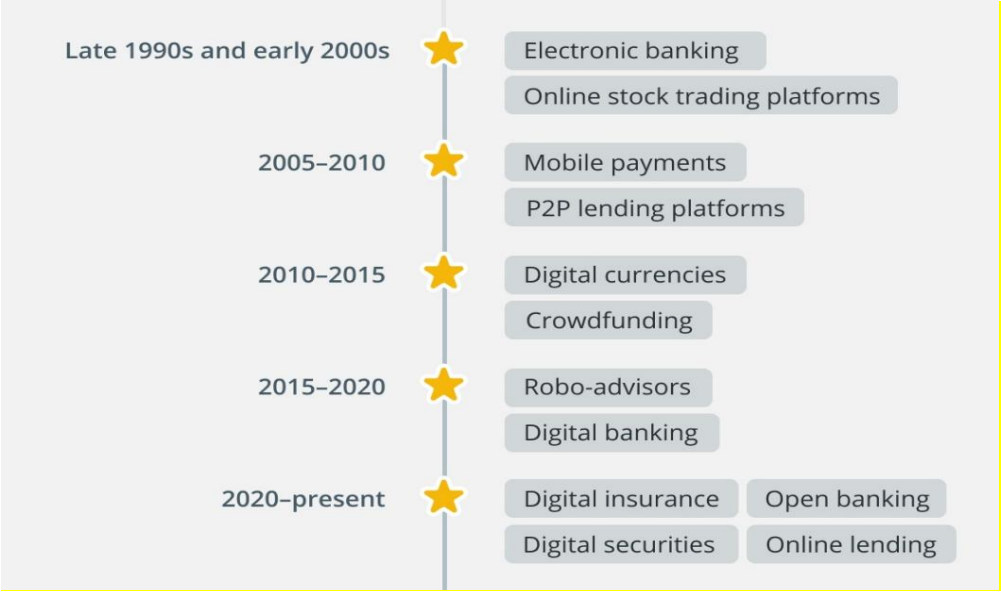
The period from 1987 to 2008 saw key developments in the growth of financial technology, as new technologies and platforms emerged that changed how financial transactions were done. Banks started adopting digital banking systems to improve efficiency and reduce costs, and database management systems were developed to store and analyse customer data more quickly. The SWIFT system also expanded to become the global infrastructure for money transfers. As the internet grew in the late 1990s, e-commerce flourished, creating a demand for digital payment solutions like PayPal, which was founded in 1998 (Maleh, Zhang, & Hansali, 2024), Until it came to payment via mobile systems, especially in emerging markets, such us the M-Pesa, system in Kenya in 2007. It is a system that allows access to money quickly and easily, only through a phone, especially in areas where banking services are limited, enabling users to pay and transfer their funds (Mas & Radcliffe, 2010) , also there was increased interest from startups and investors in financial innovation, leading to the rise of FinTech companies specializing in digital payment and financing solutions. At the same time, financial security technologies developed Secure Sockets Layer (SSL) is cryptographic protocol which protect sensitive information such as personal data, login credentials, and financial transactions from being intercepted by hackers (Delane, n.d.).

1.1.3 The Emergence of Fintech from 2008 to today

In 2008, the global financial crisis occurred, which was a major driver for modern financial technology, these technologies improved access to financial services, increased transparency, and reduced costs for both individuals and businesses, Among the services provided by financial technology offering personal loans, money transfers, and investment management without the need for traditional banks, also the global financial crisis forced the emergence of digital options for providing loans other than banks like crowdfunding and funding platforms such us lending club , after 2010, the spread of smartphones led to a digital revolution, including payment apps and digital wallets, as well digital currencies like Bitcoin and Ethereum became very popular, as they turned into a new tool for investment and payment, the creation of Bitcoin signalled a major impact on the financial sector and paved the way for the launch of the new asset class of cryptocurrencies with uses such as facilitating online payments to trading unique digital assets (Ajambo, 2023)**,** the slow development of systems that handle financial

transactions continued until the COVID-19 pandemic spread in 2020 which was a major turning in accelerating the adoption of financial technology worldwide, with the spread of the virus, we witnessed a rapid shift towards digital transactions and online financial services, as health measures and movement restrictions required unconventional solutions to ensure business continuity and meet the needs of individuals and companies (Massinissa, 2020). Consequently, social distancing and remote work further reinforced this transformation, driving an increased reliance on digital solutions such as online payments, e-commerce, online banking services, and digital loans, ultimately making financial technology an integral part of daily life, after all these developments in financial technology the global fintech market was valued at USD 294.74 billion in 2023 and is projected to be worth USD 340.1 billion in 2024 and reach USD 1,152.06 billion by 2032, exhibiting a compound annual growth rate (CAGR) of 16.5% during the forecast period (2024-2032), (Bhandari, Gurnani, & Kankhar, 2019), and predicted to continue evolving the fintech and keeping pace with the times, thanks to advancements in artificial intelligence, internet, and machine learning.

Figure 1.1: The timetable of the evolution of the Fintech industry



Source: Kaur, G. (2023, March 9). The history and evolution of the fintech industry. Retreived from:. https://cointelegraph.com/news/the-history-and-evolution-of-the-fintech-industry

1.2. Definition of financial technology (Fintech)

The term "Fintech" is a combination of two terms: "technology" and "finance." and this implies the blending of technological innovations and modern digital technologies with financial services, these innovations offer solutions that simplify financial activities, banking

services, and transactions in financial markets (Nguyen, Le, & Petratos, 2021), and that financial technologies have had a positive impact on the financial sector and the real economy, because this technology has reduced operational costs, enhanced market efficiency and provided customer convenience.

Some of the key components of FinTech include:

- Digital payments and transfers, which include electronic payment systems.

- Digital lending for individuals and businesses.

- Cryptocurrencies and blockchain technology for secure and transparent transactions.

- Digital insurance offers flexible and fast online services.

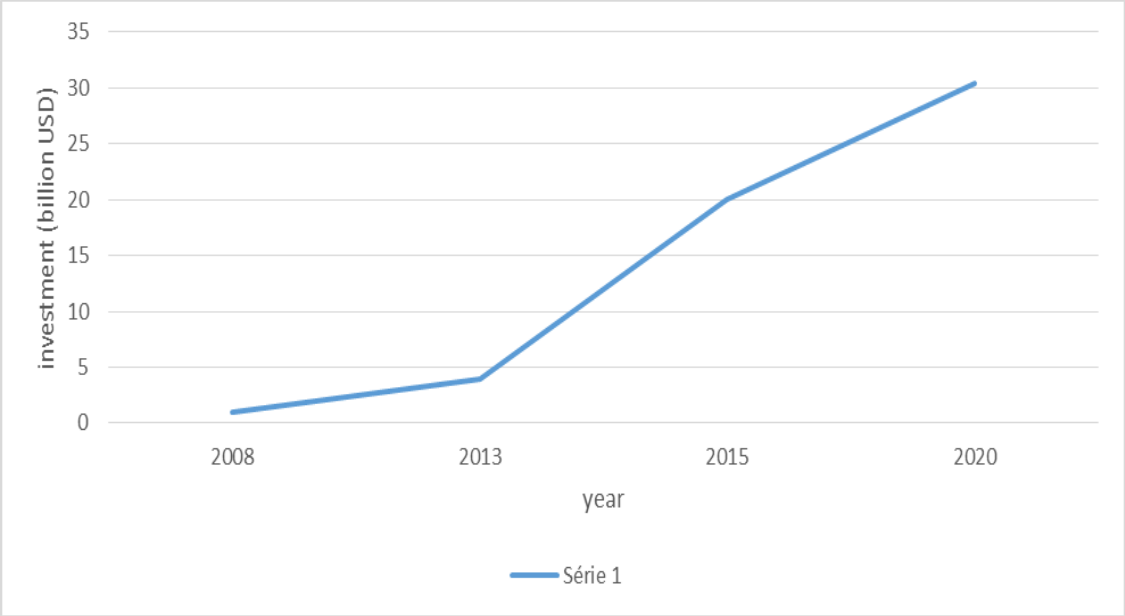
The institute for digital research in the Polish Capital Double defined fintech as « an expression of the inventions and innovations of modern technology in the financial sector, these inventions include a set of digital programs used in the financial operations of banks, including transaction with customers and financial services such as money transfer, currency exchange, interest rate calculations profits and knowledge of expected profits for investments and other banking operations » (Kadir & Gaamour, 2022). Also, the Financial Stability Board defines it as « technological advancements in finance that introduce novel applications, procedures, business models, or goods that have a measurable influence on financial institutions, markets, and the delivery of financial services » (Saida, 2024). Another definition by *Gomber, Kosh and Siering (2017)* explaining fintech as « the term FinTech is a neologism which originates from the words financial and technology and describes in general the connection of modern and, mainly, internet-related technologies like cloud computing and mobile internet which helped the establishment of business activities of the financial services industry » (Gomber, Koch, & Siering, 2017).

Therefore, financial technology can be defined as a set of innovative systems and devices that help perform financial transactions in a simple and advanced way, as it helps enhancing financial inclusion. However, despite its many advantages, it faces several challenges, including legal and regulatory issues, security and privacy concerns, and competition with traditional institutions.

1.2.1 The volume of investments in financial technology worldwide

Global investments in the fintech sector witnessed a significant rise from $928 million in 2008 to $4 billion in 2013. These investments further grew to $20 billion in 2015, according to the research firm Value Add (Zohra & Zineb, 2018). According to Qatar Fintech Center's 2021 report released today by Qatar Finance Center and Refinitiv, global investment in fintech companies during the first nine months of 2020 reached about US$ 30.4 billion and the Middle East and North Africa region is the most attractive investment in the fintech sector (QFC, 2021).

Figure 1.2: The volume of fintech investments worldwide from 2008 to 2020



Source: prepared by the researchers based on QFC report 2021.

2. Types of services offered by financial technology

In today's digital age, financial technology (Fintech) has become a crucial element in developing and enhancing the financial sector. technological advancements have led to a fundamental shift in how money is managed, transactions are conducted, and banking and investment services are provided. financial services are no longer limited to banks and large institutions; instead, financial technology offers innovative solutions that meet the needs of individuals and businesses more quickly and efficiently. through advanced technologies, it has translated into innovative solutions. Here are the major types of services offered by fintech companies:

2.1. Digital payments and money transfers

Payment is the transfer of money from one person to another as a result of the provision of a commodity or service and the payment is cash. With the emergence of fintech, the method of payment has varied and become easier by shortening the time and effort where *Chris Skinner,* one of the most prominent fintech authors and experts, said that « Fintech is about making financial services more accessible, transparent, and seamless for everyone » (Motlagh, 2012). The significant advancements in financial technology for payment methods is the introduction of mobile wallets, allowing smartphones to replace traditional cash, it is a safe, fast and convenient way to allow users to make payments by clicking on their devices contactless using Near Field Communication (NFC), this technology offers expanding business opportunities, for example, it allows users to make payments for travel tickets or purchases directly from their mobile phones, replacing the need for bank cards (Motlagh, 2012), for instance : Appel pay , Google pay or using QR code payment like : Alipay, WeChat Pay, remote payment has helped a lot in the period of COVID-19. We also consider how to pay fast from Peer-to-Peer (P2P), which has become popular in the banking environment, and allowing customers who have a bank account to transfer their money with only a click on their phones. This method is characterized by protection, security and speed.

Some popular P2P payment services include:

- Venmo: venmo allows users to send or receive money, split billet, and make payments to friend through their mobile app.

- Zelle: zelle is P2P payments platform integrated within banking apps, enabling users to send money directly to another person’s bank account.

- Cash app: cash app provides a range of features, including P2P transfers, bill payment, and the ability to buy and sell bitcoin (Singh, Singh, & Singh, 2023). It also appeared SMS-based mobile payments which are one of the financial innovations that facilitates payments and transfers of cash, deposits and withdrawals through text messages and M-Pesa is one of the successful examples innovated in 2007 by Kenya and is more used in Africa for the non-proliferation of Internet services and smart phones that helped spread financial inclusion (Osmania & Qirat, 2022), as well as, users can complete purchases directly within mobile apps without needing to leave the platform.

2.2. Lending and Credit

Lending refers to the process where one party called the lender provides resources like money to another party called the borrower under a contract or agreement to repay the money it plays a critical role in economy by providing funds to individuals and businesses. Therefore, fintech companies offer a range of services in lending and credit, leveraging technology to make borrowing more efficient, accessible, and personalised. Here is an example:

Online lending or crowdfunding provides loans or other forms of credit to individuals and small business through a digital portal , this online portal acts as a financial intermediary matching borrowers with lenders (King, 2023), for startups and small business ,online lending has revolutionized the credit industry by offering fast, flexible, and accessible loan options without the need for traditional bank branches, by leveraging artificial intelligence (AI), big data, and automation, online lenders streamline loan approvals, reduce costs, and expand financial access to individuals and businesses worldwide, there is also a peer-to-peer lending service, also known as debt crowdfunding, which is another form of crowdfunding that allows individuals and businesses to raise capital by borrowing money from a large number of people through an online platform (Massinissa, 2020), to finance their projects or activities and lenders should offer regular interest payment (coupon payment) at some future date with money borrowers, also P2P is automated processing allows for quick loans approvals with minimal paperwork also he is more flexible than bank credit but online loans provides unsecured loans which can be risk of borrowers defaulting on their loans, example in platform: Prosper, LendingClub, Funding Circle , Kiva (Kagan, 2024).

2.3. Wealth management and investment

Banks offer a range of financial services specializing in investment and wealth management to help individuals and companies develop their financial assets and achieve sustainable returns. These services include cutting-edge solutions based on fintech and artificial intelligence to deliver tailored investment strategies based on client’s financial needs and objectives. In the past, financial advisors were the ones who provided information on investments, wealth management, and other financial services but, the rise of fintech has led to the emergence of robo-advisors, which offer financial planning and investment advice through precise and objective analysis while assessing financial profiles and risks at a lower cost, however, they may not be the ideal choice for certain decisions, such as estate planning, due to its complexity. Additionally, quantitative advisors have emerged which focusing on the active management of

investment strategies. Likewise, automated retirement planning has developed, analysing future financial needs and creating a tailored retirement portfolio (Xu J. a., 2022). Besides that, one of the most important robo-advisor applications is Robinhood, which has helped people manage their investments, especially those who are busy and do not have the time to learn investing, research the market, or understand the trading tools used by professional investors. Also, robo-advisors have expanded their services to include debit cards, margin loans, and even trading in stocks and cryptocurrencies, this expansion aims to address investors challenges and facilitate investing, especially after rising interest rates and market volatility (Ranin, 2023) .

2.4. Insurance technology

Insurtech is a set of modern technologies that enhance insurance services using artificial intelligence (AI), big data, blockchain, machine learning, and cloud technology. Startups have leveraged technological advancements which provide better insurance solutions than traditional models, at a lower cost and with greater speed, and making insurance services more accessible through mobile applications, this not only improves customer experience but also, enhances market competitiveness (CFI, 2015). These technologies like AI and big data analytics have significantly improved the accuracy of risk assessments and pricing predictions, making them more effective and fair. For example, AI can analyse vast amounts of data to determine optimal pricing and risk levels, helping insurers manage risks more efficiently (Paramesha, Rane, & Rane, 2024), meanwhile, blockchain technology has strengthened transparency and security by providing a permanent, tamper-proof record of all transactions, making it easier to track policies, claims, and verifications. This, in turn, helps reduce fraud risks (Laurence, 2019). Furthermore, innovative technologies such as smart contracts in insurance and Usage-Based Insurance (UBI) have helped reshape the insurance industry, making it more efficient, customer-centric, and adaptable to modern needs (Berry, 2016).

2.5. Digital currency

Money is a medium of exchange and a unit for measuring value, it is an essential element of the economy, used for purchasing goods and services as well as for investment, and the world has agreed that the US dollar is the most powerful currency in transaction because it is considered safe and stable, solely due to this consensus (Investopedia, 2024), and now, with innovations and inventions, cryptocurrency has been introduced and people have begun to accept it and consider it as a symbol of value which can be stored on an electronic medium, transferred, or traded. Additionally, it does not require the presence of financial intermediaries

and operates without oversight from central banks, which helps reduce transaction costs, speed up exchanges, and simplify processes. Moreover, it has significantly lower transaction fees compared to credit cards and the most well-known being Bitcoin and Ethereum. Also, cryptocurrency relies on blockchain technology, which is known as a decentralised digital ledger used to store data securely and in a way that prevents tampering and fraud, making it ideal for financial transactions and smart contracts (Ali, 2021).

Among the financial technology services provided in the field of digital currencies are cryptocurrency wallets, which allow users to send, receive, store digital assets and decentralised finance (DeFi) which enables lending and borrowing without the need for intermediaries (Schueffel, 2021). However, despite its advantages, it is important to recognize that these currencies also come with risks. The most notable risks include price volatility, vulnerability to theft through hacking, and liquidity risk, as they operate independently of the economic system and cannot provide liquidity (Ali, 2021). But it remains a revolution in the digital world and its risks may decrease with the emergence of insurance innovations.

2.6. Digital saving solution

Digital saving solutions such as SaveBetter and Qapital refer to online platforms and services that help individuals and businesses manage their savings, investments, and financial goals in a more efficient, automated, and convenient manner (Xu J. b., 2022). This process can occur through opening a digital savings account which is a banking service based on internet and offer services of save and manage your money with the click of a button, which provide an entirely online experience from account opening to transaction management in contrast to conventional savings accounts, that require physical studio visits. In fact, the major benefits of a digital savings account are convenience and accessibility all over the world, at any time, lower fees and higher interest rates and advanced security features like multi-factor authentication and encryption to protect financial information (FINFIRST, 2024).

3. Specific roles of fintech

Fintech, or financial technology, is changing the financial services industry by integrating technology into the basic banking systems. They have several functions to improve user experience, accessibility, and efficiency while incorporating technology to their traditional operations. In its current state, it is important in transforming the way that people and businesses navigate and handle money, investing, and financial management. Furthermore, innovation

continues to develop, creating a dynamic and adaptive financial ecosystem to support the demands of a digital society (Iwan & Ida, 2024). Here are the key roles that fintech serves:

3.1 Enhanced accessibility and financial inclusivity

Fintech is not only a financial intermediary, but also a driver of inclusivity and equal access to financial services throughout the world (Iwan & Ida, 2024). Based on this we can explain the role of fintech in improving access to financial services is profound and multilayered by facilitating broader access to financial products, promoting enhanced global financial inclusion through various uses of technology, fintech firms are lowering barriers to entry, allowing more people to join the financial system and including more individuals in economic inclusion, which can help empower them to improve their economic situations. It also has significantly contributed to increasing financial inclusivity via financial education by helping individuals maximize the use of financial technology applications enabling them to access banking services, it gives individuals ability to explore more investments opportunities, financial information and resources available through fintech platforms helping them grow their wealth and secure their financial future.

Accessibility in fintech refers to the ease with which financial products and services are made available to all levels of society, especially those from underrepresented or underserved communities, by bridging gaps imposed by traditional banking systems. Fintech also plays a crucial role in enhancing financial inclusivity through targeted financial education initiatives for economically disadvantaged and marginalised groups with customised information that addresses their specific financial difficulties.

3.2 Cost efficiency

The shift from traditional to fintech procedures enhances the cost efficiency within the financial services sector greatly by performing repetitive work like data entry, transaction processing, and customer services automation. Fintech reduces human effort, hence reducing operational costs for instance, online banking helps avoid the need for physical branches, extra expenses, and intermediaries to minimize transaction fees by reducing fraud and speeding up the processing time all these contribute to cost efficiency. This includes workforce, infrastructure, and technology, fintech plays a key role in streamlining operations by identifying and eliminating waste so that every resource is put to the best use. Fintech brings automation to various routine and administrative processes. For example, loan approval processes, account

management, and transaction processing can be automated, reducing the need for time-intensive human intervention and eliminating the risk of human error (Arner, Buckley, & Zetzsche, 2018).

Fintech solutions can give businesses real-time insight and analytics to make better decisions that could potentially lead to cost savings, and in the same way, crowdfunding through fintech is a cheaper way for startups and capital-seeking businesses than traditional methods.

3.3 Enhancing financial security

Fintech plays a crucial role in bolstering financial security by employing advanced technologies to improve the safety and reliability of transactions and economic systems. Additionally, advanced security measures have been established using financial technology for the users to be safe from identity theft or illegal transactions. It also involves protecting users' data through fintech, which ensures that clients must provide multiple forms of verification before accessing their accounts or doing any financial transactions via user education on security best practices to avoid any suspicious attempts that would affect their personal identity information; this process is called encryption. This encryption keeps the private information of users, and biometric verification, including fingerprint and face recognition, confirms the identity of the users. Besides, real-time fraud detection systems reduce the possibilities of illegal activities since they detect and prevent fraudulent transactions through artificial intelligence and machine learning algorithms. In addition, there are many safety protocols like MPLS that separate various traffic categories and make sure that important financial data is given priority treatment, which raises the standard for traffic management and security. Segment Routing, which offers more precise control over the routing process, enabling the establishment of safe, set-up routes that reduce the possibility of data interception and IPSEC, distinguishes itself by offering end-to-end authentication and encryption, guaranteeing that data is confidential and unchanged during its transmission across the network. These protocols provide improved performance and security characteristics suited to the requirements of fintech applications (Osundare & Ige, 2024).

3.4 Enhanced customer experience

Financial technology enhances the customer experience in various ways. By exploiting data analytics, it provides personalized services to meet individual customer needs such us customized savings plans or investment insights and ensured faster transactions with real time

payment processing, user-friendly interfaces and robust costumer support which empower costumers to take more charge over their finances (Singh & Singh, 2023). Additionally digital finance has turned the space around for improved customer experience with the massive changes in financial services it introduced. Second, FinTech platforms provide financial literacy-cognitive resources and useful tools of financial management that give every user option for making relevant decisions in building their economic fortunes. User experiences are elevated on intuitive interfaces through interactive features in budgeting tools. Furthermore, transactions are expedited, with instant payment methods and automation reducing wait times for services like loan applications.

4. Fintech's modern technologies

Fintech, or financial technology, has significantly revolutionized the financial services sector by utilising many contemporary technologies that improve ease, security, and efficiency. At the core of these modern technologies and infrastructures, here is a summary for the key elements.

4.1 Neobanks

Neo banks also known as challenger or digital banks, are online-only banks operating mainly through digital channels relying primarily on technology to handle customer interactions and account management. They aim to set themselves apart from traditional one's by delivering more adaptable and specific finance services with lower fees and more competitive pricing (Naysary & Tarazi, 2024).

Neobanks operate exclusively online, delivering banking services via the internet and mobile devices. They do not operate physical branches as traditional banks do. Neobanks have appeared alongside general growth in FinTech and technology in finance. Some neobanks specialize in serving particular groups, such as freelancers, unbanked or underbanked people, international travelers, or even certain ethnic groups by offering them specially designed financial services.

4.2 Blockchains

On October 31, 2008, a person or a group of people using the pseudonym *Satoshi Nakamoto* introduced Bitcoin and its underlying technology in the whitepaper called "Bitcoin: A Peer-to-Peer Electronic Cash System". The introduction of Bitcoin and the underlying blockchain technology is a landmark event not only in the history of finance or technology, but in the history of digital innovation.

4.2.1 Definition of blockchain

Zhu & Zhou (2016) said that « Blockchain is a decentralized technology that lies on distributed ledger technology to securely record transactions in a transparent and cost-effective manner » (Zhu & Zhou, 2016). Besides, *Anandan & Deepak (2022)* also define blockchain as « a growing list of blocks (records) or simply a chain of blocks (records) that is resilient to alteration of the information. It is a Merkle tree representation of blocks which contains cryptographic hash » (Anandan & Deepak, 2022).

Considering these two definitions, we can conclude that blockchain is a secure and permanent way of recording transactions and hence increases the reliability and trustworthiness of data in many applications. This revolutionary technology is at the core of many cryptocurrencies like Bitcoin and Ethereum by offering a decentralized and cryptographic digital ledger that secures and verifies transactions.

4.2.2 Key advantages

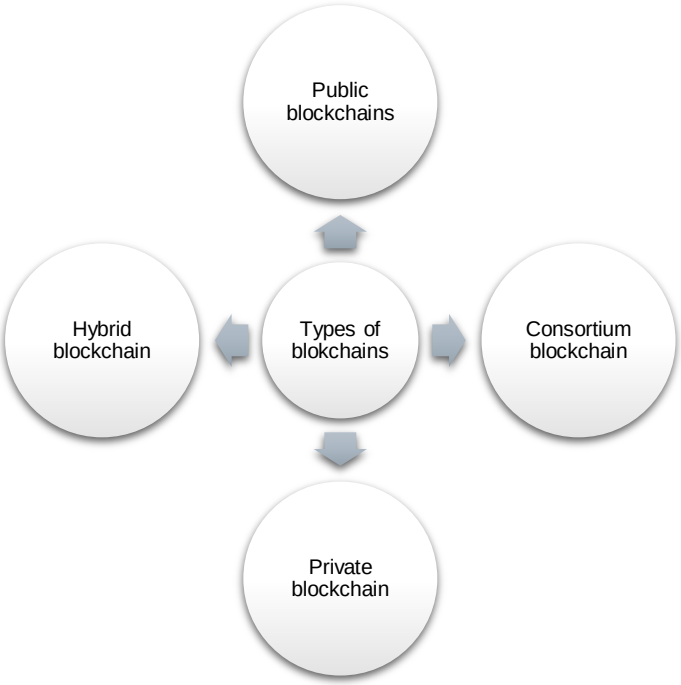
There are a number of advantages offered by blockchain technology that make it increasingly relevant not only as technology, but as a part of different sectors, such as finance. It encourages transparency, efficiency, and speed by enabling direct transaction without using intermediaries, and lowering costs. Further, it secures data permanence as information will become less or not at all modifiable or deletable once recorded. Last but not least, one of the most important key advantages of blockchain technology is traceability which means that each transaction previously recorded can be verified and tracked back from its origin to its final destination, this helps reduce the risks of fraud. In other words, blockchains decentralized characteristic adds a most vital aspect of participation for each of its actors in the verification process without giving any single person control over the data. Moreover, the verification of independent transactions brings about the elements of integrity and security into the system as a whole, making the most important required of reliability and accountability in financial and data transactions possible with this technology. With the increase in the use of blockchain, its applicability goes beyond cryptocurrencies and into other areas including supply chain management, health care, and digital identity verification, all of which point to possibly how far-reaching the technology could be in future of secure data management.

4.2.3 Types of blockchain

Blockchain technology types are primarily categorized based on access rights, governance models, and operational transparency. Understanding these types is crucial for selecting the appropriate framework for specific applications. Below is a concise overview of the main blockchain types:

a. **Public blockchains:** « In a public block-chain, anyone can simply download the blockchain node client onto their system and transact with anyone, and anyone can read the transactions over the block explorer. Bitcoin and Ethereum are some of the major examples of public blockchains » (Anandan & Deepak, 2022).
b. **Private blockchains:** Unlike a public blockchain, they are networks where only identified and authorized actors can be allowed to participate in exchanges (Sarto, Gai, & Ielasi, 2024). So, A private blockchain is governed by a single organization or consortium that controls permissions, validates transactions, and enforces rules.
c. **Consortium blockchains:** « This is partially closed and partially open type of blockchain network » (Malik, Arora, Shrawankar, & Deshpande, 2022). Controlled by a group of organisations rather than a single entity, which allow multiple organisations to work together, sharing resources while maintaining a degree of independence.
d. **Hybrid blockchains:** integrate both public and private blockchain features, the system allows the sharing of specific data publicly while securing sensitive information, making it ideal for businesses that need to maintain regulatory compliances and protect proprietary details. A company can, for example, allow the general public to verify transactions while maintaining the security of its internal processes.

Figure 1.3: Types of blockchains



Source: prepared by the researchers

4.2.4 Disadvantages of blockchain

Although blockchain technology presents certain benefits, it brings with it certain drawbacks and challenges. Here is an example:

The main challenge of the blockchain technology is energy consumption which refers to the significant amount of electrical power required, generally to validate transactions and maintain a real time ledger. besides, network security blockchain system need a high level of electricity, all this raise environmental concerns (Akkaya & Namasudra, 2023). Additionally, many individuals lack confidence in this technology, making them hesitant to invest in it. Furthermore, numerous countries are initiating the use of blockchain technology, but the absence of the establishment of common protocols presents a significant obstacle. Scalability poses a critical issue in blockchain, the limited block size restricts the number of transactions, and creating new one requires considerable work and time, making the technology complex and difficult to use. Also, this innovation is not completely secure, leading to high costs and inefficiencies, practically for users in the financial services sector (Malik, Arora, Shrawankar, & Deshpande, 2022). Finally, data privacy is another significant concern as a public blockchain can expose many sensitive data. Overall, while blockchain show a great potential, its disadvantages must be carefully managed to ensure successful implementations.

4.3 Artificial Intelligence (AI) and Machine learning

Artificial intelligence can be defined as « an intelligent machine that perform many tasks, solve problems and suggest decisions » (Blank, 2022). AI is a branch of computer science focused on designing systems through algorithms, statistical models and reasoning in order to process various information's, it requires a continuous interaction with data and environment. However, machine learning is a subset of artificial intelligence in which a model concentrates on creating algorithms that learn from previous data, identify patterns, make decisions with minimal human intervention and storing them for future reference (Kikani, 2021). In the current context the emergence of AI in finance sector has a profound impact, changing all the aspects of financial services. Initially advanced AI technologies play a crucial role in trading by analysing a large dataset, identifying market opportunities reducing profit loss, besides AI models provide a customer support 24 h, assisting clients in all processus from obtaining personalised financial service to resolving issues, this will improve customer experience. Finally, AI contribute in the financial forecasting by predicting future financial shifts this will improve decisions accuracy (Iwan & Ida, 2024). In summary, such advanced scrutiny permits financial institutions to undertake much more effective real-time security responses. AI chatbots and virtual assistants provide 24/7 support for customers, handling countless inquiries, guiding them financially to some extent, and aiding them in many complex tasks.

4.4 Open banking

Open banking also known as open bank data is described as « sharing customer data by ba<nks with other parties with the permission of costumer » (Jeng, 2022). This ecosystem allows third-party financial services providers open access to the client for example financial data, transactions history, and other banking information this service is offered by the financial institutions. All dealing with digital payments, a cashless economy makes banks have to be open and share information with others. Apart from this, the banking organizations have an obligation to decentralize data for the banking organizations to make confidential information available to any individual with the consent of the owner (Laplante & Kshetri, 2021).

In conclusion, open banking democratises finance by shifting the power from institutions to consumers. In order to provide more advantageous loan terms, open banking may assist lenders in gaining a more precise understanding of a borrower's financial status and degree of risk through the usage of networked accounts. Before taking on debt, it might also assist customers to obtain a more realistic view of their personal financial situation. It empowers consumers to

grant access to their financial data, including account information and transaction history, enabling such data to be used in innovative ways, also creates an ecosystem of innovation, low costs, and personalisation.

4.5 Cloud computing

The National Institute of Standards and Technology (NIST) defining cloud computing as: « A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction » (Mell & Grance, 2011). Consistent with cloud adoption, the financial services sector has been using cloud technology to fast-track innovation in financial services especially by the Covid-19 pandemic. These financial institutions from fintech startups to traditional institutions are employing cloud technology in many ways to expedite innovation in providing financial services. facilitates the outsourcing of technology operations to cloud service providers, allowing enterprises to employ computer resources in an adaptable, effective, and secure way. This is reflected in benefits including include automated services, uninterrupted operations, growth and speed, customer focus, artificial intelligence capabilities, possibilities for data management, and environmental efficiency are examples of how this is displayed. Finally cloud computing has a transformative impact on the fintech industry in many ways, making financial decisions more accurate and cost effective (Lee, Lim, Phoon, & Wang, 2022).

4.6 Reg-Tech technologies

Reg-Tech (Regulatory Technology) is a currently modern form of innovation within the FinTech sector, addressing cutting-edge regulatory problems through advanced digital tools in the process. Unlike traditional compliance methods that relied primarily on manual workflows and static systems, Reg-Tech includes real-time monitoring, predictive risk analysis, and dynamic accommodation relating to shifting regulatory conditions. The FSB defines Reg-Tech as « any range of applications of fintech for regulatory and compliance requirements and reporting by regulated financial institutions. This can also refer to firms that offer such application » (FSB, 2020). The Reg-Tech industry is a specialized industry requiring cooperation among unusual partners, namely investors, technology and software developers, regulators and regulatory specialists. An effort or platform in the interest of the community would warrant bringing together all this expertise (IIF, 2016).

It is indispensable within the fintech ecosystem, where efficiency, cost reduction, and better compliance with regulatory requirements are achieved. With a constantly changing regulatory environment in relation to technological advancement, its relevance will continue to increase and foster more innovative solutions that support businesses in responding to their regulatory challenges even more effectively.

5. Risks associated with fintech

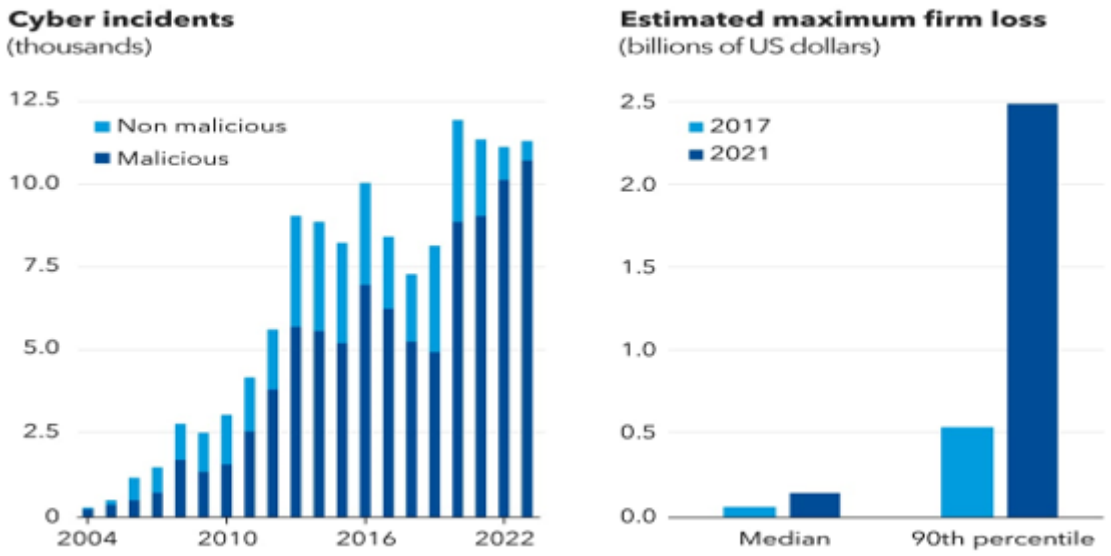
Recently, fintech revolution accelerated and individuals rely on these technologies extremely in their daily life, so with this expansion in the use of digital finance, it is necessary to address the other side, which concerns the risks associated with this sector. The development and application of digital financial technologies have contributed redefine economic and financial processes globally, but they have also exposed people, systems, and administration to unfamiliar risks which threaten the effectiveness of established protocols and laws (Jain, Kumar, Sood, Grima, & Rupeika-Apoga, 2023).

5.1 Cybersecurity and data privacy

Recent studies have shown that cyberattacks on financial institutions have more than doubled since the pandemic with extreme losses (Natalucci, Qureshi, & Suntheim, 2024). With fintech rapidly advancing and transforming the financial services sector, offering new solutions to traditional financial challenges, cybersecurity and data privacy are now primary issues for both businesses and clients due to the sector's reliance on digital platforms and sensitive financial data.

Fintech services providers handle vast amount of personal and transactional information, so they became first targets for cyber-attacks such as hacking, scams, identity theft and malware which expose data to harmful threats. These threats can result damage to the company's reputation and in result high costs, which highlights the necessity of implementing every precaution including robust cybersecurity measures, real-time monitoring and multi-factor authentication in order to maintain customer trust and contribute to creating a secure and innovative environment in the fintech world. (Hansali, Zhang, & Maleh, 2024).

Figure 1.4: Increasing cyber-attacks incidents and estimated firm loss



Source: Advisen cyber loss data; capital IQ; and IMF staff calculation IMF REPORT

5.2 Regulatory and compliance risks (legal risks)

It's referred to the potential legal and financial consequences and risks that financial technology face. « Legal risk refers to an unclear legal status and lack of universal regulations of Fintech » (Ryu, 2018). According to (Nwafor & Ayodele, 2024), the accelerated development of FinTech poses complex issues for regulators, necessitating flexibility, accurate enforcement, and international cooperation. The inability of traditional financial rules to keep up with technology changes is a significant obstacle. Additionally, cross-border problems make regulation even more difficult. Since fintech services sometimes operate in several countries, each with its own set of regulations, it is challenging to provide uniform guidelines. Fintech companies risk severe financial loss, ruin to their reputation, and a breakdown in customer trust if they ignore regulatory and compliance issues. This ultimately threatens their ability to compete in the longer term. Also, regulators have to balance maintaining financial stability with fostering innovation.

In closing, the implementation of detailed Anti-Money Laundering (AML), countering the financing of terrorism (CFT) and know your customer (KYC) measures is crucial for overcoming regulatory and compliance risks in finance sector, securing the fintech ecosystem, and building trust among clients (ICC, 2019).

5.3 Operational risks

The federal deposit insurance corporation defines operational risk as « the risk of loss resulting from inadequate or failed internal » (FDIC, 2009). Furthermore, since operational risks significantly affect customers use of fintech services, they are considered as one of the most major risks for clients (Ryu, 2018). In addition, a large variety of operational risks in fintech sector can occur, such as inadequate operational capability, information technology infrastructure and dealing with the frequently rapidity of fintech industry change, are the biggest obstacles facing many companies. Also, interconnectivity in open banking or third-party services can result in additional risks. Besides that, weak internal control is a major operational risk in fintech firms, it is more likely that businesses won't have the proper internal controls place when there are no minimum standards or norms relative to new fintech services type. This may result in errors, failures, or complete fraud, as well as an insufficient monitoring mechanism. The digital finance services must prioritize an integrated risk management approach, including advanced encryption, regular testing, employee training, and proactive alignment with fintech measures, by embedding these practices into operational workflows, fintech providers strike a balance between agility and resilience, ensuring seamless service delivery while neutralising risks such as fraud, system failures, or data mismanagement. This equilibrium is vital to maintaining customer confidence in an industry wherein order to balancing innovation with stability in providing financial utilities and navigate these operational challenges effectively.

5.4 Systemic risks

Systems are most susceptible to external dangers, which can arise from within the framework of digital financial ecosystems. As a result, the potential for such disruptions to spread over connected institutions, markets, or economies endangers overall financial stability, which made systemic risks different from operational risks as they stem from the interconnectedness and mass of fintech innovations, often being enhanced by their integration with both traditional financial systems and the global digital infrastructure. As stated by *Schwarcz (2021)*, the systemic risk is that an initiating event like an institutional breakdown or economic crisis causes a series of negative financial consequences, also known as a domino effect. These effects can include market failures and/or a series of large losses to financial institutions or major price volatility in the financial markets. So, it affects markets, financial services companies, or both in any scenario. While the potential in financial technology is enormous, it is essential to know

the risks associated with it by remaining well-informed, implementing strict security protocols, and developing a culture of compliance, we can effectively address these difficulties and responsibly exploit the full potential of financial technology (Schwarcz, 2021).

Table 1.1: Summary of key fintech risks and their description

Risk category	Description	Examples
Cybersecurity and data privacy risks	Related to cyber-attacks, unauthorised access to data and digital threats.	Payments scams, malware attacks, stolen data.
Regulatory & compliance risks	Potential legal consequences and unclear legal status.	Laws violations, changing regulations, and licensing issues
Operational risks	Challenges from internal failures, process inefficiencies and human error.	Wrong transactions, technology system downtime and data loss
Systemic risks	Risks threating the stability of the entire financial system.	Crypto market collapses, financial crises and geopolitical instability.

Source: prepared by the researchers.

Conclusion

In summary, this chapter provided a look at the theoretical and conceptual framework of financial technology, examining its historical background and how it has developed over time from the traditional instruments to the innovative ones. Then, we explored the meaning of this concept, its various types, such as digital payments, lending and credit and other tools. The interplay of innovations and the critical roles they play in transforming financial system landscape highlights the dynamic nature of fintech industry.

Furthermore, addressing the different risks associated with fintech, including cybersecurity and data privacy risks, regulatory, operational and systemic risks, underlines the necessity of an informed approach to facilitate the development of this technology in a safe and sustainable growth. By building this foundational framework, we can comprehend better this concept and its impact on the financial system illuminating the knowledge gap around this topic.

Chapter II:
Comprehending Financial Inclusion Concepts and Practices

Introduction

Financial inclusion is a fundamental aspect in the 21st century, it concerns the various access to affordable and sustainable financial services along with digital financial tools and the availability of financial institutions in underserved areas. Due to this crucial role in economic and financial system, researchers continue to this day to delve deeper into studying this concept, which despite being complex, is essential for achieving economic growth in all sectors. Within this chapter, we will explore the essence of this element, accompanied by a set of definitions that will guide us toward related key concepts and theories linked to financial inclusion. This will eventually lead to a discussion of the various dimensions and indicators used to measure the level of financial inclusion among individuals worldwide.

This concept has an impact that exceeds its apparent scope as a result of this significance, many countries and international institutions such as world bank group and international monetary fund have accorded it substantial value by setting different objectives and recognising its influence on the overall economic structure. Consequently, there are unavoidable obstacles, challenges and factors that may directly or indirectly prevent its advancement and restrict certain groups from fully participating in the financial system. Through this chapter, we will navigate through both of them goals intended to be achieved by financial inclusion, as well as the barriers that stand in its way.

In recent years, financial technology (fintech) has become revolutionary force in overcoming these barriers and promoting financial inclusion. Digital innovations such as mobile banking, blockchains, intelligence artificial and machine learning have significantly improved financial inclusion across the world.

In the course of this chapter, we will present specifically this role and its impact on financial inclusion and economic accompanied by some of case studies of successful fintech worldwide. By exploring these ideas, this chapter will provide a comprehensive understanding of financial inclusion and its potential to contribute to a more inclusive and resilient global economy.

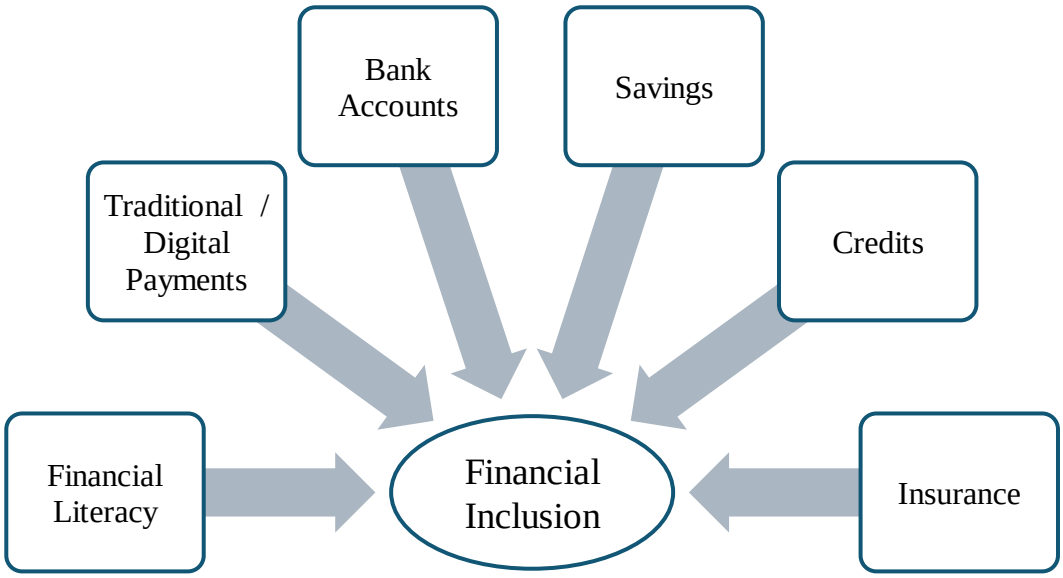
1. Concept of financial inclusion

Early in the year 2000, the term "financial inclusion" became widely used, especially in reference to international initiatives to increase marginalized groups access to financial services. The World Bank's Annual Meetings in 2005 were one of the pivotal events in the term's introduction.

1.1 Definition of financial inclusion

For many years, the researchers and financial experts have been trying to comprehend the concept of financial inclusion and its vital role in world economy, this term can be described according to Global Financial Development Report as « the proportion of individuals and firms that use financial services » (WorldBank, 2014). Another definition for financial inclusion mentioned by *Song, Qin, Wang, & Li, (2025*) « financial inclusion strives to make financial services widely available to all segments and groups » (Song, Qin, Wang, & Li, 2025). Furthermore, it encompasses a wide range of dimensions, representing the diverse array of available financial services and consequently equitable access to economic opportunities. These services can include payments, savings accounts, credit, insurance, pensions, financial education, and investment in securities markets. The concept can vary for individuals compared to businesses, as their needs and access to financial services may differ significantly (WorldBank, 2014), it also explains the approach to providing banking and financial support and services to all individuals in society without restriction of any form. Its main objective is to encompass everyone by offering basic financial services regardless of a person's income or savings. In the other hand financial inclusion aims to engage everyone in society, encouraging their active participation in responsible financial management, this means that financial inclusion seeks to ensure that all individuals, regardless of their background or economic status, have the opportunity to manage their finances effectively. Moreover, the international monetary fund (IMF) defines financial inclusion as « a multifaceted concept, encompassing various dimensions, including access to and use of financial services as well as other aspects such as affordability and quality, of financial services and products» (Villanova, Chhabra, & Fan, 2020). Based on this we can summarise that financial inclusion gathers a range of concepts, including access to financial services, affordability, financial literacy, and supporting inclusive economic growth through regulation and policies framework.

Figure 2.1: The scoop of financial inclusion



Source: prepared by the researchers

1.1.1. Digital financial inclusion

According to the Consultative Group to Assist the Poor (CGAP), digital financial inclusion « can be defined broadly as digital access to and use of formal financial services by excluded and underserved populations » (Lyman & Lauer, 2015). In light of this, it refers to the use of innovative technologies to provide financial services to unbanked individuals or marginalised groups.

Furthermore, the Arab Monetary Fund (AMF) released a policy brief on "Digital Financial Inclusion" which explained that the term refers to « digital access and use of official financial services by the financially uncovered population, so that these services are appropriate to the needs of customers, and provided in a responsible, sustainable and cost-effective manner within an appropriate legislative and legal framework » (AMF, 2021).

Overall, digital financial inclusion involves the use of innovative technologies, such as mobile devices, online platforms, internet access and fintech tools, in order to reach various financial services and engage with the financial system.

1.2 Key concepts and theories

1.1.1. Key concepts

Financial inclusion, is all about making people more engaged in the financial system regardless of their financial status, it addresses the barriers that prevent individuals from accessing to efficient and affordably priced financial services and solutions that satisfy their requirements. Here are some key concepts and pillars related to financial inclusion:

a- Accessibility

Financial services include a wide range of activities focused on managing money for people, businesses and government, through credit, insurance, investment services, and fintech, the importance of these services is various as they not only support economic but also facilitate individual financial growth which made access to them a fundamental component of financial inclusion. Also, Financial services accessibility can be viewed as a public good that is necessary to allow participation in the advantages of the current, market-based economy, much like access to pure water, healthcare, and basic education (Thorsten & Torre, 2006). Following this, we can define access to financial services as the ability to obtain and use financial products and resources in order to improve living standards, ensure inclusivity and business expansion.

b- Affordability

One of the main pillars, as the financial inclusion is not only about the access to financial products but also the quality, usage and suitability of these services to consumers. It involves access to and the use of financial service for example, as one crucial first step toward financial inclusion is account ownership, access to a bank account may not mean use of it, However, in order to get the most out of having an account, users must be able to use it in convenient and secure ways, (Demirgüç-Kunt, Klapper, Singer, Ansar, & Hess, 2017), that's why affordability is a crucial determinant for inclusivity ensuring that services are accessible and beneficial to all in terms of cost efficiency, availability of products, and accessibility to this services for low-income and marginalised populations based. In conclusion, affordability as key aspects of financial inclusion are defined by the access to the financial product like the basic one bank account and the minimum amount needed to create an account as well as the account maintenance costs (Beck, Demirgüç-Kunt, & Peria, 2008).

c- Financial literacy

Financial literacy, financial education or financial knowledge can be defined as stated by *Ozili, (2025)* « financial literacy refers to the ability to understand and effectively use various financial skills to make informed decisions regarding money. The skills include personal financial management, budgeting, and investing » (Ozili P. K., 2025). In light of this, financial literacy is a critical concept of financial inclusion as a source of empowerment for individuals to use financial tools effectively, improving their decision making by providing them with the necessary knowledge to evaluate financial options. Furthermore, with financial education individuals can manage their own money better, knowing how to protect themselves from risks and promoting responsible financial behaviour, in order to grow their wealth over time. As individuals attain financial literacy, they will pursue formal financial services wherever available. All this, help to improve inclusivity among populations about the usage of financial services and products and participate fully in the financial system (Ozili P. K., 2020).

d- Regulatory and policy framework

Regulations are rules set by governments or other authorities, while policies are the actions or plans intended to influence various decisions. These include laws, guidelines, regulatory reforms, customer protections standards and National Financial Inclusion Strategies (NFIS). They play a crucial and central role in promoting financial inclusion across countries. In addition, regulatory improves financial inclusion, by establishing clear, stable laws and regulations that lower obstacles, increase access to financial services, and foster trust in the financial system among individuals and financial institutions, which increase participation in formal financial activities that support wider economic growth by establishing these rules that make financial services available to everyone, particularly in underserved communities (Ul-Durar, Iqbal, Naveed, Massacci, & Saleem, 2025). Furthermore, central banks, financial regulatory organizations, corporate institutions, and nongovernmental groups can all implement financial inclusion strategies at the national level which require effort, plans, and resources, all of that grant greater financial access (Yoshino & Morgan, 2016).

In summary, achieving financial inclusion requires a multidimensional area ensuring that everyone has access to essential financial services making them affordable and comprehensible for all individuals in order to make informed decisions, regulatory framework play an important role in creating inclusive ecosystem. These key concepts not only promote inclusion but also economic growth.

1.1.2. Dimensions and indicators

1.1.2.1. Dimensions of financial inclusion

As stated by the (2024) Financial Access Survey highlights of the International Monetary Fund (IMF) that, financial inclusion necessitates a variety of financial services that are both accessible and utilised by a broad segment of the population offering effective and beneficial value (Beyene, Huayta-Zapata, Quevedo, & Segoviano, 2024). Based on this, we can include three dimensions: access, usage and quality.

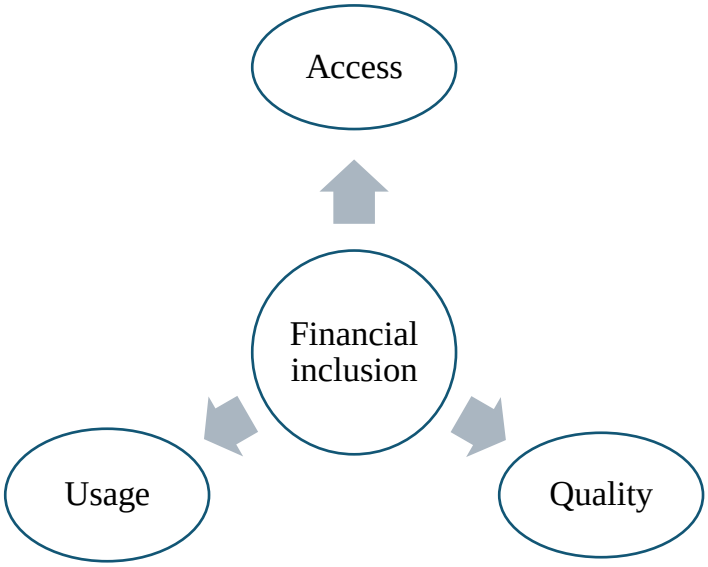
a- **Access:** the capacity of households and businesses to use financial services and products, especially in light of time and location constraints (Gadanecz & Tissot, 2016). Also, it's the degree of penetration of the financial system among its users and the percentage of the population in an economy that has access to financial services (Sharma & Changkakati, 2022).

b- **Usage:** making a distinction between access to and use of financial services is crucial. Some people may have access to certain products yet decide not to use them. So, usage is defined as the degree to which a person adopts and consistently uses the formal financial services that are accessible to them in order to meet their regular financial demands (Kumari, 2021).

c- **Quality:** this includes ensuring safe, appropriate, affordable and transparent financial services and products for customers. Also, customer support channels are vital for addressing user issues and enhancing their total experience with monetary services. Therefore, it involves how well financial tools meet the needs of customers in responsible and sustainable manner. (WorldBank, 2015b)

To summarise, financial inclusion involves three key dimensions which ensures that individual can access to financial services, use them effectively and benefit from high quality offerings to fulfil their requirements in order to create an inclusive framework across various segments of society.

Figure 2.2: The three dimensions of financial inclusion



Source: prepared by the two researchers

1.2.2.2 Financial inclusion indicators

In line with the world bank research on financial inclusion, it is mentioned as one of several sustainable development goals, that's why the world bank and other international institutions developed a diverse set of indicators to measure financial inclusion as well as digital financial inclusion, through its three dimensions which are: access, usage and quality. The (2024) Financial Access Survey highlights of the International Monetary Fund (IMF) state that in order to define this indicator we should combine data from users of financial tools which known as supply-side data and data from providers as known demand-side data. (Beyene, Huayta-Zapata, Quevedo, & Segoviano, 2024).

The table below summarise some typical financial inclusion indicators through its three dimensions using information from the Group of Twenty (G20) summit on financial inclusion indicators. All these indicators are available in the world bank or International Monetary Fund data base.

Table 2.1: Summary of key financial inclusion indicators

Access dimension	
Indicators	Number of Bank Branches per 100,000 adults
	Number of ATMs per 100,000 adults
	Number of mobile agent outlets per 100,000 adults
	Number of POS terminals per 100,000 adults
	Number of debit cards per 1,000 adults
Usage dimension	
Indicators	Number of deposit accounts per 1,000 adults
	% of adults with an account at a formal financial institution
	Number of e-money accounts per 1,000 adults
	Number of outstanding loans per 1,000 adults
	Number of mobile money transactions per 100,000 adults
Quality dimension.	
Indicators	Financial knowledge score (Arithmetic score which sums up correct responses to questions about basic financial concepts).
	% of adults using savings for emergency funding
	Total rate to be paid for a credit (basic costs plus commission rates.
	The strength of credit reporting systems and the effectiveness of collateral and bankruptcy laws in facilitating lending. Measured as Distance to frontier score.

ATM: Automated Teller Machine, POS: Point of Sale terminal

Source: prepared by the researchers based on data from GPFI. (2012). G20 financial inclusion indicators Los cabos: Global Partnership for Financial Inclusion.

1.1.3. Evolution of financial inclusion around the world

Over time, financial inclusion started gaining attention globally, therefore international organisations like the world bank have driven efforts and initiatives to ensure the inclusion of the excluded populations. Financial inclusion has emerged as an important factor in developing the economy sector around the world, ensuring that everyone has access to financial services regardless of income, region or gender.

The current statistics shows that global bank accounts ownership rose from 51 percent in 2011 to over 76 percent in 2021, which is significant and positive step forward. It reveals that more people worldwide are obtaining access to financial instruments and engaging with the financial system. In addition, both high-income and developing economies witnessed average increases in account ownership, but the average growth rate in developing economies was higher. From 42 percent in 2011 to 71 percent in 2021 a rise of more than 70 percent account ownership in developing economies increased by 30 percentage points overall. (Demirgüç-Kunt, Klapper, Singer, & Ansar, 2022).

Figure 2.3: Global account ownership increased from 51 percent to 76 percent between 2011 and 2021



Source: Global Findex Database 2021

1.1.4. Relevant economic theories

Financial inclusion practices differ across countries, making it essential to uncover the core principles, these principles, referred to as theories, provide a framework for understanding the diverse financial inclusion practices observed worldwide. The importance of financial inclusion is not only to improve individual access and usage of financial instruments but also its potential to accelerate economic growth. Financial inclusion goal is to enable people to invest, save, and access to credit, it fosters greater participation in the economic activities.

To understand this influence, various economic theories provide deep insights. These theories examine the way through access to financial services enhances growth and contribute to more equitable and dynamic economy, this includes finance growth nexus theory, mercy-corps theory and endogenous theory.

a- Finance growth nexus theory

Theoretical discussions and debates on the relationship between finance and growth date back to Bagehot's work in the 1870s. Bagehot's theorising the role of financial systems in combining financial resources and allocating them to the most profitable enterprises, which develop the economic sector. In addition, many academics were interested in Bagehot's works, particularly in the early and second half of the 20th century, we can find, Schumpeter argued that financial development is a key factor in economic expansion. (Marwa & Zhanje, 2015).

In summary, this theory explores the link between financial and economic sector it implies that by effectively allocating resources, lowering transaction costs, and financing investments, building a strong financial system which will support economic growth. Financial inclusion, on the other hand, focuses on ensuring that individuals and businesses have access to affordable financial services, it increases economic activity, boosts productivity, and creates an environment for equitable and sustainable economic growth by attracting more individuals and businesses into the formal economy, it plays a pivotal role in strengthening this nexus.

b- Mercy-corps theory

Mercy corps financial inclusion theory of change claims that « within inclusive financial systems, participants are able to access, use, and afford a range of financial services and products ». In each market where Mercy corps operates, it starts by analysing how and why the financial market does not currently work for low-income or vulnerable people in order to establish systems that incorporate and serve these customers. It aims to provide the underserved and chronically underserved with complete financial inclusion. (MercyCorps, 2017).

In addition, this theory highlights how making financial services available to everyone, like loans, savings accounts and insurance, helps individuals and business grow. It gives them tools to invest in opportunities, handle crises and play a bigger role in building stronger economies.

c- Endogenous theory

Endogenous theory emerged in the 1980s as an alternative to the neoclassical theory, the idea is that internal economic variables, rather than external ones, are what drive economic growth. The theory's foundation is the notion that advancements in human capital, knowledge, and innovation boost productivity, which in turn improves the state of the economy. In finance context, driven by internal elements including innovation, education, and governmental reforms, the endogenous theory of financial inclusion emphasises that financial inclusion can develop naturally inside an economy. In short, this theory sees financial inclusion as something that evolves over time from the progression of economic and social systems and the emergence of policies that support financial knowledge, education, and entrepreneurship which promote a culture of financial engagement and increase inclusion (CFI, 2020).

In conclusion, the exploration of economic theories related to financial inclusion such as the finance-growth nexus theory that focused on increasing access to resources and improving their allocation, mercy-corps theory illustrates how inclusive financial services, particularly in underserved populations, and the endogenous theory reveals how to enhance financial systems and drive financial inclusion.

All of these frameworks, highlights the multifaceted nature of financial inclusion and its importance in driving economy. Based on these relevant theories, we can conclude that the concept of financial inclusion as the access, usage of financial services to all types of population is crucial to enhance their economic status, improve the financial system and in result an inclusive economy.

1.2. Financial inclusion objectives

Financial inclusion is a broad concept that covers a wide range of objectives, and among its primary aims are the following:

- **Elimination access obstacles:** Financial inclusion work on reducing the obstacles that individuals face in terms of access to financial services for example geographical issues, administrative complications, high costs and also low-income matters. By resolving these limitations, it will improve access to different financial resources and reduce inequality (Booklet Financial Inclusion, 2014).

- **Economic empowerment:** Financial inclusion aims to give low-income and excluded people access to formal financial services including insurance, credit, and savings. By empowering them the resources to handle their money and make investments in businesses that generate revenue (Grant, 2024). With access to financial tolls such as loans will lead to job creation, entrepreneurship, community development and economic empowerment as a result.
- **Financial awareness:** One of the main objectives of financial inclusion is to increase the understanding principals and knowledge of the financial services/products. This aims to include everyone in the financial system loop and to provide to all individuals the capability in handling traditional or digital instruments.
- **Digital inclusion:** Financial inclusion works toward expanding the scope of technology, facilitate its accessibility and usage, with the intention of reducing the gap between the use of traditional mechanisms and modern ones, making it possible for more people to engage with the digital financial economy.
- **Strengthen the synergy between financial system actors:** The government must ensure that branch offices are empowered and that laws permitting expansion of official financial services between all the actors of the financial system also financial inclusion guarantee the circulation of symmetric information between government, banks, non-bank financial institutions, individuals, corporations, central banks and international organisations (Booklet Financial Inclusion, 2014).
- **Enhance customer protection:** Financial inclusion aims to establish policies, mechanisms, laws, and plans that ensure for individuals and businesses especially those newly integrated into the financial system safety and clear protection against diver's risks and guarantee transparency. Also, every financial customer should get fair, honest, and equitable treatment throughout their interactions with financial service providers. (G20/OECD, 2022).
- **Financial sustainability:** Sustainability is a pivotal objective of financial inclusion it can be defined as the process of preserving our well-being and the benefit of resources for the long term so financial inclusion intend to make certain that essential financial services are delivered in a sustainable manner and established in sustainability principles, as well as that access to these services is ensured in a sustainable manner. (Ozili P. K., 2022)
- **Inclusive economic growth:** Among the largest and most important main goals of financial inclusion is economic growth. Naturally, if financial inclusion aims to involve as many individuals as possible in the financial system, it consequently strives to achieve inclusive economic growth and boost the infrastructure of the economy.

In conclusion, financial inclusion is one of the must transformative tools for developing our daily life. It has a unique set of objectives that consistently contribute to the development and growth of individuals, companies, financial institutions, and the various participants in the financial system as whole as services providers or users.

2. Barriers to financial inclusion

Like any economic concept, financial inclusion covers both opportunities and challenges. These challenges often emerge as factors that influence two main areas, individuals access to various financial services on the demand side and the institutions providing these services on the supply side.

Based on *Llewellyn (2024)*, there is four sets of barriers to financial inclusion (Llewellyn, 2024), we can find:

a- Structural factors

Refer to systemic challenges that prevent individuals and businesses from accessing financial services, the major factor is the lack of financial infrastructure especially in many rural areas the absence of bank branches and long distance to reach the financial institutions present an obstacle for individuals to reach financial services as its very costly for banks to serve separated people in a large geographical area. In the other hand, the lack of well-established regulatory framework and consumer protection policies represents a significant structural obstacle to achieve financial inclusion and discourage individuals from using financial services. These barriers often affect marginalised groups, such as those in low-income communities or rural areas where may be few or no banks or financial institutions, making access difficult (Llewellyn, 2024).

b- Institutional constraints

This relates to the various limitations set by financial institutions. First, we have the economic barriers, such as low-income levels, high services costs, minimum account balance requirements and the absence of credit history, which can individuals from accessing financial system. Additionally, the amount and the complexity of required documents may exclude certain groups from participation. Secondly, offering small loans, credit, and insurance to low-income individuals may be perceived as unprofitable for financial institutions that are exposed to potential financial risks due to limited institutional capacity to develop products tailored to underserved populations. That’s why financial institutions may prioritise urban areas over rural

ones and prefer services which are more effectively designed to serve wealthier individuals and larger businesses (Llewellyn, 2024).

All the factors mentioned earlier are part of the supply side, this is why government in partnership with central banks and financial institutions need to step in to reduce these issues and ensure a greater financial inclusion.

c- Demand factors (individuals)

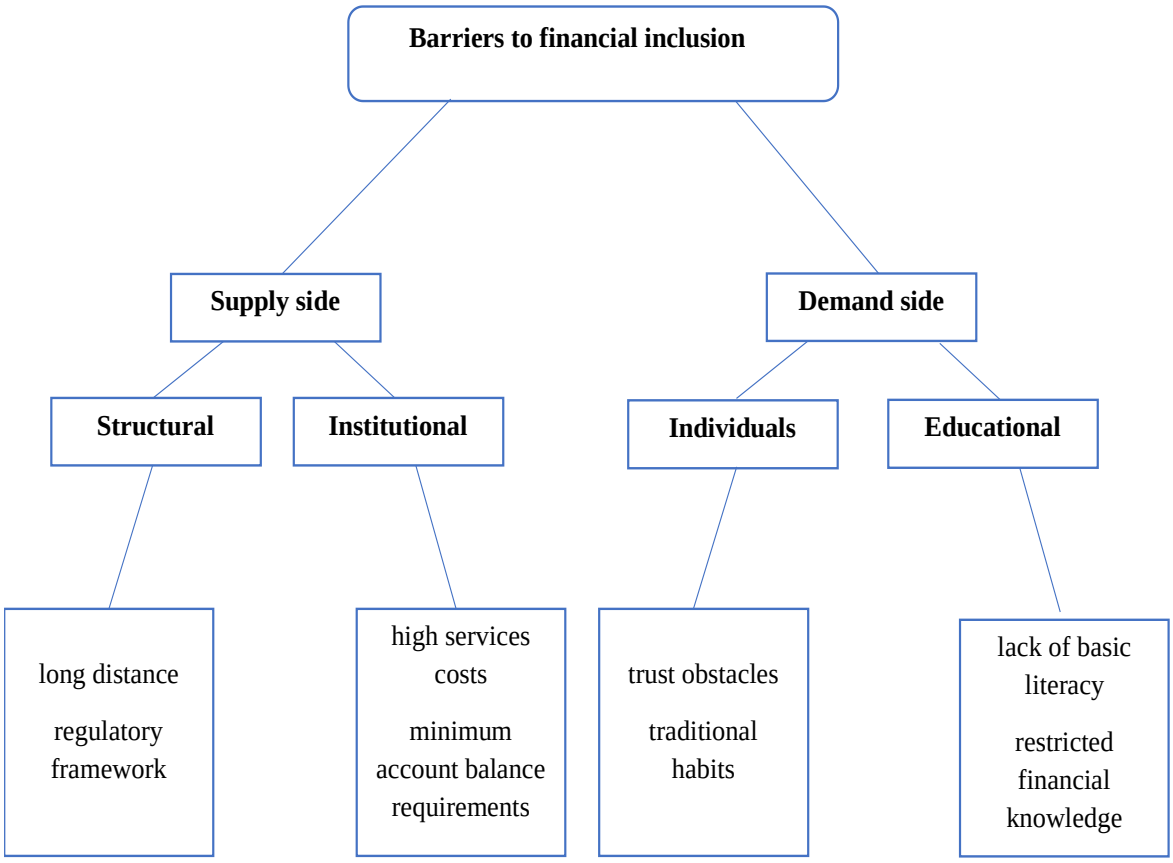
Act as barriers to financial inclusion when individuals or businesses face challenges in accessing financial services due to their own circumstances either through the digital or traditional way. Some products or services could be excessively complex and inappropriate for certain groups of people. Also, bureaucratic processes or fear of failure might discourage potential users from engaging in the financial system. In addition, when people or communities don't trust financial institutions and systems, trust obstacles to financial inclusion occur. This lack of trust may serve as a major barrier for example negative interactions with bank staff or limited access to information or even economic crises or corruption, people may distrust financial systems due to fears of losing savings or investments. Finally, in some communities, especially for women, involvement in official financial institutions could be discouraged or limited due to traditional habits. access to financial tools might be influenced by individual's religion, especially when certain behaviours or instruments go against their beliefs. So, religion can be a barrier to financial inclusion and financial institution should pay more attention to afford a suitable financial services or product in order to face this challenge (Llewellyn, 2024).

d- Educational limitations

Educational limitations create significant barriers to financial inclusion, especially for underserved communities. Many individuals suffer from the lack of basic literacy in understanding financial terms and financial services, which make access and using financial instruments difficult. Also, restricted financial knowledge can make people not aware about benefits of the variety of financial products and services available to them, such as low-cost savings accounts, microloans, or affordable insurance plans to all society segments. Furthermore, the dependence on unofficial financial systems include borrowing from friends or relatives resulting from low official education and limited financial literacy. We can increase the inclusivity of financial systems and enable people to engage in the formal economy by removing these educational barriers (Llewellyn, 2024).

The figure below summarises the four key barriers to financial inclusion from both supply and demand.

Figure 2.4: Barriers to financial inclusion



Source: prepared by the two researchers.

To address financial inclusion barriers and allow greater access to financial services for everyone, we need to analyse these challenges from both supply and demand sides. We can start by adding more bank branches, or ATMs, educating people, and boosting financial literacy for individuals. Additionally, making financial tools available and affordable, especially for those who struggle with low-income problems, can promote inclusion; analysing cultural and social behaviours can offer a better understanding for populations, which makes them more involved in the formal financial system. Lastly, governments can play a significant role by creating regulations and policies that favour more financial inclusion to achieve an inclusive environment.

3. The role of fintech in promoting financial inclusion and economic growth

Fintech has played a significant role in transforming the financial world by enhancing financial transactions, making them easier and more accessible. Now, anyone, anywhere, and

at any time can access financial services remotely. In other words, fintech has been a key driver of financial inclusion. Additionally, the widespread adoption of financial services has also contributed to accelerating economic growth by driving entrepreneurship, increasing efficiency, and expanding financial markets.

Fintech promoting financial inclusion and economic growth in various ways which is:

- **Promoting financial inclusion:** Fintech has ensured that individuals and businesses can access various financial services regardless of their geographic location or income level, as it does not impose high costs. It has provided innovative uncomplicated solutions, such as mobile payment platforms like M-Pesa, allowing transactions without the need for a bank account. Additionally, fintech has introduced banking services through mobile applications and facilitated lending for small businesses and individuals without strong credit histories by leveraging artificial intelligence and big data (Tiony, 2024). It has also made investment opportunities more accessible through crowdfunding and robo-advisors. Moreover, digital currencies have helped combat high inflation, while blockchain technology offers decentralised financial services, reducing reliance on traditional banks (Saber, 2024). Furthermore, the widespread adoption of fintech enhances financial literacy and empowers individuals to make informed financial decisions through educational tools and digital advisory applications.

- **Driving economic growth:** Fintech has played a significant role in the economy by stimulating economic growth and making it more efficient and effective. Some of the key ways in which fintech has contributed to economic growth include:

- Helping users learn various investment strategies, such as saving and money management, through educational platforms.
- Facilitating lending through financing platforms, which has helped small and medium-sized enterprises (SMEs) expand. This, in turn, has contributed to the creation of new job opportunities (Tiony, 2024).
- Improving the efficiency of financial markets by providing accurate financial insights that help enhance investment decisions through the use of artificial intelligence and big data analysis.
- Strengthening e-commerce, which has become a fundamental element of the global economy.

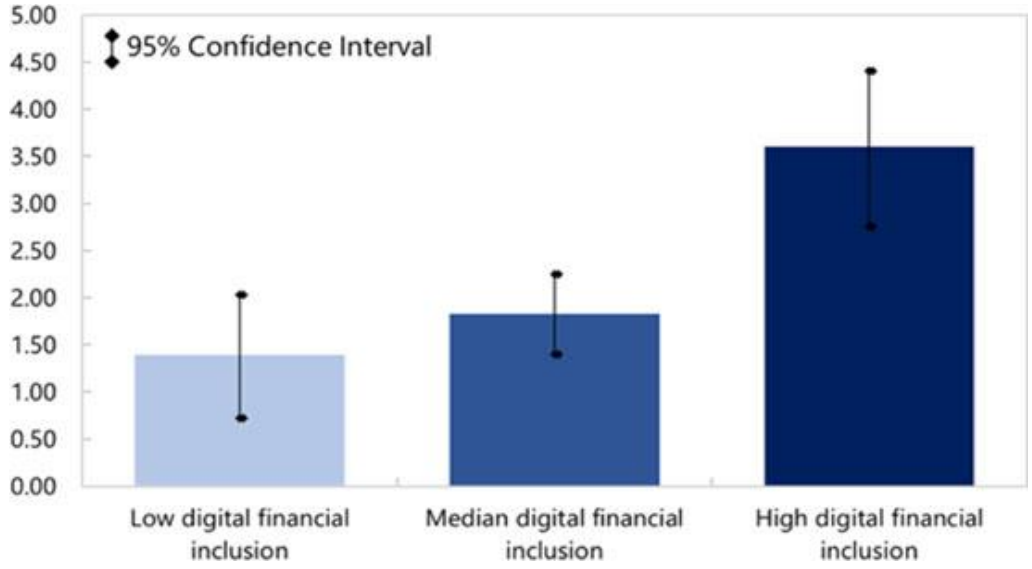
- Attracting investments and encouraging innovation through investment funds, leading to the creation of new job opportunities (Northwest, 2024).

As a result, the impact of financial technology is expected to continue improving global economies, enhancing financial sustainability, and creating new economic opportunities.

The financial access survey report by IMF state that financial inclusion has an impact in driving inclusive economic growth, supporting the achievement of the Sustainable Development Goals (SDGs), it promotes fair employment opportunities and economic development while fostering entrepreneurship and creating new jobs (Beyene, Huayta-Zapata, Quevedo, & Segoviano, 2024).

The figure below illustrates some statistics about the relationship between digital financial inclusion and economic growth worldwide over the period 2011–2018 measured by GDP and digital financial inclusion levels at the 25th, 50th, and 75th percentiles of the sampled countries is referred to as low, median, and high, respectively. It suggests that an increase in average economic growth of up to 2.2 percentage points is linked to a rise in digital financial inclusion in payments from the 25th percentile to the 75th percentile. Overall, greater digital financial inclusion is associated with positive effects on economic growth so, promoting fintech could play a crucial role in boosting inclusive growth (Khera, Ng, Ugawa, & Sahay, 2021).

Figure 2.5: Impact of digital financial inclusion on growth (In percent of annual real GDP growth)

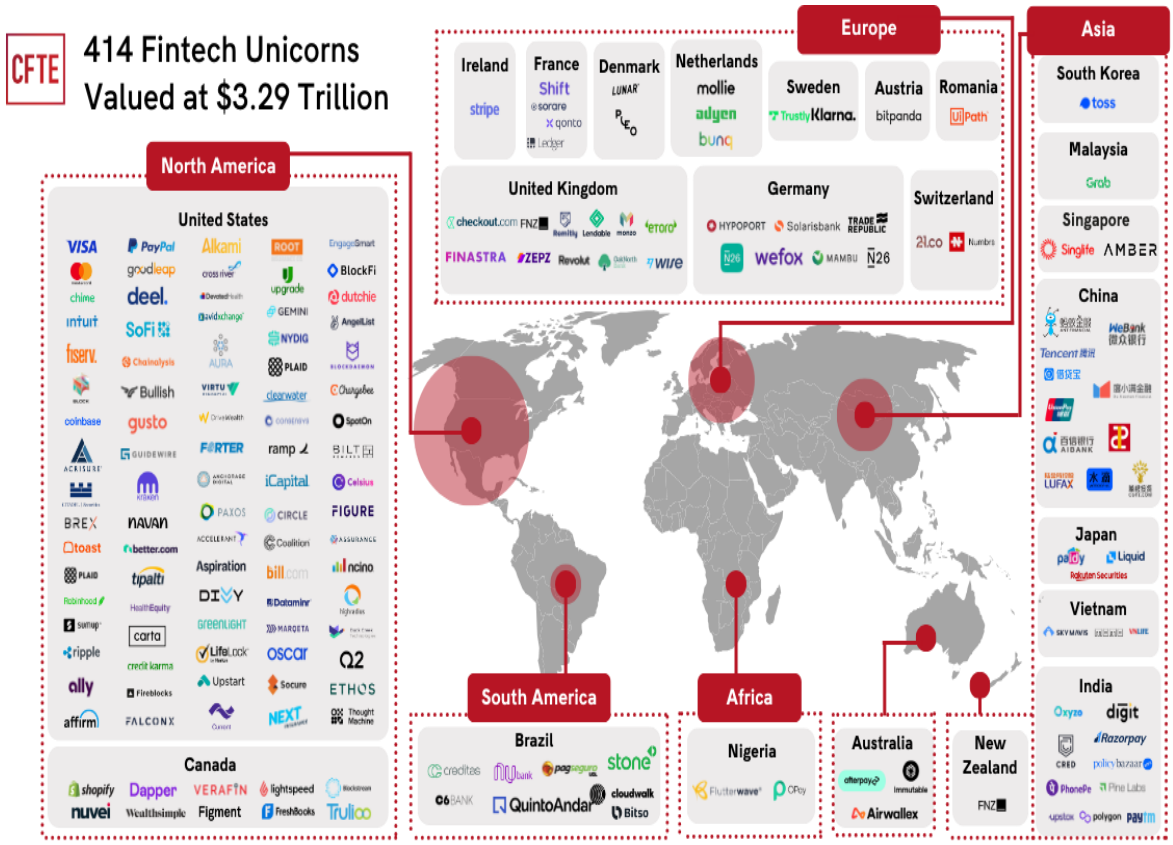


Source: Khera, P., Ng, S., Ugawa, S., & Sahay, R. (2021). Is Digital Financial Inclusion Unlocking Growth? International Monetray Fund. Retrieved from: https://www.elibrary.imf.org/view/journals/001/2021/167/001.2021.issue-167-en.xml?Tabs=toc-108883

4. Concept of fintech companies

Fintech companies, short for "Financial Technology companies", are businesses that leverage technology and innovation to enhance and deliver financial services in a more efficient, secure, and accessible manner. This sector encompasses a wide range of digital solutions, including electronic payments, digital lending, insurtech, wealthtech, cryptocurrencies, blockchain technology, as well as financial compliance and cybersecurity solutions. The fintech industry aims to reshape the traditional financial landscape by providing faster, more cost-effective, and flexible alternatives to conventional financial institutions such as banks and insurance companies. For example, mobile payment applications offer seamless transaction solutions, while digital lending platforms enable individuals and small businesses to access financing easily without relying on traditional intermediaries (Northwest, 2024) Furthermore, artificial intelligence and big data analytics contribute to improving customer experience, as companies utilize advanced algorithms to understand consumer behaviour and offer personalized financial services. Blockchain technology also plays a crucial role in enhancing transparency and security in financial transactions, reducing the risks of fraud and manipulation (Dupé, 2023). The fintech sector has experienced tremendous growth in recent years, driven by the increasing use of the internet and smartphones, the emergence of new payment systems, and the rising demand for more efficient digital financial solutions. Supportive regulations and flexible regulatory environments in some countries have further accelerated the adoption of fintech and its integration into traditional financial systems (Preethi Vijayagopal, 2024). Ultimately, fintech companies represents a digital revolution in the financial world, fostering financial inclusion through its provided service, facilitating access to financial services for the unbanked population, and driving a fundamental transformation in how money is managed and financial transactions are conducted on a global scale. The figure underneath shows largest fintech companies across the world in 2024, we can observe the dominance of North America with the highest number of fintech institutions especially in the United States, followed by Europe and Asia.

Figure 2.6: Global largest fintech companies around the world in 2024



Source: CFTI. (2024). Largest Fintech Companies 2024. Retrieved from: Center for Finance, Technology and Entrepreneurship: https://courses.cfte.education/ranking-of-largest-fintech-companies/

5. Case studies of successful fintech

Developments and innovations have continued to move toward the top, and financial technology has been one of the greatest inventions in the world of financial transactions. It has facilitated payments, money transfers, withdrawals, and even lending in a modern way. Consumers no longer rely on traditional banking and financial institutions. As a result, fintech companies have become successful and outstanding in their achievements by transforming the global financial landscape.

Among the most distinguished companies that have transformed the global financial landscape are:

a- Stripe (Simplifying Payments with a Developer-Centric Approach)

Company Stripe dominated the financial scene in 2010, founded by Patrick and John Collison, in the field of payment technology developments by creating a solid infrastructure. It met the needs of businesses and simplified processes in programming, because it operates as a

payment processor and a payment service provider by various methods including credit cards, debit cards, mobile wallets, and more (Sheriffdeen, 2024).

The Stripe's business model offers numerous advantages for merchants and customers:

- Ease of Integration: Stripe's API is easy to use, allowing businesses to set up a payment system quickly with minimal coding effort. It also simplifies the integration process for developers.
- Global Reach and Multi-Currency Support: Stripe has expanded globally, enabling businesses to accept payments from customers in various ways, including credit cards, digital wallets, and even cryptocurrencies. It has also been utilized in e-commerce and digital marketplaces.
- Advanced Security and Compliance: Stripe is known for its security and trust in digital transactions. It provides a tool called PCI DSS (Payment Card Industry Data Security Standard) to protect payment card data, as well as Stripe Radar, an AI-powered tool designed to detect fraudulent transactions.
- Scalability and Customization: whether you're running a startup or a large enterprise, Stripe offers scalable solutions tailored to your needs. Stripe Connect enables businesses to manage payments for multi-vendor platforms, while Stripe Atlas assists entrepreneurs in incorporating their businesses seamlessly. Moreover, Stripe Terminal extends Stripe's capabilities to in-person transactions (Ipbusinessacademy, 2024).

b- Robinhood (Democratizing Investment)

Robinhood is a financial investment application invented in 2013 by Vladimir Tenev and Baiju Bhatt (Ibrahembot, 2023). It became popular for its unique feature compared to other applications which is commission-free investing. This allowed users to buy and sell stocks and investment funds without fees, as well as trade options and cryptocurrencies. It became the ideal choice for beginner and casual investors due to its easy-to-use interface (Sheriffdeen, 2024). Here is some applied Strategies in Robinhood:

- Commission-Free Trading: Robinhood's pioneering feature eliminated financial barriers associated with commissions, allowing more individual investors to enter the market with ease.

- Simple and User-Friendly Design: With its sleek and intuitive interface, stock trading became more accessible and less intimidating, enhancing the platform's appeal to new users.
- Providing Educational Resources: Robinhood offers educational content to help beginners understand market dynamics, enabling them to make more informed and confident investment decisions (Digitaldefynd, 2025).

c- Lemonade (Disrupting Insurance with AI and Behavioural Economics)

Financial insurance is one of the most important processes applied in financial transactions. Traditionally, insurance operations were conducted by assessing risks and collecting periodic premiums from clients in exchange for providing financial compensation in case of covered losses. Although it offers financial security, insurance policies often include exceptions and complex conditions, and premium costs can be high depending on the type of insurance and associated risks. Additionally, claim processing can sometimes take a long time (Bhattacharya, 2022), with technological advancements and the growing need for more efficient insurance solutions, modern insurance emerged, exemplified by Lemonade, which was founded in 2015. This company replaced brokers and paperwork with algorithms, leveraging artificial intelligence, big data, and machine learning (Digitaldefynd, 2025). Thanks to this innovation, claim processing times have been reduced from 25 minutes to just 90 seconds, and premium costs have decreased due to lower operational expenses (Barbera, 2023) , so its strategies are based on leveraging artificial intelligence for automation, making operations fast, easy, and transparent. Additionally, it applies behavioural economics principles to design policies that enhance customer satisfaction and promote positive engagement. The application also relies on clear and simple pricing methods, avoiding hidden fees and complexities (Sheriffdeen, 2024).

d- M-Pesa (Transforming Mobile Payments in Emerging Markets)

M-Pesa is an electronic platform that provides financial services via mobile phones. It was launched by Safaricom in Kenya in 2007. The letter "M" stands for "Mobile," while the word "Pesa" means "Money" in Swahili. The platform has expanded to countries in the Middle East and North Africa due to its success (Chourouk, Eldjilali, & Moustepha, 2021), as it allowed users to pay, receive, and withdraw money easily and securely, making it an alternative to traditional banks, and the primary goal of this platform was to enable borrowers to repay their short-term loans via mobile phones. Additionally, it introduced a savings service by offering interest-bearing savings accounts to users. The platform was also used for lending and

international money transfers, under regulatory supervision. M-Pesa's system is distinguished by several features, including the absence of financial intermediaries and allowing customers to have full control over their electronic funds.

All these factors contributed to its success (Omar & Karim, 2023), which, in turn, played a significant role in financial inclusion, particularly in Kenya, and in expanding business activities.

e- Revolut (UK) (Digital Banking Disruption)

Revolut, founded by Nikolay Storonsky and Vlad Yatsenko in 2015, has become one of the most influential fintech companies in the banking industry, this app started as a simple service offering multi-currency travel cards and later evolved to provide a wide range of financial services, such as creating digital bank accounts for customers, enabling stock and cryptocurrency trading, and managing budgets. Its most distinctive feature is fee-free currency exchange, making it the ideal choice for people who deal with multiple currencies, such as travelers and entrepreneurs, due to its low costs and ease of use (Insiderlondon, 2023).

Hence Francesca Carlesi, Revolut UK, CEO, said: « We want to move from being a disruptor to being a primary banking partner. It's about deepening the relationship with our customers, it's about not just having a Revolut card in your wallet when you travel but making sure Revolut comes top of mind for any financial needs » (Reynolds, 2025).

f- Chime (Revolutionizing Personal Banking)

Imagine a banking experience with no monthly maintenance fees draining your balance, no overdraft fees making things worse and no foreign transaction fees cutting into your travel funds. This revolutionizing personal banking approach came and introduced this feature, which is providing completely free services (Dixit, 2025) , which sparked a revolution in its founding year 2013, Chime is also known for other features, including the ability to receive a pay check up to two days early through direct deposit, the SpotMe service, which allows eligible users to overdraft up to a certain limit without fees, and automatic savings features, such as rounding up purchases to the nearest dollar and transferring the difference to a savings account ,at a time when traditional banks burdened their customers with high fees and complex procedures. Chime introduced digital banking services free of fees and restrictions, leading to a growing customer base and solidifying its position as a leading digital banking institution (Digitaldefynd, 2025).

g- Opay

Opay is one of the leading fintech companies in Africa, particularly in Nigeria. It was founded in 2018 with support from Opera Software and focuses on providing electronic payment solutions, financial services, and e-commerce. This includes money transfers, bill payments, airtime and data purchases, card services, merchant payments, and more as lending and credit options, savings and investment products and insurance offerings. Dauda Gotring who is the managing director of OPay said, « In 2023, OPay gained significant milestones gaining dominance and relevance in the financial industry evident with the exponential growth of its customer base, people empowerment with the Agent and Merchant networks, provided affordable financial services through our robust technology payment platform, resilient to our mission in making financial services more inclusive through Technology. I say thank you to our esteemed customers for your continued patronage and regulators for their guidance to ensure strict conformance in our service offerings ». (Ogbonna, joy, Chukuwuma, & Ogungbangbe, 2024).

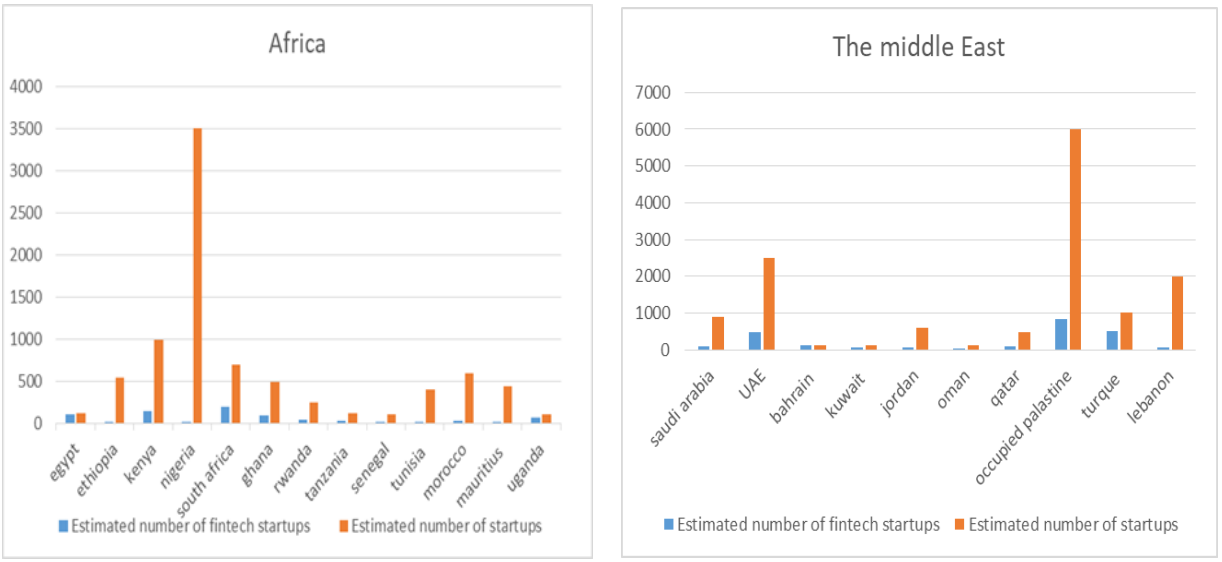
Opay also faces fundamental challenges, including compliance with evolving regulatory requirements, strengthening cybersecurity to combat fraud, and effectively expanding its services across the African continent. However, its growth opportunities depend on its ability to adopt advanced technologies, develop strategic partnerships, and continuously innovate to meet user needs and support the expansion of the digital payments sector (Ahiabuike, 2024).

These companies are among the most renowned in the field of financial technology and have achieved remarkable success. However, there are many other well-known and successful companies in this sector. In addition, there is no doubt that successful fintech companies have become essential in facilitating financial transactions worldwide. Also, they have managed to provide solutions that have streamlined the financial sector and enhanced its efficiency through advanced technologies such as Artificial Intelligence, blockchain, and big data analytics. As a result, financial inclusion has been achieved, and reliance on traditional banks is no longer absolute. With the continuous evolution of digitalisation in payments, digital financing, and other financial technology solutions, the traditional banking infrastructure has undergone significant changes. In the future, even more innovative and astonishing opportunities are expected for this sector, as leading companies will continue to redefine the standards of financial innovation, contributing to the development of a smarter, more inclusive, and efficient global economy (Northwest, 2024).

5.1. Study on FinTech Adoption Statistics in Africa and the Middle East

The adoption of financial technology in Africa and the middle east plays a pivotal role in reshaping financial system landscape. These two regions work on driving financial integration using digital innovation, allowing more access to financial services for individuals by promoting fintech companies the figure below shows the estimated number of fintech companies and startups in Africa and Middle East in 2022.

Figure 2.7: The estimated number of FinTech companies and startups in Africa and the Middle East for the year 2022



Source: prepared by the two researchers based on Kardoussi, M. (2024). The role of fintech in promoting financial inclusion [Doctoral dissertation, University of Guelma]. University of Guelma Institutional Repository. http://dspace.univ-guelma.dz/jspui/handle/123456789/15846 (Translated and adapted from arabic).

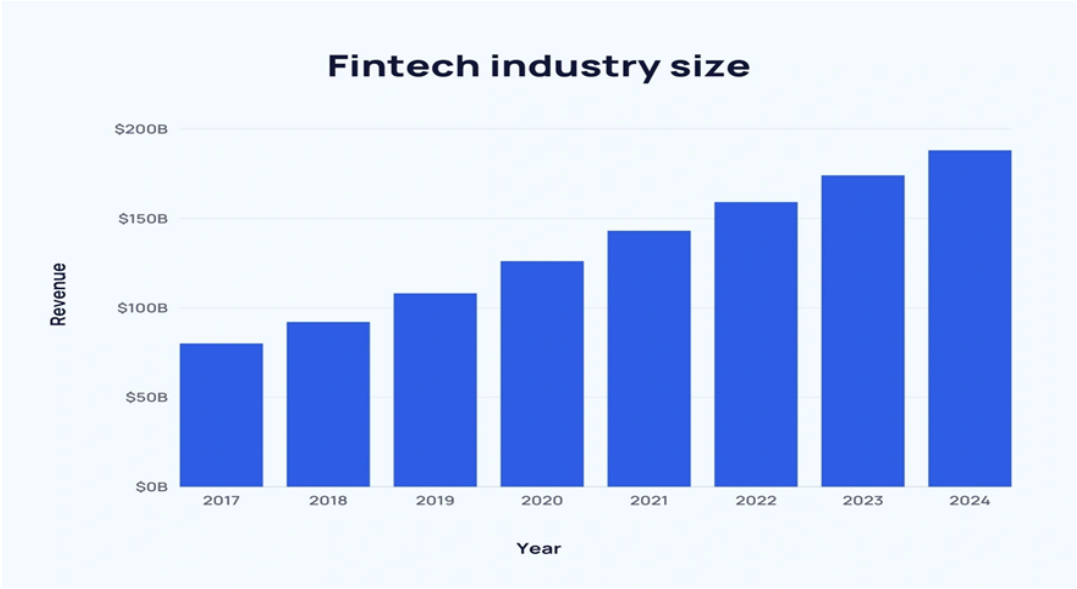
The fintech sector has witnessed significant growth in recent years, with the emergence of thousands of startups worldwide. According to a report by the Centre for Finance, Technology and Entrepreneurship (CFTE) in 2021, there are more than 26,000 startups operating in the fintech industry globally (Ahmed, 2024). Regarding Africa, 70% of fintech companies are concentrated in the four major countries: Nigeria with 250 companies, South Africa with 200 companies, Kenya with 150 companies, followed by Egypt with 112 companies. There is also a growing number in Ghana and Uganda (Kardoussi, 2024). Meanwhile, the figures for the Middle East show a growing number of fintech companies compared to Africa, especially in occupied Palestine and Turkey, followed by the UAE. As for 2024 the UAE Fintech Report 2024 provides an updated version of the country's fintech map, tracking the growth of active fintech companies. According to the latest edition, there are 329 fintech companies operating

in the UAE, with 61.7% of them headquartered in Dubai, reinforcing the emirate's position as a leading fintech hub in the country (East, 2024). Let's not forget the Americas, where there are over 13,000 fintech startups, making the region a leading hub for innovation in financial technology. Among the most notable companies is Stripe, a payment processing services company based in San Francisco, followed by Chime, another major player in the fintech sector, with a valuation of $25 billion (LCSS, 2024). These figures indicate the rapid growth and continuous expansion of the fintech sector worldwide.

5.2. Analysis of fintech industry

This figure below gives us a full presentation of the global fintech industry in terms of revenue from 2017 to 2024.

Figure 2.8: Global fintech industry size from 2017 to 2024



Source: Howarth, J. (2024, February 12). 57+ Incredible Fintech Stats (2024-2026). Retrieved from Exploring Topics: https://explodingtopics.com/blog/fintech-stats.

This figure illustrates the global fintech in terms of revenue from 2017 to 2024. It shows a steady growth in the fintech industry's revenue over years, starting at 50 dollars billion in 2017 and reaching 200 dollars billion in 2024. This growth reflects the increasing adoption of fintech solutions globally and highlights the fintech sector's rapid expansion, its role in reshaping the financial system and inclusive economy. The table below represent, a detailed analysis of fintech industry revenues between 2017 and 2024 in Americas, Europe, Middle East, Africa and Asia pacific.

Table 2.2: Analysis of fintech industry revenues between 2017 and 2024 in Americas, Europe, Middle East, Africa and Asia pacific

Year	Americas	EMEA	Asia Pacific	Total
2017	$31.14 billion	$20.41 billion	$34.37 billion	$85.92 billion
2018	$37.6 billion	$21.5 billion	$40.8 billion	$98.8 billion
2019	$45.2 billion	$22 billion	$48 billion	$116 billion
2020	$52.62 billion	$24.7 billion	$57.99 billion	$135.32 billion
2021	$59.07 billion	$25.78 billion	$68.73 billion	$153.58 billion
2022	$62.29 billion	$27.92 billion	$79.47 billion	$170.67 billion
2023	$65.51 billion	$30.07 billion	$91.29 billion	$186.87 billion
2024	$67.66 billion	$31.14 billion	$103.10 billion	$201.9 billion

Source: prepared by the researchers based on global financial reports.

The table provides an overview covering three main regions the Americas, EMEA and Asia Pacific. It shows a stable growth across all regions, with Asia pacific leading the way with 101 dollars billion in 2024, followed by the Americas and then EMEA. Total revenues increased significantly, highlighting the global rise of fintech and its role in transforming economic sector.

Conclusion

This chapter has provided a comprehensive understanding of financial inclusion, which helped explain its foundational concepts, key theories, objectives such as empowering communities driving economic growth. But there still challenges that faced this inclusion like a weak infrastructure, complex regulations, which make it harder for some people especially those in rural areas to access these services. In addition, we explore the financial technology role in this field and how these tools contribute to a more inclusive environment, showing the differences, it made in promoting financial inclusion and boosting economic growth in many regions.

In a summary, this chapter explain the importance of financial inclusion including access to financial services and how modern technology is helping and giving chance to more people particularly those from underserved societies, in order to engage in the financial system and improve their economic well-being.

In the next chapter, we will present a deeper exploration of these theoretical framework, analysing the fintech role in promoting financial inclusion and economic growth, while linking these foundational concepts with practical insights and empirical data analysis, for more understanding of this research, in order to enable a deeper and more detailed exploration, fostering interpretations within the scope of this study.

Chapter III:

The role of fintech in promoting financial inclusion and economic growth

Introduction

The final chapter serves as a comprehensive analysis of the relation between fintech, financial inclusion and economic growth across the studies countries in Africa. It starts by the composition of the study panel and the criteria applied in the selection framework. This will follow by an investigation of the financial inclusion landscape and fintech state within the context of each country.

In addition, we will explore the role of central banks and economic/financial environment in shaping the financial inclusion and fintech ecosystem in the chosen African regions, through macroeconomics factors that influence the economic/financial development. Next, we will provide a detailed information of the current state of financial inclusion by regions, along with the financial technology scope. Finaly, our research method involves applying empirical analysis on a panel model, in order to offer more in-depth insights from real world data sources, using a statistical method and a critical results discussion. This chapter contributes to a deeper understanding of how digital innovation drives financial inclusion and promotes economic growth in the African nations.

1. Sample presentation

In our study we chose a panel of 10 Countries: Algeria, Tunisia, Morrocco, Kenya, Nigeria, Ghana, South Africa, Tanzania, Uganda, and Zambia. Selecting these nations for this study, highlights the diverse ways fintech influences financial inclusion and economic growth across different countries of the continent. Africa's unique landscape offers a rich field for comparison and analysis in this study with different nations at varying stages of financial and economic progress.

1.1. Selection framework

1.1.1. Interconnected regional aspects

1.1.1.1 Geographical proximity and shared characteristics

North African countries such as Algeria, Tunisia and Morrocco have developed similar historical, cultural, and economic patterns over time. Their close geographical location has encouraged trade and strengthened economic ties. Meanwhile, the majority of the other countries belong to Sub-Saharan Africa, making them part of the region with shared socio-economic opportunities and challenges. Furthermore, due to its distinct set of formal and informal financial practices, Africa continues to be the second most economically unequal region in the world, behind Latin America and Caribbean which made this study approach more suitable in the African economic system (AFDB, 2024).

1.1.1.2 Social and economic challenges

As North Africa continues to embrace fintech and have unique opportunities to build on the successes of their Sub-Saharan counterparts while tailoring solutions to their local contexts. Less than 5% of utility payers in North Africa use digital methods, compared to over 50% in East and Southern Africa. Analysing these differences will provide a general perception for the financial/economic systems in Africa (Klapper, Mbabazi, & Nsanzabaganwa, 2025).

1.1.2. Digital and financial expansion

1.1.2.1 Growing fintech ecosystems

The rate of fintech investment attributed to North Africa went from 4 percent in 2023 to 36 percent in 2024, driven by the region's largest transaction. Meanwhile, West Africa's share of total funding more than doubled, rising from 16 percent in 2023 to 45 percent in 2024. Africa's fintech sector is among the most rapidly expanding globally, with revenue anticipated to more than triple from 2023 to 2028, reaching $47 billion. This ecosystem foster innovation, increase

competition, and improve the availability and accessibility of financial services, driving financial inclusion (Chauhan, 2025).

1.1.2.2 Mobile money penetration

While mobile money adoption has been slower in North Africa compared to Sub-Saharan Africa, on average, 28% of adults have a mobile money account as of 2022. When mobile money was first introduced in Tanzania in 2008, the country was among the first to use it. In Uganda, mobile money transactions account for a significant portion of gross domestic product (GDP), providing individuals with access to basic financial services such as payments, savings, and credit (WorldBank, 2024).

1.1.2.3 Access to Data

The Global Findex Database, International Monetary Fund data and the African Development Bank statistics, provide detailed data on financial inclusion indicators, which can be applied for in-depth analysis in Africa. Many studies applied on a panel data ensure the availability of comprehensive data help to draw conclusions about fintech's impact in these African countries.

1.1.3. Youth-driven economic growth and regulatory influence

1.1.3.1 Youthful population

Africa is home to over 19 percent of the world's youth population, according to projections, there will be up to 42 percent more young people in Africa by the year 2030. Over 70 percent of the population in many of these countries is between the age of 15- 30, and they are more likely to adopt and adapt in the same time to new technologies driving innovation and increasing financial inclusion (Devara, 2023).

1.1.3.2 Economic growth potential

Despite global economic challenges, African economies continue to demonstrate resilience, as highlighted in the latest African Economic Outlook report by the African Development Bank Group. North Africa, maintained steady growth at 3.5% in 2004, and expected to slow from an estimated 4.1% in 2023 to 3.6% in 2024, before rising to 4.2% in 2025, with a 0.3 percentage point downward adjustment for 2024. East Africa, the fastest-growing region on the continent, recorded a 4.9% growth rate in 2004 and projected to see its real GDP increase from an estimated 1.5% in 2023 to 4.9% in 2024 and 5.7% in 2025, with a slight downward adjustment

of 0.2 percentage points for 2024. In the meantime, West Africa experienced 3.9% growth in 2004, with a slight dip to 3.6% in 2023, followed by projections of 4.2% in 2024 and 4.4% in 2025. Finally, Southern Africa's economic growth, which stood at 2.8% in 2004, later experienced periods of slowdown but it's expected to improve gradually, rising from an estimated 1.6% in 2023 to 2.2% in 2024, and further strengthening to 2.7% in 2025. (AFDB, 2024). Despite economic challenges since the early 2000s, Africa continues to show significant economic growth potential, with multiple regions expected to exceed their 2004 economic performance in the years ahead.

1.1.3.3 Regulatory support

Nigeria in 2012, the national financial inclusion strategy (NFIS) was approved by the Central Bank of Nigeria (CBN). Supportive regulatory frameworks encourage fintech innovation and adoption, ensuring consumer protection using (KYC) procedures while fostering growth (CentralBankofNigeria, 2018). The other countries such as North African countries and Kenya, central banks recognize the importance of regulatory support in creating a suitable ecosystem for fintech evolution.

By examining these shared characteristics, we can gain a comprehensive understanding of how fintech influences financial inclusion and economic growth across diverse African contexts. This diversity enriches the study, making it more relevant and impactful.

To sum up, the main takeaways are:

- They offer a representative sample of Africa's diversity in terms of economy, culture, and technological adoption, making the findings more generalisable.
- Nations rich in natural resources, such as Algeria (natural gas) and Nigeria (oil), present interesting cases for how fintech can be leveraged to diversify economies and reduce dependence on a single commodity.
- The varying economic growth rates among these countries (e.g., Ghana's rapid growth versus more stable economies like South Africa) offer a rich information to examine how fintech contributes to economic expansion.
- Kenya is renowned for its vibrant tech-scene, particularly in Nairobi, which has fostered numerous fintech startups. Similarly, Nigeria's Lagos has emerged as a hub for fintech innovation.

- The success of mobile money services like M-Pesa in Kenya demonstrates the potential for fintech to increase financial inclusion. Other countries, like Tanzania and Uganda, have also seen significant uptake in mobile financial services.
- Membership in regional economic communities such as the East African Community (EAC), Economic Community of West African States (ECOWAS), and Southern African Development Community (SADC) and finally the North African countries (NA) which facilitate cross-border trade and financial transactions, therefore fintech can significantly enhance.

2. The fintech and financial inclusion landscape in the African countries

2.1. Central banks

The landscape of fintech and financial inclusion in the African countries can't be shown without relying on the role of central banks in this, as the main financial institutions in a country. Central banks play a pivotal role in the financial system, managing the currency, control monetary policies and supervising the banking system to ensure stability. In the context of fintech, they perform an indispensable role by providing regulations and guidance that help the innovative technologies to grow safely. In other hand, central banks ensure the inclusion of the individuals in the financial system, especially those who don't have suitable access to financial services, establishing policies and strategies to boost inclusion and encourage economic growth. In summary central banks represents a crucial instrument in the economic and financial system of a country.

2.1.1. Bank of Algeria

Bank of Algeria serves as the central bank of Algeria, it was established by law No. 62-144, passed by the Constituent Assembly on 13 December 1962, which created and defined the statutes of the central bank. The bank of Algeria also has a network comprising 49 agencies and branches, ensuring an effective presence in each of the country's provinces (BankofAlgeria, 2022).

The Bank of Algeria has several key missions, including:

- Monitoring and ensuring the efficiency and security of payment systems under the rules that are established through regulations issued by the Currency and Credit Council.

- The Bank of Algeria is tasked with maintaining price stability as a primary objective of monetary policy. It oversees and regulates the circulation of money, utilising all suitable measures to manage and control it effectively
- The Bank of Algeria defines the general conditions under which Algerian and foreign banks and financial institutions may be authorised to establish themselves and operate within Algeria. It also sets the terms for modifying or revoking such authorisation.
- The Bank of Algeria oversees the foreign exchange market within the framework of exchange rate policies established by the Currency and Credit Council, while adhering to Algeria's international commitments.
- The Bank actively promotes education to empower individuals and businesses to make informed financial decisions.
- The Bank supports the adoption of digital payment systems and mobile banking to enhance accessibility. It works to ensure that banking services are available to all citizens, including those in remote areas, through initiatives like the right to a basic bank account. (BankofAlgeria, 2022).

2.1.2. Overview of central banking institutions across the selected panel

The table (3.1) offers a summary of central banks across the selected panel, focusing on their role in promoting digital financial inclusion and driving economic growth.

2.2. Economic and financial environment

The economic environment encompasses the characteristics and framework of the economy, the phase of economic development, economic resources, income levels, economic policies. The primary elements of the economic environment are: The nature of economic system and economic/financial development.

2.2.1. The nature of economic system

All the 10 countries have a mixed economy, which means that their economic systems include a combination of the private sector alongside significant government involvement.

The difference between the nations is the variation of the mixed approach for example, for the North African countries, we find a more government-leading than the other countries that have a stronger private sector.

Table 3.3: Summary of key aspects of central banks in promoting financial inclusion through fintech

Country	Central bank	Key role in financial inclusion	impact of fintech
Algeria	Bank of Algeria	Promotes financial literacy	Support digital payments
Tunisia	Central bank of Tunisia	Financial regulations	Strengthens fintech through innovation
Morrocco	Bank Al-Maghrib	Support access and usage of financial services	Advanced mobile banking
Kenya	Central bank of Kenya	Encourage mobile banking	Drives fintech innovation
Nigeria	Central bank of Nigeria	Expands access to credit	Facilitates e-commerce
Ghana	Bank of Ghana	Develops microfinance	Enhance digital platforms
South Africa	South African reserve bank	Promotes banking infrastructures	Advances blockchain technology
Tanzania	Bank of Tanzania	Focuses on rural banking	Promotes mobile money
Uganda	Bank of Uganda	Improves financial education	Integrates fintech solutions
Zambia	Bank of Zambia	Expands banking services	Boosts fintech adoption

Source: prepared by the researchers based on data from the world bank and central banks.

2.2.2. Economic and financial development

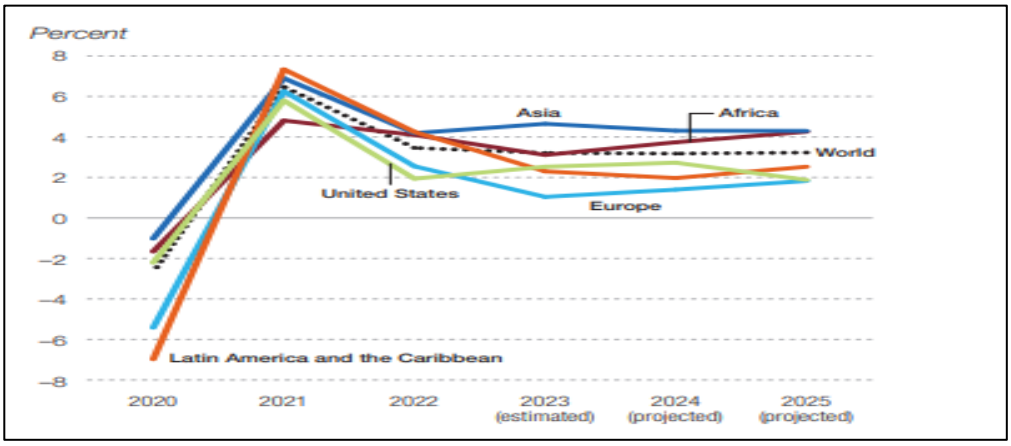
Economic development refers to the structural transformation of an economy through the introduction of more modern and mechanised technology in order to improve labour productivity, employment, earnings, and the population's standard of life (Panth, 2020). In the other hand, the world bank financial development report defines the financial development as the process by which the financial sector including institutions, instruments, markets, as well

as the legal and regulatory framework reduce the costs associated with obtaining information, enforcing contracts, and conducting transactions. In addition, the development of the financial sector can aid in the expansion of small and medium-sized businesses (SMEs) by giving them access to financing, results in economic development as the outcome (WorldBank, 2019). Furthermore, the financial and economic development can be measured using various indicators, that capture growth, progress and access in different aspects of economy.

a- Economic development in Africa

For the economic development, the gross domestic product (GDP) is an indicator that refers to the rate at which a country's economy grows, this provides a comprehensive view of economic development in Africa. It measures the increase in the value of all goods and services produced within a country over a period, expressed as a percentage.

Figure 3.8: Real GDP growth, by world region, 2020–2025



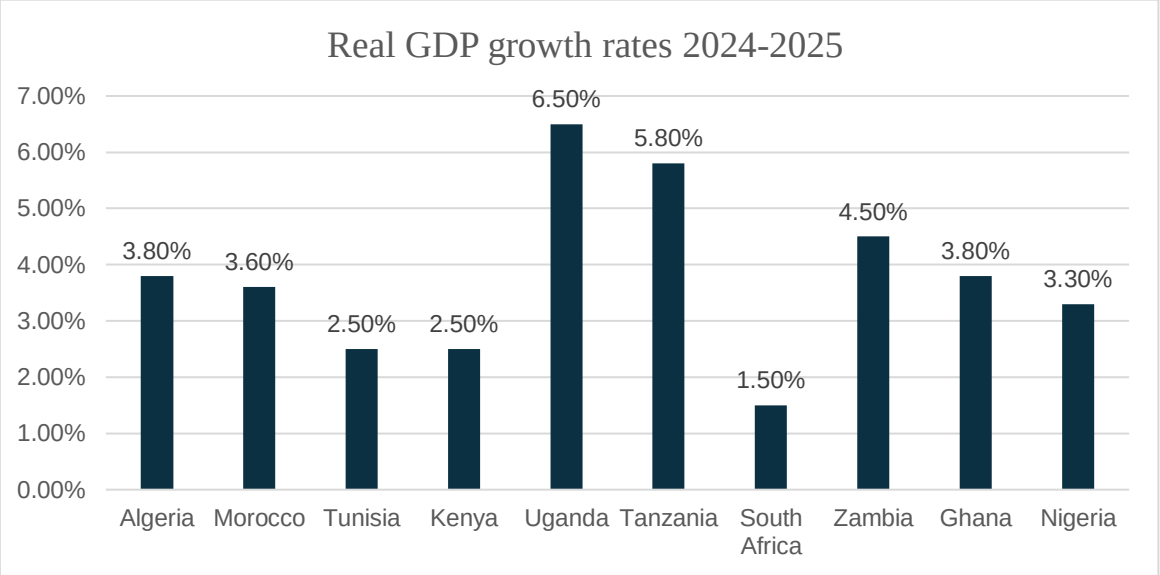
Source: AFDB. (2024). AFRICAN ECONOMIC OUTLOOK 2024 Driving Africa's Transformation The reform of The Global Financial architectures. African Development Bank Group. Retrieved from https://www.afdb.org/en/documents/african-economic-outlook-2024

The graph represents the real GDP growth rates across various regions around the world from 2020 to 2025, Africa growth has been growing after 2020, reached its peak in 2021, surpassing 4 percent. The African continent is expected to continue to be robust in regard to the global issues that have put economies throughout the world to the challenge.

With the acceleration of growth, Africa will maintain its status as the second-fastest expanding area following emerging Asia, with an anticipated average real GDP growth of 3.7 percent in 2024, surpassing the global average of 3.2 percent. It is anticipated that real (GDP) growth will go over the 4.1 percent in 2022 and increase to 4.3 percent in 2025. This reflects

the continent's adaptability, since then, growth rates have stabilised showing the economic advancements in Africa in recent years compared to other regions worldwide (AFDB, 2024).

Figure 3.9: Real GDP growth in the panel countries 2024-2025



(*2025 projected data)

Source: prepared by the researchers based on previous data from African Development Bank Group staff calculations.

The chart illustrates projected real GDP growth rates for 10 African nations from 2024 to 2025, countries like Uganda with 6.50 percent, Tanzania 5.80 percent and Zambia 4.50 percent, show significantly higher real GDP growth projections, also nations like South Africa with 1.50 percent or Kenya and Tunisia 2.50 percent show a lower growth which may reflects challenges. For Algeria, Ghana, Morocco and Nigeria revealed a moderate growth. In the end, these rates present regional disparities in terms of economic growth among the panel countries.

b- Financial development in Africa

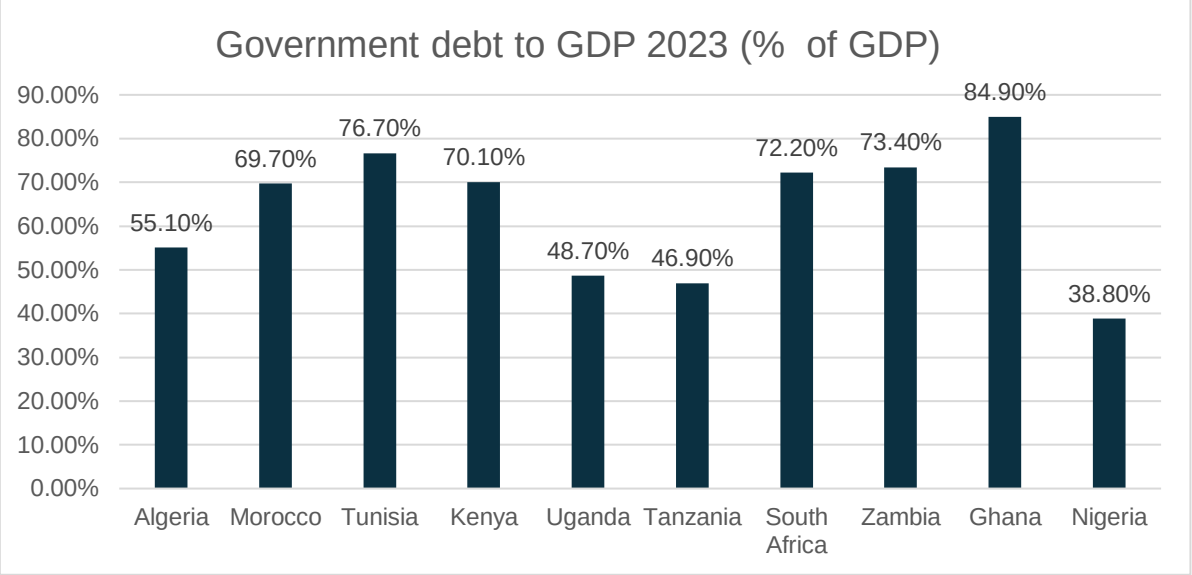
The government debt ratio percent of GDP compares a country's total debt to its gross domestic product (GDP). It helps evaluate the ability to repay debt and maintain financial stability. A high ratio represents significant debt, leading to financial instability and the inverse applies, this will give us a clear observation of financial development in Africa (Kenton, 2025).

Based on the African economic outlook report for 2024 by the African Development Bank (AFDB), Africa debt ratio to GDP, shows a rise from 54.5 percent in 2019 to 64 percent in 2020, remained in 2021-2023 around 63.5 percent. Despite this, the ratio remains high which

indicates a significant amount of debt compared to the continent economic output. (AFDB, 2024).

The figure below represents an outline of the 10 countries debt ratio to GDP in 2023.

Figure 3.10: Government debt to GDP 2023 (%of GDP)



Source: prepared by the researchers based on data from Country List Government Debt to GDP, Africa in TRADING ECONOMICS.

This chart on government debt to GDP for various African countries in 2023 represent a helpful insight in order to describe the financial development in the chosen countries. We observe a higher debt ratio in Ghana with an 84.9 percent following by Tunisia 76.7 percent and Zambia with 73.4 percent. In reverse, lower ratio in Nigeria 38.8 percent, suggests a low compared to global and regional benchmarks. Indeed, countries like Uganda, Tanzania and Algeria fall into moderate range reflecting a measured strategy in managing government debt in proportion to the country's economic performance. These countries likely implement careful fiscal policies to ensure sustainable debt levels while continuing to support economic growth.

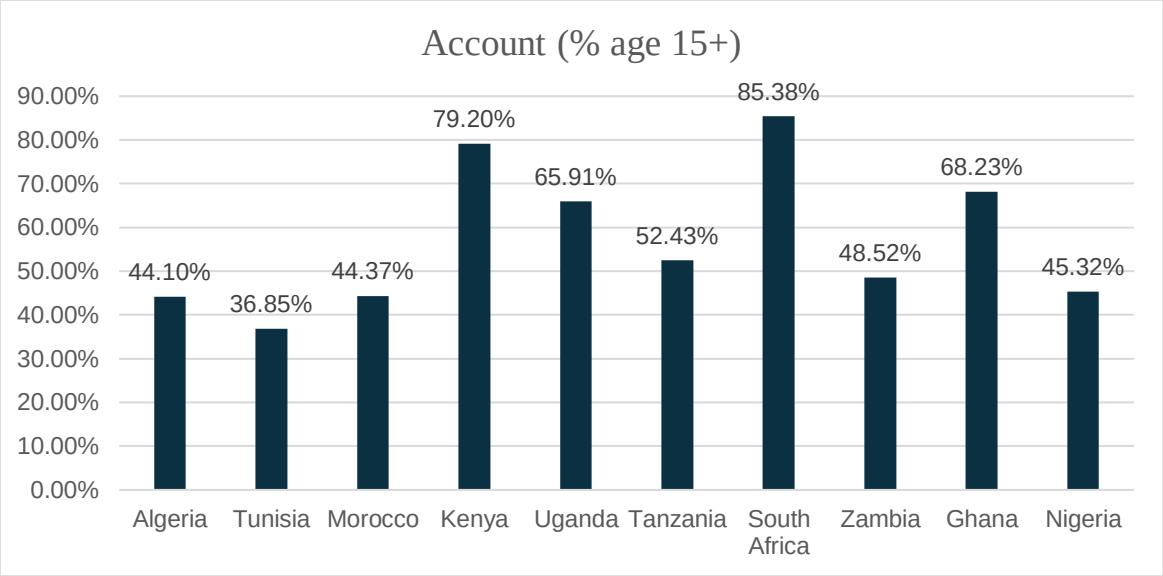
2.3. Financial Inclusion state regional perspective across panel countries

Across panel countries, financial inclusion reflects a diverse landscape, in this part, we will investigate this landscape measuring the level of financial inclusion by using both access to financial services and usage of formal financial tools.

2.3.1. Access to financial services

The state of financial inclusion varies widely due to differences in economic structures, technological adoption, and regulatory frameworks. It's crucial to measure the access level using the percentage of individual with financial accounts. According to the most recent data available, the figure below represents the percentage of individuals who report having an account (by themselves or together with someone else) at a bank or another type of financial institution across the panel countries.

Figure 3.11: The percentage of individuals who report having an account at a bank or another type of financial institution in 2021



Source: prepared by the researchers based on data from The Global Findex Database 2021.

This chart shows how many individuals in different African countries have account at banks or other financial institutions in 2021. The statistics represent the percentage of people aged 15 and older. The highest percentage is in South Africa 85.38 percent, following by Kenya 79.2 percent, the lowest is in Tunisia 36.85 percent, other countries like Ghana, Uganda with 68.23 percent and 65.91 percent respectively. Algeria has 44.1 percent which means about half of the adult populations uses financial services similar with Morrocco with 44.37 percent. Other countries like Tanzania, Zambia and Nigeria have almost similar moderate levels of access with 52.43 percent, 48.52 percent and 45.32 percent respectively. Overall, this chart highlights many differences in financial inclusion across chosen countries.

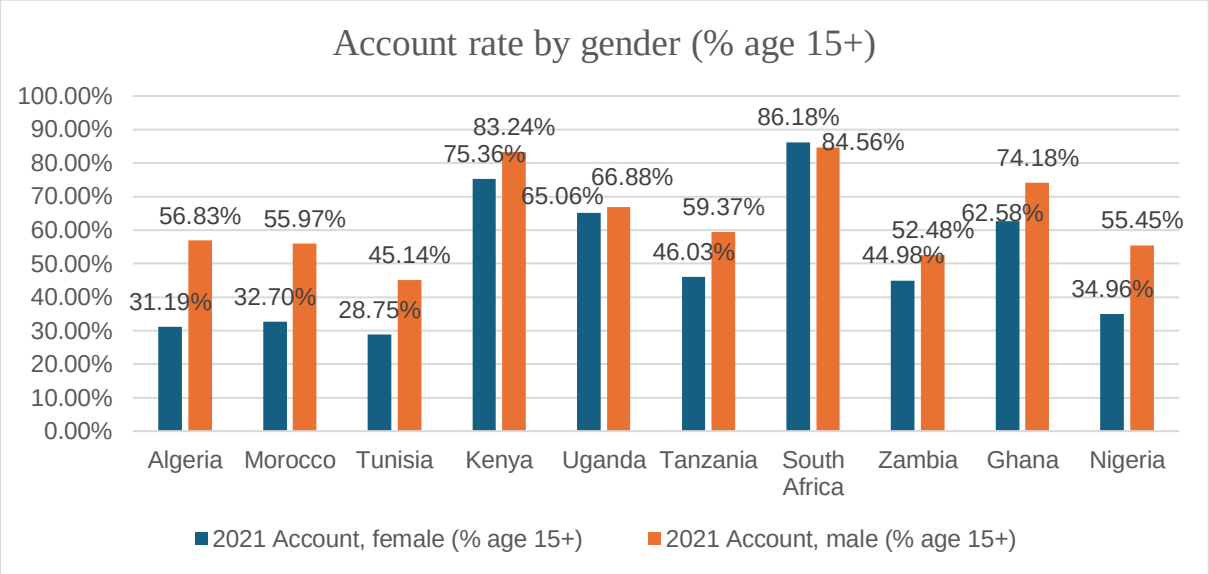
2.3.2. Demographic variations in financial inclusion

Access to financial services also vary by demographic characteristics such as gender and individual income. This allows more insights into the state of financial inclusion in Africa.

a- By gender

The chart below represents the percentage of individuals aged 15 and older. who report having an account at a bank or another type of financial institution in 2021 by gender.

Figure 3.12: The percentage of individuals aged 15 and older with an account at a bank or another type of financial institution in 2021 by gender



Source: prepared by the researchers based on data from The Global Findex Database 2021.

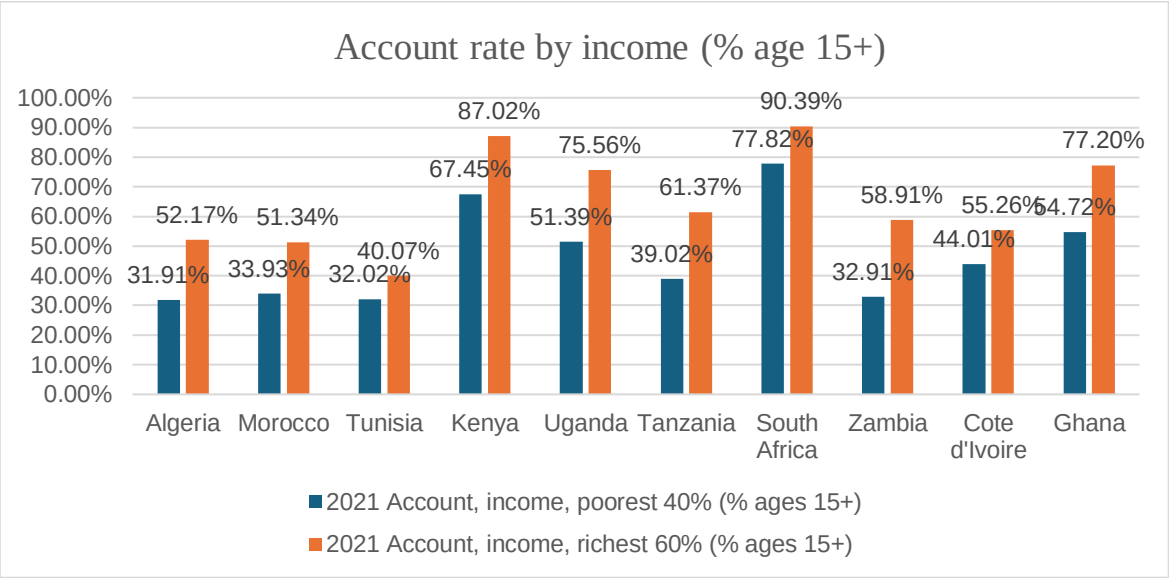
Based on this chart, men are more likely than women to have an account at a financial institution, the data highlights many differences in financial inclusion rate especially between the north African countries and the other ones. North Africa shows acceptable account ownership, but the gap between men and women remains highly noticeable. The remaining countries, on the other hand, has seen a major shift towards access to financial services. In Kenya, Uganda and South Africa the gender gap is almost non-existent compared to the other regions.

b- By individual income

Financial inclusion varies significantly based on income levels. Higher incomes have more access to financial services, while the lower-income groups often face many challenges in

financial access. Using data from the world bank and analysing these disparities, we can analyse how accounts rates differ across income groups across countries.

Figure 3.13: The percentage of individuals aged 15 and older with an account at a bank or another type of financial institution in 2021 by individual income



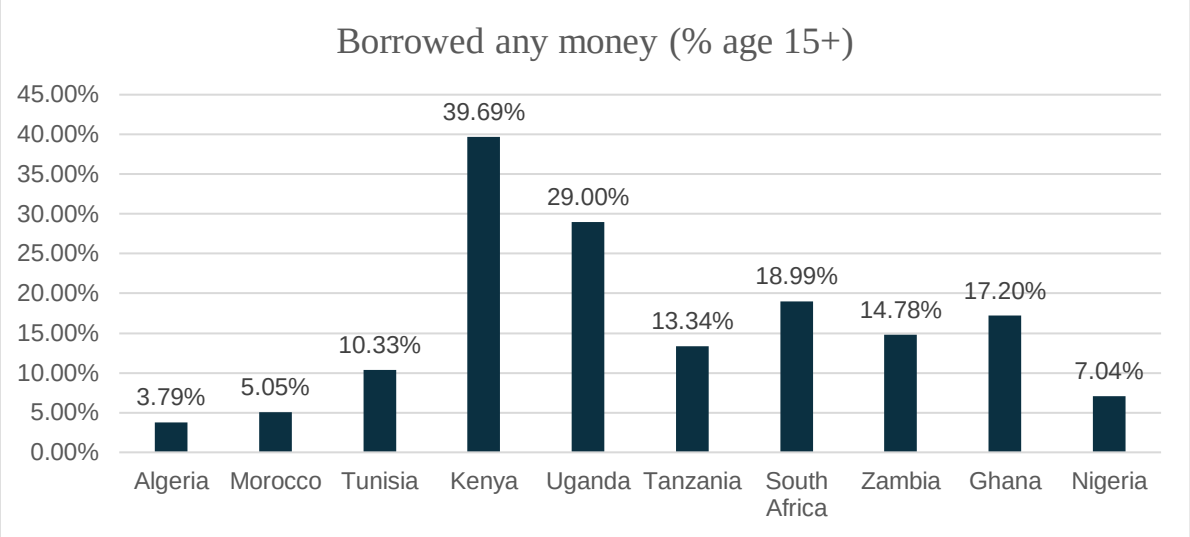
Source: prepared by the researchers based on previous data from The Global Findex Database 2021.

The data shows a clear difference in financial access between the poorest 40% and richest 60%, in the selected countries, there is a general gap between higher income and low-income individuals but it's relatively moderate. The highest level of account rate is in South Africa 90.39 percent, which means that over 90 percent of the richest 60% populations has access to financial services through a financial institutions account while for the poorest 40% we have 77.82 percent has an account. The lowest rate is in Algeria with 31.91 percent in the 40% lower income group.

2.3.3. Usage of financial services

Usage is necessary for financial inclusion outcomes and impact. This dimension focuses on how people engage with financial services rather than just access. In order to gather more insights into the financial inclusion state we include the dimension of usage of financial services measuring by the borrowing (Cenfri, 2017). The figures below present the percentage of individuals aged 15 and older**,** borrowed/ saved any money including mobile money, from a formal financial institution in the 10 African countries based on the 2021 global Findex data.

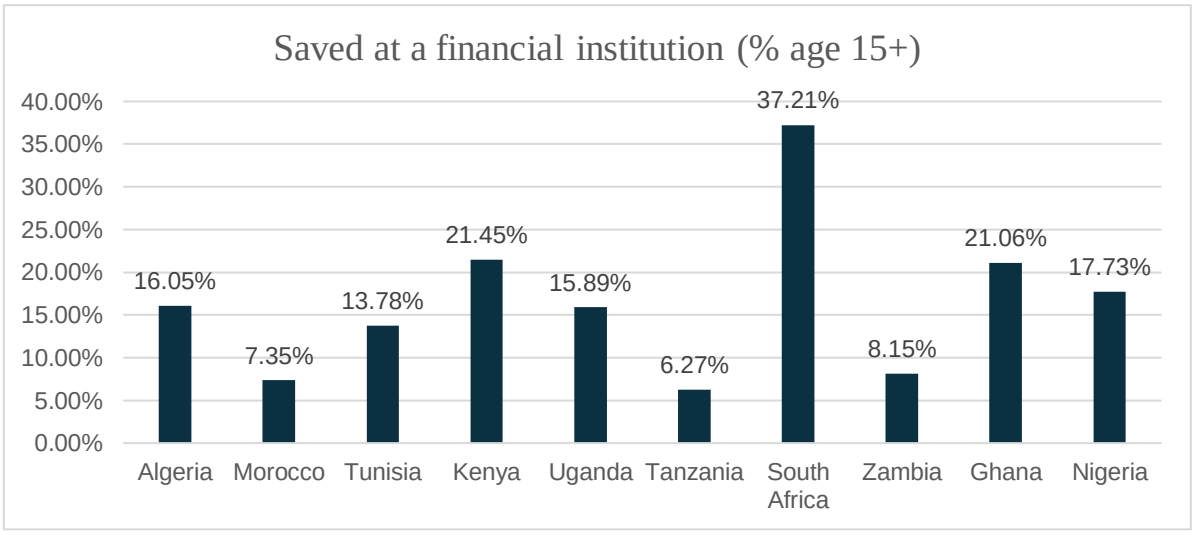
Figure 3.14: The percentage of individuals borrowed any money from a formal financial institution (% age 15+)



Source: prepared by the researchers based on previous data from The Global Findex Database 2021.

This chart illustrates how financial services are utilised beyond just having an account. Kenya leads with 39.69 percent indicating a strong engagement with formal credit and mobile money borrowing, following by Uganda, South Africa and Ghana with relatively high percentages. A moderate usage percentage in Zambia, Tanzania and Tunisia with percentages between 15 percent to 10 percent. We can observe a very low usage percentage in Nigeria, Morocco and Algeria.

Figure 3.15: The percentage of individuals saved any money from a formal financial institution (% age 15+)



Source: prepared by the researchers based on previous data from The Global Findex Database 2021.

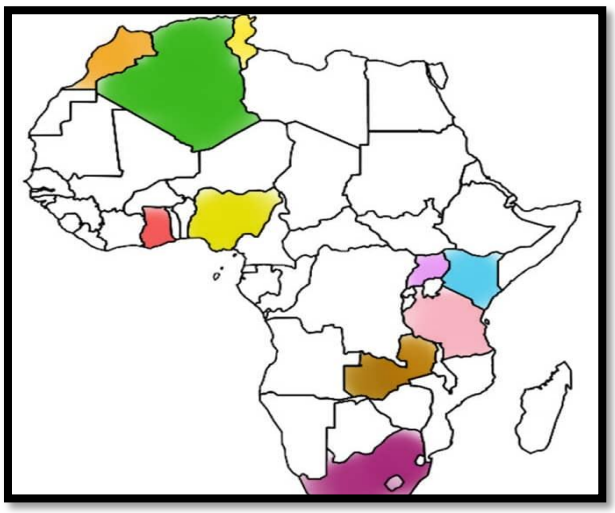
This graph provides a valuable analysis of the state of financial inclusion across the panel countries, measured by the percentage of individuals aged 15 and above who saved at financial institutions. In the Sub-Saharan context, South Africa with the highest percentage 37.21 percent, which indicate a more inclusive environment, followed by Kenya with 21.45 percent, while in North Africa, Algeria lead the way with 16.05 percent, Tunisia then Morrocco as the lowest percentage with 13.78 percent and 7.35 percent respectively.

In conclusion, financial inclusion state across panel countries varies significantly, reflecting diverse economic system, social and technological infrastructure. Based on the previous statistics, Sub-Saharan Africa has seen an increase in access and usage of financial services. However, gaps remain, in some nations access to financial tools still limited, especially for women and low-income individuals. For this reason, efforts must be undertaken to reach an inclusive system that promote economic growth in Africa.

2.4. Fintech state comparison across countries

Over the past decade, financial technology in Africa has experienced remarkable growth, driven by the widespread use of mobile phones and the rising demand for more inclusive and innovative financial solutions especially in regions underserved by traditional banking systems. Despite varying levels of digital maturity across the continent, many African countries have emerged as fertile ground for fintech development, actively working to attract investment and expand financial inclusion. In this comparison, we highlight twelve African countries: Algeria, Morocco, Tunisia, Ghana, Kenya, Nigeria, Zambia, Uganda, Tanzania, and South Africa to examine the key features of the fintech ecosystem in each of these nations.

Figure 3.16: Positioning of countries whose fintech ecosystem will be compared



Source: prepared by the researchers

2.4.1. Fintech ecosystem in North Africa

The North African region is witnessing remarkable growth in the financial innovation sector and has become one of the promising emerging markets in this field. This is driven by the youth's eagerness for technology and the urgent need for financial solutions. In this section, we shed light on the growth features of financial technology in North African countries namely Algeria, Tunisia, and Morocco and their fintech ecosystem.

- **Algeria**

In line with efforts to foster financial inclusion, and specifically to promote the use of digital payment tools, Algeria expanded its regulatory measures in 2018 by mandating the installation of electronic payment terminals (TPE) across all commercial businesses. This initiative aimed to reduce reliance on cash and encourage electronic transactions, in terms of supporting innovation and entrepreneurship, the Algerian Startup Fund (ASF) was launched in October 2020 with the goal of creating a favourable financing environment for startups and strengthening the entrepreneurial ecosystem. Since its establishment, the fund has successfully mobilized approximately 1.2 billion Algerian dinars, reflecting the state's commitment to supporting the digital economy and fostering innovation (Ameziane, 2024).

Building on this digital expansion, promising fintech startups have begun to emerge, including:

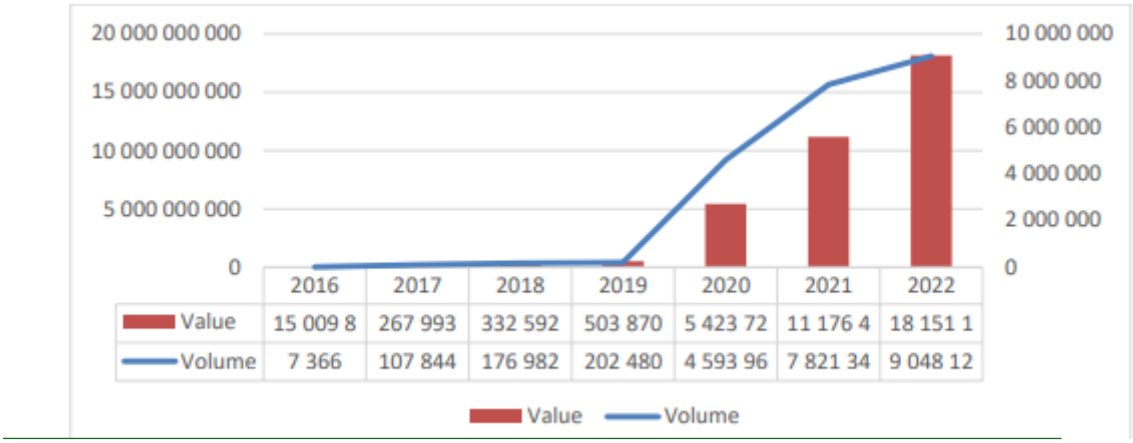
- Banxy: A fully digital bank operating via mobile.
- DFA: A platform specializing in open banking solutions.
- ESREF Pay: A digital wallet for electronic payments.
- Yassir: A multi-service super app that includes banking features and became the most funded Algerian startup as of 2023.

These developments reflect a growing momentum toward the digitization of financial services, supported by an improving digital infrastructure and an expanding culture of local innovation in the financial sector.

As part of Algeria's efforts to digitize its banking system, public entities such as GIE Monétique and SATIM have played a pivotal role. Additionally, Algeria Poste has significantly contributed to promoting financial inclusion by offering a variety of digital financial services, Algeria records high rates of mobile and internet subscriptions, with over 37 million mobile

internet users and more than 3.5 million fixed broadband internet subscribers as of 2021 (Santosdiaz, 2025).

Figure 3.17: The total number of online payment transactions



Source : Amrane, S., & Damene, O. (2023). FinTech adoption in the Algerian banking sector: Reality and challenges. Journal of Economic Integration, 11(5)

This chart illustrates a sharp increase in the volume of electronic financial transactions from 2016 to 2022 in Algeria, specifically in the internet payment service using the CIB card, and it can be observed that a significant shift occurred between 2019 and 2020, marked by a notable rise in the number and value of financial transactions. This change is largely linked to the COVID-19 pandemic, which accelerated the adoption of online payments due to the increased reliance on remote work and digital commerce. Currently, a total of 321 online merchants are affiliated with the interbank card-based internet payment system.

Despite the availability of electronic payment options such as Edahabia and CIB cards, users predominantly rely on them for cash withdrawals, showing a continued preference for cash over digital payment methods (Amrane & Damene, 2023).

Algeria's fintech landscape has undergone a remarkable transformation, the timeline below captures the major shifts that have shaped the country's fintech sector from policies to regulatory reforms.

Figure 3.18: Timeline of key fintech highlights



Source: Santosdiaz, R. (2025, February 24). From Oil to Algorithms: Algeria's Fintech Path in 2024. The Fintech Times. Retrieved from, https://thefintechtimes.com/fintech-overview-of-algeria-in-2024.

- **Morrocco**

The fintech ecosystem in Morocco has witnessed remarkable development, positioning the country as one of the leading players in North Africa. This progress is largely driven by strong regulatory support, led by Bank Al-Maghrib, which launched the National Financial Inclusion Strategy in 2019 and introduced a Regulatory Sandbox in 2022, allowing startups to test innovative financial solutions under controlled conditions (Ameziane, 2024). Other regulatory bodies, such as the Moroccan Capital Market Authority (AMMC) and the Insurance and Social Security Control Authority (ACAPS), have also contributed to creating a legal framework conducive to growth. This momentum is supported by relatively advanced digital infrastructure, widespread access to smartphones and the internet, and a young population open to technological innovations (Battanta, Lancioni, Giolfo, & Magli, 2025).

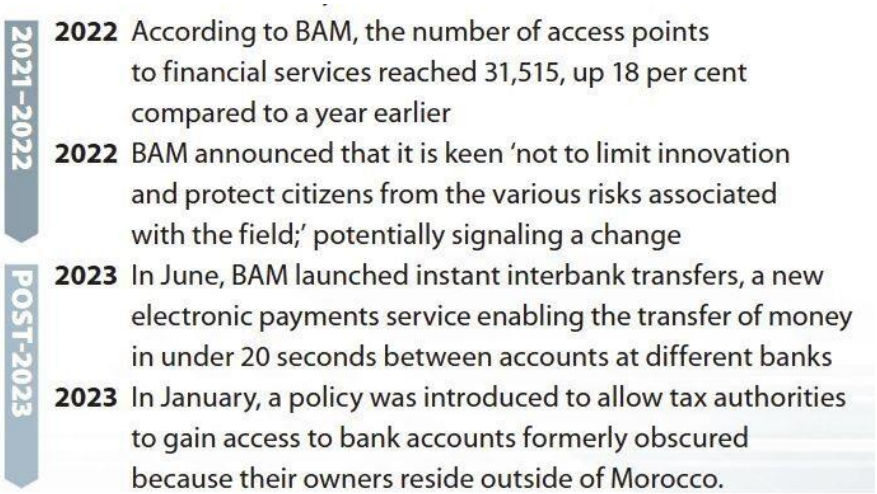
Several pioneering fintech startups have emerged, including Inwi Money, Payit, Wafacash, and Hps Worldwide (conference, 2024) , in addition to digital banking initiatives like CIH PAY (FintechNewsAfrica, 2024). Despite these advancements, the ecosystem still faces challenges such as low financial literacy among certain segments of the population, persistent reliance on

cash transactions, and limited access to venture capital funding (Anguer & Bennis, 2024). Nevertheless, Morocco continues to strengthen its position as a strategic hub for expansion into Francophone African markets, enhancing its potential to become a regional leader in fintech in the near future (Heba, 2024) .

- **Fintech highlights timeline in Morocco**
  - 2013: Bank Al-Maghrib (BAM) established the Moroccan Foundation for Financial Education to promote financial literacy among citizens.
  - 2014: BAM introduced a new banking law allowing the creation of payment institutions focused on small-value financial transactions.
  - The monopoly of Maroc Telecommerce on online payment processing ended, opening the market to new players such as: AmanPay, PayZone, F-Pay
  - 2015: BAM enacted the first new banking law since 2006, aiming to modernize the legal framework of the financial sector.
  - 2018: The National Financial Inclusion Strategy (NFIS) was launched by BAM to improve access to financial services and enhance overall financial inclusion. (Santosdiaz, 2025).

The figure below shows fintech highlights timeline in Morocco from 2022 to 2023, many policies and framework were adopted in order to facilitate the establishment of the fintech ecosystem.

Figure 3.19: Fintech highlights timeline in Morocco 2022-2023



Source: Santosdiaz, R. (2025, February 7). Morocco Fintech Overview: Adopting Tech While Maintaining Tradition. The Fintech Times. Retrieved from, https://thefintechtimes.com/fintech-overview-of-morocco-in-2024/

- **Tunisia**

Tunisia's fintech ecosystem is evolving steadily, driven by increasing digital connectivity, government-led reforms, and a young population eager for digital solutions. Despite notable progress in internet and smartphone penetration, the country still faces challenges related to financial inclusion and a strong reliance on cash approximately two-thirds of the population use the internet, and smartphone penetration reaches 66%; however, only 2% of the population use mobile money transfer services. However, with proactive steps by regulators and emerging fintech startups, Tunisia is positioning itself to become a more inclusive and digitally integrated financial environment. Tunisia's fintech ecosystem is home to 27 active fintech companies (Ameziane, 2024). Therefore, the Central Bank of Tunisia (BCT) launched the BCT-FINTECH initiative in June 2020 as a key step toward modernizing the country's financial ecosystem and promoting financial inclusion. This initiative includes a regulatory sandbox, which provides fintech startups with a controlled environment to test innovative financial products and services under the supervision of the central bank. By doing so, BCT aims to strike a balance between encouraging innovation and ensuring financial stability. As part of the initiative, the BCT also developed a dedicated fintech portal, serving as both an accelerator and a platform for collaboration between regulators, startups, and stakeholders in the financial sector (Zone, 2021).

2.4.2. Fintech ecosystem in East Africa

East Africa is considered one of the most dynamic regions for fintech innovation in Africa. Driven by tech-savvy populations, and supportive government policies. Among the East African countries that we will cover are Kenya, which is one of the leading fintech hubs in Africa, as well as Tanzania and Uganda.

- **Kenya**

Kenya is one of the leading countries in the field of fintech in Africa, where digital innovations have contributed to enhancing financial inclusion and expanding financial services. One of the most prominent of these innovations is the M-Pesa mobile payment service, which is a pioneering platform offering financial services through mobile phones, especially in rural areas lacking traditional banking services (Soyres, Jelil, Cerruti, & Kiwara., 2018) , Kenya’s fintech landscape is supported by a robust regulatory framework, with the Central Bank of Kenya (CBK) playing a key role in regulating the industry and ensuring

financial stability (Younes, walid, & Jawal, 2022) , its fintech ecosystem includes a wide range of companies offering services such as mobile payments, micro-lending, insurance, digital banking, and blockchain. Notable fintech startups include M-Shwari (mobile-based savings and loan service), Tala (a mobile lending platform), and PayPal Kenya, which allow consumers and businesses to engage in secure online transactions. And between 2010 and 2017, fintech companies based in Kenya secured $204 million in funding, positioning the country at the forefront of East African fintech investment. This figure represented 28% of the total investments directed toward fintech's across the region during that time (Warigia, 2018), these innovations have contributed to increasing the percentage of adults served by formal financial service providers to 75.3% in 2016, compared to 66.9% in 2013, reflecting the progress made in digital financial inclusion (Ndung'u, 2017) , Kenya's experience demonstrates how fintech can lead to a transformative shift in the financial system, contributing to enhanced financial inclusion and driving economic growth.

- **Tanzania**

Before the emergence of digital financial services in Tanzania, access to banking services posed a significant challenge for a large portion of the population, particularly in rural areas. According to the first national survey of its kind (Fin Scope) conducted in 2006, a substantial share of adults—more than half—had no access to formal financial institutions. The concentration of banks in urban centres and their near absence in rural communities made it difficult for people in remote areas to carry out even basic financial transactions, such as sending money or obtaining a loan .This situation disproportionately affected economically vulnerable groups, including women, low-income farmers, and small business owners, who remained excluded from the formal financial system. As a result, their ability to save, expand their businesses, or achieve long-term financial stability was severely limited (FSDT & Mwatosya, 2024). The fintech sector in Tanzania is still lagging behind compared to other markets in the region, but in recent years, the country has seen significant growth in this field. This development can be attributed to proactive policies adopted by Tanzanian regulatory bodies, which have worked hard to foster innovation in fintech and expand financial inclusion across the country. One of the key steps was the establishment of the Tanzanian Information and Communications Technology (ICT) Commission in 2015 by the government, which played a major role in advancing the country's digital transformation. At that time, fintech services were mainly limited to basic operations such as mobile phone top-ups, money transfers, and deposit and withdrawal transactions. However, these services laid the foundation for the

expansion of other digital financial solutions over time. These initiatives helped pave the way for the development of more diverse and inclusive financial services, improving access to financial services, particularly in rural and remote areas (Moodley, Pillay, & Thiel, 2024).

- **Uganda**

Uganda's fintech ecosystem has witnessed significant growth in recent years, driven by the rapid expansion of mobile phone usage and digital payment services. Key players in this ecosystem include mobile money providers such as MTN Mobile Money and Airtel Money, which enable millions of Ugandans to send and receive money, pay bills, and access basic financial services without the need for traditional bank accounts (Jacketeh, 2025) A supportive regulatory environment, led by the Bank of Uganda, has helped establish a favourable legal framework that encourages the growth of financial innovation while ensuring consumer protection (Coghlan, 2022). According to a report by WeeTracker, a total of 343 funding rounds for startups in Uganda were carried out between 2015 and 2020, raising approximately $85 million. Although this amount is modest compared to Kenya, which raised $375 million in 2020 alone, it still reflects notable progress in Uganda's fintech sector (Pharostudies, 2022).

2.4.3. Fintech ecosystem in West Africa

West Africa has witnessed progress in the field of financial technology in recent years. Among these countries we have, Ghana and Nigeria.

- **Ghana**

The financial technology (fintech) ecosystem in Ghana is rapidly evolving, driven by the convergence of telecommunications, banking, and financial services, with telecom companies playing a pivotal role in service delivery. Ghana has emerged as the fastest-growing mobile money market in Africa, revolutionizing the way financial transactions are carried out by allowing users to send, receive, and store money without the need for a traditional bank account. This development has significantly enhanced financial inclusion, especially in rural and underserved communities. In response to the growing demand for digital financial solutions, the Government of Ghana has launched several forward-thinking initiatives under the Digital Ghana Agenda. These include the establishment of a regulatory and innovation sandbox, which creates a safe space for fintech startups to experiment with new technologies and business models under the supervision of regulatory authorities. Additionally, the government is investing in digital infrastructure, promoting e-governance, and encouraging

public-private partnerships to accelerate innovation. These collective efforts are positioning Ghana as a leading fintech hub in West Africa, with the potential to drive sustainable growth and empower millions through accessible financial services. (AustraliaAfrica, n.d.).

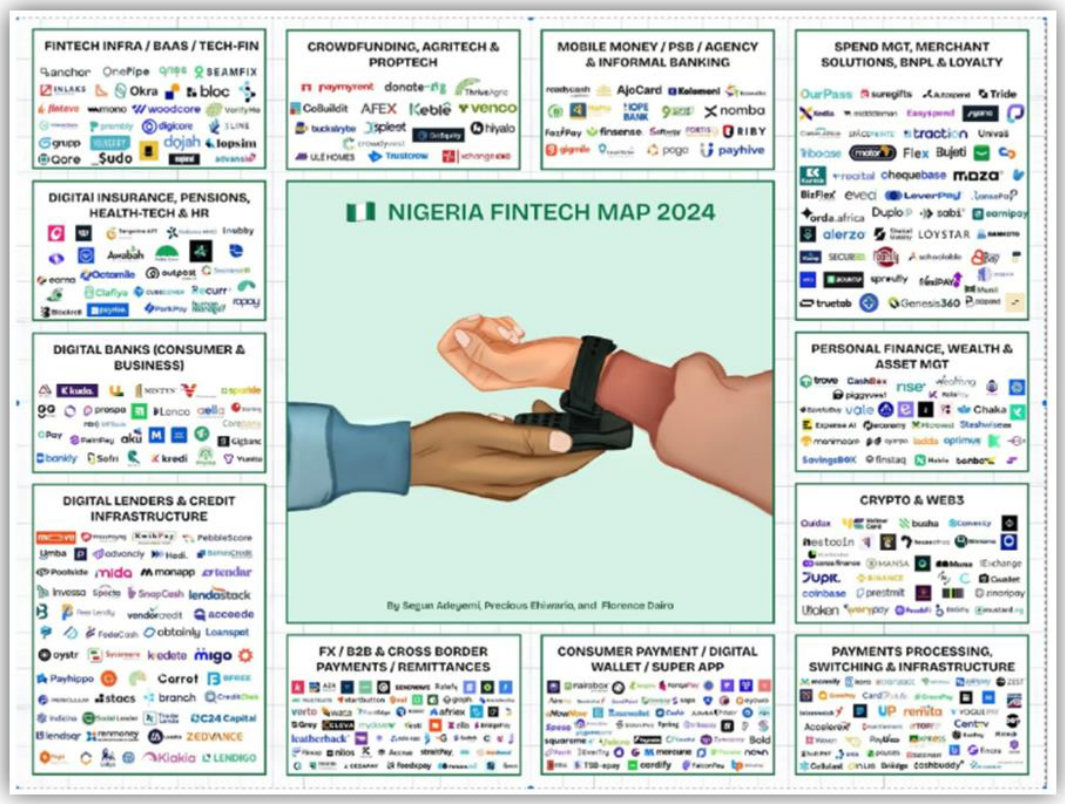
- **Nigeria**

Nigeria is home to some of the most prominent and innovative fintech ventures in Africa and is considered one of the continent's "Big Three" fintech markets. In 2023, out of 678 fintech startups across Africa, 217 originated from Nigeria, accounting for 32% of the total reinforcing the country's reputation as a fintech hub. This figure represents a 50.1% increase from 144 startups in 2021, which itself had grown from 101 in 2019 and 74 in 2017. Nigeria's share of the continental fintech market has also seen steady growth, rising from 20.6% in 2019 to 25% in 2021, and reaching 32% in 2023. Several key factors have contributed to Nigeria's leadership in the African fintech space. In addition, the growing comfort of Nigerians with online shopping has fuelled a rising demand for digital purchases, creating opportunities for fintech companies to step in particularly through solutions like Buy Now, Pay Later (BNPL) models. Whether by providing payment systems or lending infrastructure, fintech startups play a key role in supporting the growth of eCommerce. With projections estimating the number of online shoppers in Nigeria to reach 122 million by 2025, the potential for fintech innovation in this space is immense (Moodley, Pillay, & Thiel, 2024).

As of February 2025, Nigeria had over 430 fintech companies, showing significant growth compared to the 255 recorded in January 2024. This sharp rise highlights the rapid expansion of the country's fintech sector within just one year (FintechNewsAfrica, 2025).

In a summary, Nigeria fintech sector has rapidly evolved into one of Africa's most dynamic financial ecosystems. The figure shown underneath presents a map of Nigeria fintech's companies, it provides a comprehensive overview of the key players in shaping Nigeria's digital financial innovations.

Figure 3.20: Nigeria fintech map 2024



Source: Fintechnews Africa. (2025, March 13). Nigeria's Fintech Sector Surges 70% Despite Challenges. Retrieved from https://fintechnews.africa/44869/fintech-nigeria/nigerias-fintech-sector-surges-70-despite-challenges/

2.4.4. Fintech ecosystem in Southern Africa

We know that the Southern Africa region is characterized by prosperity and development due to its support for the field of digitalization and investments in financial technology. Among the countries concentrated in Southern Africa that will be included in our study are Zambia and South Africa.

- **Zambia**

57 fintech companies are presently active in Zambia, according to UNCDF. Since the UNCDF fintech landscape survey in 2018, which found 25 fintech market participants, this number has more than doubled that's why, the use and adoption of digital financial services has increased significantly in Zambia over the past ten years. The financial sector is becoming more diverse and accessible due to digital financial services. Any individual could open a digital wallet with just their National Registration Card via a progressive approach to know-your-customer (KYC) regulations implemented in 2018 by the Bank of Zambia, which oversees banks and non-bank financial firms (Malambo, Holly, Kambandu, Adongo, &

Katimbo, 2023). Debit and credit cards, online and mobile banking, automated teller machines (ATMs), point of sale (PoS), e-commerce, mobile money, and digital credit are examples of how technology is used in Zambia to provide financial services and goods. Mobile platforms are important channels for the growth of fintech innovations in Zambia. The traditional banking industry and other utility services platforms started fintech technologies for push and pull transaction processing, bill payment, insurance, and travel reservations, among other uses (Nason Kapako, Alutul, Banda, & Mulenga, 2024).

- **South Africa**

South Africa stands out for its development and prosperity, and its fintech ecosystem is considered one of the most mature in the African continent. This is due to substantial investments in financial innovation, which have positioned the country at the forefront of the financial sector. South Africa's prominent position in Africa's fintech sector is reflected in the size and diversity of its fintech ecosystem. As of 2023, the country hosted around 140 fintech startups, accounting for approximately 20.6 percent of all such ventures across the continent, based on data from Disrupt Africa's FInnovating for Africa 2023 report. This makes South Africa the second-largest hub for fintech in Africa, trailing only Nigeria, which leads with 217 startups and a 32% share of the market (FintechNewsAfrica, 2024). Within this dynamic ecosystem, a number of South African fintech firms have established themselves as leaders in their respective niches, experiencing rapid growth and attracting significant investment interest.

The most important of these companies are:

- Yoco: Yoco specializes in providing point-of-sale payment solutions tailored for small enterprises. The company delivers various services, such as card readers and online payment gateways, simplifying the payment acceptance process for merchants. With increasing demand for its payment devices nationwide, Yoco now supports a network of 350,000 local businesses.

- Jumo: jumo operates as a mobile money platform offering financial solutions to individuals who often lack access to conventional banking services in micro finance. By leveraging data science and machine learning, the company tailor's financial products to meet the specific needs of its users. By 2021, Jumo had successfully raised $120 million in funding to expand and enhance its service offerings (Moodley, Pillay, & Thiel, 2024).

South Africa's support for financial innovation has contributed to enhancing financial inclusion and achieving economic development. Despite existing challenges, promising opportunities remain, making the country's digital future increasingly bright.

In summary, the dominant fintech structure in Africa is observed in Nigeria, Kenya, South Africa and Zambia which facilitate digital payments for businesses and individuals, improving e-commerce and online transactions. In other nations, Tanzania is by far the best example with extensive mobile money usage for everyday payments. Uganda is capitalising on FinTech to enhance credit access as a means of financial inclusion and access opportunity. Zambia is on course using digital platform for government payments and more widely for financial inclusion initiatives. In North Africa modernising banking and providing financial services to the unbanked are the main goals of the initiative. Funding programs are also being developed to encourage startups in the financial technology industry and to develop digital payments services as a result an economic growth.

3. Fintech, Financial inclusion and Economic growth: Empirical Study

3.1. Methodology and data

Many studies and researches were carried out to study the impact of financial technology in promoting financial inclusion and economic growth, given the importance of this topic from the financial and economic perspective for any country, among these studies, we find many literatures that analysed this relation. We find, *Mihasonirina A., & Kangni K. (2012) Mohammed Jasim Mohammed (2020), Qusay Ali Dheyab, L.Mustafa.A Salam and Haider M. Kareem (2023), Nadjet Ouis, Djelloul Cherifi and Youcef Souar (2023),* and many others that explored this impact (See Literature Review). Therefore, this study will contribute to the existing researches by giving more information about this relation in Africa context.

In the other hand, by using the available data for the period 2004 to 2021 and applying a panel data model in our diagnostic, this research aims to analyse this relationship from early stages, and we will delve more in this topic for the African regions. There are many indicators that can be used for this study, but due to the study period and the chosen countries, we stick with the following indicators, the main dependent variable to measure the economic growth is GDP per capita, in addition, our independent variables are: the number of ATMs per 100.000 adults for financial technology, domestic credit to private sector ratio to GDP and bank deposits ratio of GDP as variables that capture main dimension of inclusion which is access, in addition we use the financial development index to measure the access, depth and efficiency of financial

system, and finally to assess this impact and investigate it, we add control variable which is population growth ratio. Moreover, many related studies used the same variables and indicators. We start by, *Muntaj Abida, Sima Mohsen Alawi Al-Obaidi (2022), Garidi R. and Karama S. (2022) and Kardoussi Maroua (2024)* they used ATMs, domestic credit to privet sector, bank deposits as proxy for fintech and financial inclusion. Next, for the GDP per capita was applied by *Massinissa (2023), Nadjet Ouis, Djelloul Cherifi and Youcef Souar (2023), Obed Kipkemboi Tiony (2024) and Meshesha Demie Jima, Patricia Lindelwa Makoni (2023)* to capture growth.

The data collection was based on World Bank data bases and IMF data sets. Furthermore, all the mentioned studies applied on the period approximately from the early 2000 to 2020 or 2021. To analyse this effect, we adopt for our panel data model an ARDL approach for the purpose of capturing both short-run and log-run relationship between our variables, this method was employed in many analyses as a powerful tool to measure the financial/economic phenomena.

Meshesha Demie Jima, Patricia Lindelwa Makoni (2023) applied an ARDL model in panel of 26 sub-Saharan African countries over the 2000-2019 period. And this aligns with our selected approach. The table below show a summarise for our sampled countries.

Table 3.4: Countries of the study

North Africa	**Sub-Saharan Africa**
Algeria, Tunisia and Morrocco	Kenya, Nigeria, Ghana, South Africa, Tanzania, Uganda, and Zambia

Source: prepared by the researchers

3.2. Data definition

The next table defines the dependent, independent and control variables.

Table 3.5: Definition of variables and sources

Variable	Definition	Source
GDP per capita	GDP per capita is the sum of gross value added by all resident producers of a given country divided by the total population.	•World Bank development indicators. (2023)
ATMs per 100.000 Adults	the total number of Automated teller machines for every 100,000 adults in the reporting country. Calculated as (number of ATMs) *100,000/adult population in the reporting country.	•World Bank development indicators (2023)
DCPS	Domestic credit to private sector (% of GDP) refers to financial resources provided to the private sector by financial corporations.	•International Monetary Fund, International Financial Statistics and data files, Global financial development indicators (2021)
BDGDP	Bank deposits to GDP (%) is the total value of demand, time and saving deposits at domestic deposit money banks as a share of GDP. Deposit money banks comprise commercial banks and other financial institutions.	• International Monetary Fund, International Financial Statistics and data files Global financial development indicators (2021)
FDI	Financial development index measures the strength and efficiency of financial institutions and markets.	•International Monetary Fund, International Financial Statistics and data files Global financial development indicators (2021)
POP	Population growth % Annual population growth rate. Population is based on the de facto definition of population.	•World Bank development indicators (2023)

Source: prepared by the researchers

3.3. Methodology

Autoregressive Distribution Lag Model for our panel data. Initially, panel analysis was chosen based on the dynamic research topic, in order to capture the relationship between our variables across countries over time. This methodology is adopted when dealing with a mix of stationary at level I (0) and non-stationary I (1), we executed a stationarity test using both (PP) Phillips-Perron test and (ADF) Augmented Dickey-Fuller test to determine whether a time series is stationary or non-stationary. Afterward, a pooled mean group (PMG) and mean group (MG) techniques were applied to capture both short and long run effects, verifying cointegration. Following this, (ECT) is utilised to analyse the short run adjustments towards equilibrium. Diagnostics residual test was implemented to ensure the validity and reliability of

our results. The entire estimation process is conducted using EViews 14 software, providing insights into the interactions between the studied variables in the panel data.

The ADF test extends the basic Dickey-Fuller framework by incorporating lagged differences to address autocorrelation determining whether a variable is stationary or non-stationary. The null hypothesis (H_0) states that the series has a unit root (non-stationary), while the alternative (H_1) suggests stationarity. While the PP test corrects for autocorrelation and heteroskedasticity using non-parametric adjustments. The null hypothesis (H_0) is the same as ADF which consists the presence of a unit root. Both tests help determine whether variables possess unit roots, which is crucial before proceeding with cointegration analysis.

The ADF test checks for unit roots in a time series and is given by the following equation:

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_t + \sum_{i=1}^{p} \delta_i \Delta Y_{t-1} + \varepsilon_t$$

- Y_t is the variable being tested
- ΔY_t represents the first difference
- α is a constant
- β_t accounts for trend
- γ is the coefficient for the lagged level
- δ_i represents lagged differences
- ε_t is the error term

The PP test can be expressed as the following equation:

$$\Delta Y_t = \alpha + \gamma Y_{t-1} + \varepsilon_t$$

- Y_t is the variable being tested
- ΔY_t represents the first difference
- α is a constant
- γ is the coefficient for the lagged level
- ε_t is the error term

The Johansen cointegration test, utilised to examine whether multiple non-stationary variables share a long-term equilibrium relationship. This method can identify multiple cointegrating equations, making it highly effective for panel data applications and it's based on Vector Error Correction Model (VECM), The test is defined by the equation below:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{p} \Gamma_t \Delta Y_{t-i} + \varepsilon_t$$

- Y_t is a vector of variables
- Π is the matrix that determines cointegration relationships
- Γ_t are short-run adjustment coefficients,
- ε_t is the error term

Following cointegration confirmation, estimation techniques such as the PMG, MG estimators, introduced by Pesaran, Shin, and Smith (1999), they are used within panel ARDL models. This foundation leads to the final estimation equation, which formally models the interactions between dependent and independent variables while accounting for both short-run and long-run dynamics. The general form of an ARDL panel equation is:

$$Y_{\text{it}} = \alpha + \sum_{p=1}^{p} \beta_p \, Y_{\text{it}-p} + \sum_{q=1}^{q} \gamma_q \, X_{\text{it}-q} + \varepsilon_{\text{it}}$$

This equation captures both long and short run relationship dynamics in panel data.

- Y_{it} is the dependent variable for country i at time t.
- $X_{\text{it}-q}$ represents independent variables with lags.
- β_p and γ_q are coefficients.
- ε_{it} is the error term.

Next, we have the error correction representations in the form below which separates the short run and long run effects.

$$\Delta Y_t = \gamma_0 + \sum_{i=0}^{p-1} \gamma_i \, \Delta Y_{t-i} + \sum_{j=0}^{q-1} \delta_j \, \Delta X_{t-j} + \emptyset \, (y_{t-1} - \theta_0 - \theta_1 X_{t-1}) + \varepsilon_{\text{t}}$$

Where:

- Δ denotes the first difference.
- γ_i and δ_j short-run coefficients.
- $\emptyset$ is the error correction term (ECT) coefficient, expected to be negative and significant.
- $(y_{t-1} - \theta_0 - \theta_1 X_{t-1})$ is the long-run equilibrium relationship.

- θ_1 is the long-run coefficient of $\mathcal{X}$ on $\mathcal{Y}$.

Using our variables we will have the following equation:

$$GDP_{\text{it}} = \alpha + \sum_{p=1}^{p} \beta_p \, \mathcal{Y}_{\text{it}-p} + \sum_{q=1}^{q} \gamma_q \, \mathcal{X}_{\text{it}-q} + \varepsilon_{\text{it}}$$

- GDP_{it} is the dependent variable for country i at time t.
- $\mathcal{X}_{\text{it}-q}$ represents independent variables (ATMs, DCPS, BDGDP, FDI, POP), with lags.
- β_p and γ_q are coefficients.
- ε_{it} is the error term.

Building upon the theoretical foundation established through stationarity assessments, cointegration analysis, and dynamic panel estimation techniques, and on the basis of some empirical investigation (*Meshesha, et al., 2023; Mohammed Jasim Mohammed 2020;* Soha, et al., 2024), the following model is formulated to investigate both the short-term dynamics and long-run determinants of economic growth, with GDP as the dependent variable. The model is defined as follows:

$$\boldsymbol{GDP_{it} = \beta_0 + \beta_1 ATMs_{it} + \beta_2 DCPS_{it} + \beta_3 BDGDP_{it} + \beta_4 FDI_{it} + \beta_5 POP_{it} + \varepsilon_{it}}$$

- GDP_{it} represents the dependent variable GDP per capita
- $ATMs_{it}$ is the number of automated teller machines for every 100,000 adults
- $DCPS_{it}$ is the domestic credit to private sector (% of GDP)
- $BDGDP_{it}$ represents the number of deposits (% of GDP)
- FDI_{it} is the financial development index
- POP_{it} represents the population growth rate
- ε_{it} is the error term.

3.4. Discussion results

3.4.1. Descriptive statistics

The table below presents a summary of descriptive statistics for the studied variable

Table 3.6: Descriptive statistics

Variables	LGDP	ATMS	DCPS	BDGDP	FDI	POP
Mean	7.5744	14.3331	28.2553	35.9133	0.2050	2.2058
Median	7.6095	9.1600	15.6778	28.7560	0.1661	2.3122
Maximum	9.0649	68.9600	70.3819	98.5394	0.5925	3.5666
Minimum	5.6781	0.0000	6.5290	0.0000	0.0783	0.6208
Std. Dev.	0.7997	15.5906	21.1187	22.5114	0.1264	0.8131
Skewness	-0.1832	1.9959	0.7685	0.8762	1.6726	-0.2036
Kurtosis	2.1461	6.6439	1.8791	3.1334	4.9760	1.7321
Jarque-Bera	6.4395	217.8690	26.9895	23.0392	112.5780	13.2266
Probability	0.0400	0.0000	0.0000	0.0000	0.0000	0.0013
Sum	1355.825	2565.630	5057.699	6428.475	36.697	394.835
Sum Sq.	10383.47	80039.640	222294.913	321071.508	10.365	988.618
Sum Sq. Dev.	113.8468	43266.1362	79388.0764	90203.9053	2.8420	117.6952
Observations	179	179	179	179	179	179

Source: prepared by the researchers based on EViews 14 outcomes.

3.4.2. Stationarity and cointegration tests

In order to determine whether a time series variable has a constant and variance over time. For ARDL model stationarity tests are crucial to identify if variables are integrated at level I (0) or first difference I (1), it's essential to ensure that none are integrated at the second difference I (2). Our data were tested using the PP test and ADF test, the results showed a mixed order of integration I (0) and I (1) indicating that the panel ARDL model is suitable.

a- Unit roots tests

Table 3.7: Unit root tests using PP, I (0)

At Level I (0)							
Variables		**LGDP**	**ATMS**	**BDGDP**	**DCPS**	**FDI**	**POP**
With Constant	t-Statistic	0.0341	0.0077	0.0021	0.0806	0.3082	0.9919
	Prob.	0.0005	0.7668	0.2399	0.0963	0.9087	0.9908
	Sig	***	n0	n0	*	n0	n0
With Constant & Trend	t-Statistic	0.3050	0.1884	0.0152	0.7205	0.8807	0.1009
	Prob.	0.1071	0.6842	0.3480	0.2834	0.0369	0.8647
	Sig	n0	n0	n0	n0	**	n0
Without Constant & Trend	t-Statistic	0.9855	0.9866	0.9815	0.9094	0.9680	0.1051
	Prob.	0.9860	0.9365	0.6914	0.5462	0.8958	0.0003
	Sig	n0	n0	n0	n0	n0	***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. And (no) Not Significant *MacKinnon (1996) one-sided p-values.

Table 3.8: Unit root tests using PP, I (1)

At First Difference I (1)							
Variables		**d(LGDP)**	**d(ATMS)**	**d(BDGDP)**	**d(DCPS)**	**d(FDI)**	**d(POP)**
With Constant	t-Statistic	0.0282	0.0000	0.0021	0.0800	0.1170	0.0160
	Prob.	0.0152	0.0064	0.0093	0.0000	0.0011	0.2460
	Sig	**	***	***	***	***	n0
With Constant & Trend	t-Statistic	0.0894	0.0000	0.0047	0.0806	0.1334	0.0184
	Prob.	0.0153	0.0132	0.0132	0.0001	0.0080	0.6584
	Sig	**	**	**	***	***	n0
Without Constant & Trend	t-Statistic	0.0082	0.0001	0.0005	0.0113	0.0325	0.0147
	Prob.	0.0043	0.0043	0.0005	0.0000	0.0003	0.2436
	Sig	***	***	***	***	***	n0

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant *MacKinnon (1996) one-sided p-values.

Table 3.9: Unit root tests using ADF, I (0)

At Level I (0)							
Variables		**LGDP**	**ATMS**	**BDGDP**	**DCPS**	**FDI**	**POP**
With Constant	t-Statistic	0.2588	0.1285	0.1114	0.0806	0.2775	0.9980
	Prob.	0.0641	0.7643	0.2642	0.1094	0.9036	0.9985
		*	n0	n0	n0	n0	n0
With Constant & Trend	t-Statistic	0.4335	0.1979	0.1540	0.7205	0.8807	0.7380
	Prob.	0.2609	0.6842	0.3480	0.9391	0.0341	0.7477
		n0	n0	n0	n0	**	n0
Without Constant & Trend	t-Statistic	0.9801	0.7514	0.9697	0.9425	0.9105	0.0725
	Prob.	0.9860	0.9438	0.6471	0.4415	0.8898	0.1309
		n0	n0	n0	n0	n0	n0

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant *MacKinnon (1996) one-sided p-values.

Table 3.10: Unit root tests using ADF, I (1)

At First Difference I (1)							
Variables		**d(LGDP)**	**d(ATMS)**	**d(BDGDP)**	**d(DCPS)**	**d(FDI)**	**d(POP)**
With Constant	t-Statistic	0.0256	0.0000	0.0024	0.0747	0.1246	0.3890
	Prob.	0.0150	0.0067	0.0121	0.0000	0.0025	0.0456
	Sig	**	***	**	***	***	**
With Constant & Trend	t-Statistic	0.0701	0.0000	0.0071	0.0800	0.1334	0.0029
	Prob.	0.0159	0.0253	0.0584	0.0001	0.0145	0.0474
	Sig	**	**	*	***	**	**
Without Constant & Trend	t-Statistic	0.0069	0.0000	0.0006	0.0098	0.0334	0.3969
	Prob.	0.0043	0.0041	0.0006	0.0000	0.0004	0.5747
	Sig	***	***	***	***	***	n0

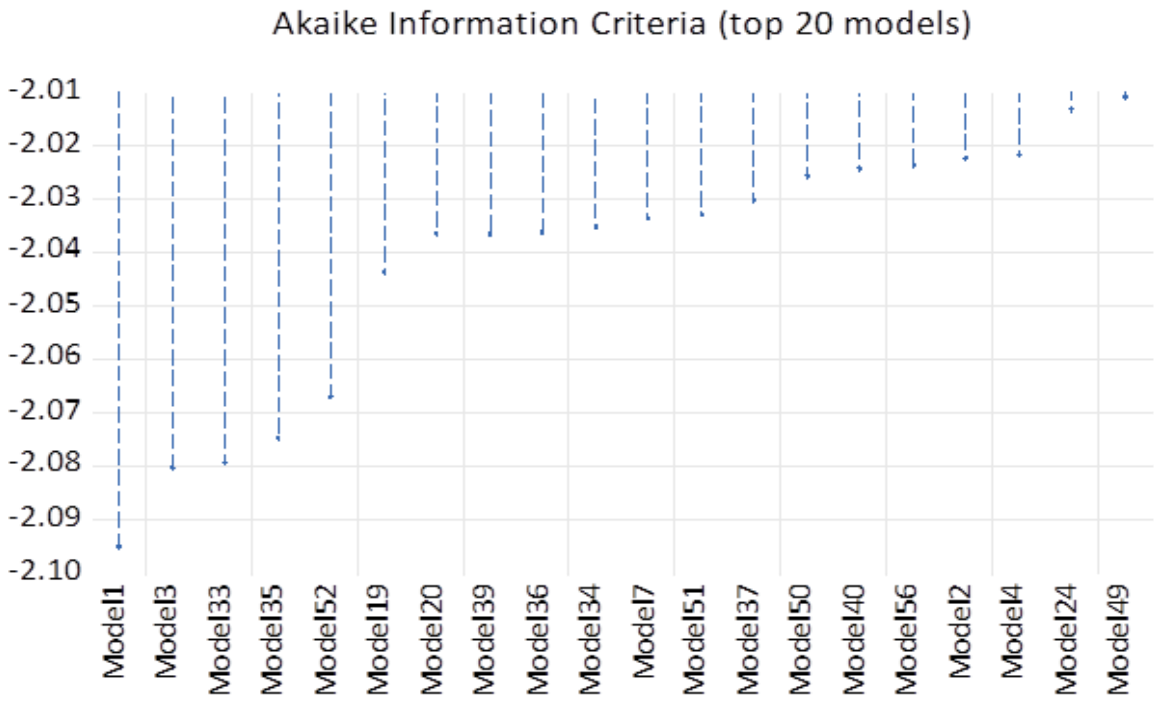
Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant *MacKinnon (1996) one-sided p-values.

Since all the variables are stationary either at Level (0) or 1st difference (1) based on ADF and PP tests and none variables are integrated in order I (2), we can apply the ARDL model for our study, which can accommodate variables that are a mix of I (0) stationary at level and I (1) stationary after first differencing.

3.4.3. ARDL model selection

We worked with an ARDL model of (2.1.1.1.1.1) because it has the lowest AIC value, among 64 other models evaluated.

Figure 3.21: AIC Values for ARDL models



Source: prepared by the researchers based on EViews 14 outcomes.

- **(Johansen-Hendry-Juselius): Cointegrating test**

Table 3.11: Johansen-Hendry-Juselius cointegration test

Hypothesized	Fisher Stat.*		Fisher Stat.*	
No. of CE(s)	(from trace test)	Prob.	(from max-eigen test)	Prob.
None	0	1	0	1
At most 1	267.6135	0.0000	208.6414	0.0000
At most 2	491.4573	0.0000	435.2178	0.0000
At most 3	269.4657	0.0000	213.9333	0.0000
At most 4	137.7024	0.0000	99.8901	0.0000
At most 5	81.4416	0.0000	81.4416	0.0000

Source: prepared by the researchers based on EViews 14 outcomes.

The Johansen Fisher panel cointegration test reveals strong evidence of long run equilibrium relationships among the six variables across the panel. Both the trace and maximum eigenvalue tests reject the null hypothesis of no cointegration at all ranks up to four. Also at the individual country level, 8 out of 10 countries exhibit at least 4 cointegration relationships at the 5 percent significance level. We applied this test as first confirmation of cointegration between our studies variables. Furthermore, we proceeded with the ARDL pooled mean group and mean group estimations.

3.4.5. Panel ARDL estimation results

In the following, we will present the cointegration results using pooled mean group and mean group estimation, along with Hausman test, which help to determine whether we choose PMG estimators or MG estimators based on the p-value. The table below represent both PMG and MG estimators along with Hausman test:

Table 3.12: PMG and MG estimators

Variables	PMG long-run	MG long-run	Variables	PMG short-run	MG short-run
ATMs	0.0044477 (0.0026) ***	0.132390 (0.1711)	D(ATMs)	0.020516 (0.3510)	-2.63E-05 (0.9993)
DCPS	0.010509 (0.0000) ***	-0.010438 (0.8187)	D(DCPS)	-0.024898 (0.0169) **	-0.005939 (0.6925)
BDGDP	-0.012059 (0.0000) ***	-0.050752 (0.1242)	D(BDGDP)	-0.007097 (0.3140)	0.006660 (0.4815)
FDI	1.648814 (0.0000) ***	17.663498 (0.3313)	D(FDI)	1.184322 (0.3514)	3.571667 (0.2123)
POP	-0.501223 (0.0000) ***	0.105298 (0.8505)	D(POP)	0.062602 (0.7554)	0.579107 (0.2759)
C	8.426219 (0.0000) ***	6.620626 (0.0075) **	ECT	-0.492430 (0.0504) *	-0.486734 (0.1692)
Hausman test	0.2314 p-Value > 0.05		D(LGDP(-1))	0.011174 (0.9621)	-
Number of Obs	159				
Dependent variable	LGDP				

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%; between () prob.

Source: prepared by the researchers based on EViews 14 outcomes.

The table presents the results of the ARDL model estimated using both PMG and MG estimators and Hausman test, we observe a statistically long-run relationship according to PMG while the MG estimators does not show a significant effect. The Hausman test provides a p

value greater than 0.05. Relying on this outputs, Hausman test confirms that PMG is more efficient, the results show the following key findings:

Table 3.13: Panel ARDL estimation outputs summary

Equation name:	**EQ01**	**Estimation outputs summary**				
Method:	**ARDL**					
Dep. Var: D(LGDP)						
Indep. Var	**ATMS**	**DCPS**	**BDGDP**	**FDI**	**POP**	**C**
coefficients	0.0044765	0.01050948	-0.01205855	1.648814	-0.50122	8.426219
T-statistic	[3.0615] **	[8.0195] **	[-8.7618] **	[5.7978] **	[-9.4969] **	[48.4521] **
Std. Error	(0.0015) **	(0.0013) **	(0.0014) **	(0.2844) **	(0.0528) **	(0.1739) **
Observations: 159						
R-squared: 0.7692						
F-statistic: 6.7547						
Prob(F-stat): 0.0000						

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%; between () indicate Std. Error and brackets indicates t-statistic

Source: prepared by the researchers based on EViews 14 outcomes.

Derived from these results, we observe an R-squared value of 0.7692 which means that approximately 76.92 percent of the variation in the dependent variable is explained by the independent variables in the model, The PMG model results reveal a significant long-run relationship between the studied independent variables and GDP per capita across ten African countries from 2004 to 2021. Specifically, ATMs, DCPS, FDI have a positive and statistically significant impact on long-term economic growth. In contrast, population and deposits are negatively associated with GDP per capita in the long run and the most short-run coefficients are insignificant. The analysis finds the following results:

- ATMs: variable that measure fintech infrastructure has a positive impact on log-run growth, which means that fintech play a key role in driving economic growth. As a main component of fintech, ATMs expand access to banking services allowing more individuals to deposit, withdraw and transfer money, this will increase accessibility, foster savings, investment, as well as economic activity. This finding aligns with the progress observed in financial infrastructure across studied countries. In North Africa, efforts are made to promote financial inclusion through ATMs expansion and relatively stable economic growth, meanwhile in west and east Africa increased ATMs has supported the availability of financial services especially in urban areas contributing to region growth. Southern Africa has long invested in fintech by facilitating ATMs access

which enable broader economic participation and over time translates into higher GDP per capita.

- DCPS: domestic credit to private sector by banks is highly significant and positive, this variable measure individuals' access to credit through our panel as main indicator for financial inclusion in it's both dimension access and usage, it has a positive impact on economic growth. This crucial role is highlighted by enabling people to more credit access, it allows them invest in productive activities and improve their economic statue leading to higher GDP growth in the long-run. In fact, credit availability plays a crucial role in economic growth in our panel countries, with a mixed nature of economy system in majority of the nations, they have made a significant progress in promoting credit through regulations, sector reforms, lending platforms and empowering SMEs.
- BDGDP: results show that this variable has a negative impact on GDP growth for the long-run. It is explained by a financial intermediation gap in the African countries, banks mobilise deposits but don't transform these funds into effective credit, also deposits in the most time are passive savings, not used for investments or consumption and only concentrate on traditional deposits systems. The results match regions financial systems dynamics, this is confirmed by the fact that most countries show a high deposits rate especially in Kenya, South Africa and Uganda. This reality affirm that excess liquidity is often not invested in growth driven sectors and not effectively used in productive investments, leading to the absence of the economic impact.
- FDI: financial development index shows a significant and positive relationship on GDP, moreover a developed financial system drives economic growth. This index refers to access to financial services, depth and efficiency the findings assure that when financial systems improve, economies grow faster and more inclusively, bringing more people into the formal economy, bridging gaps and significantly contributes to an increase in GDP per capita. These results fit with the broader economic reality that more inclusive financial systems simulate growth as it is found in (*Christelle, et al., 2025; Mac junior, et al., 2020*). In particular financial development index reflects how financial reforms and expanded access across the studies regions from digital solution banking in Kenya, Tanzania and Uganda to capital and funds development in Southern and North Africa that have supported productive investments which plays a pivotal role in affecting growth.

- POP: population growth rate presents a negative relation with GDP, population growth may lead to lower per capita growth in the African countries. Many African economies suffer from unemployment, so a high population growth present a challenge to increasing GDP per capita.

Based on these outcomes, the final estimated panel ARDL pooled mean group model equation, between GDP per capita and the key financial and demographic variables across the ten African countries over the period 2004-2021:

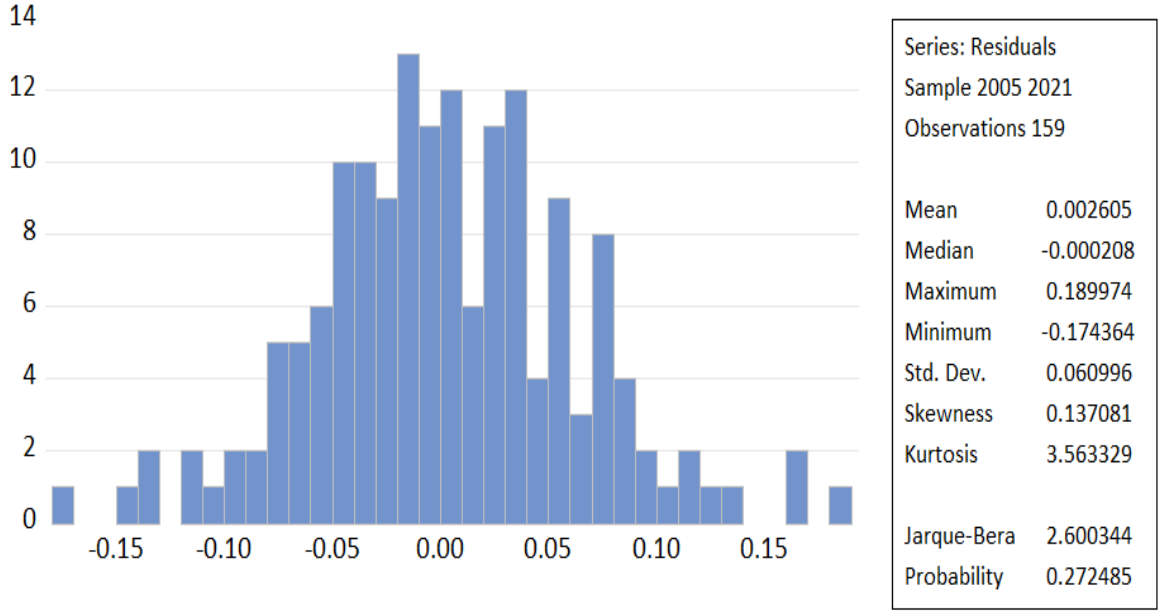
$$GDP_{it} = 8.4262 + 0.0044\, ATMs_{it} + 0.0105\, DCPS_{it} - 0.0120\, BDGDP_{it} + 1.6488\, FDI_{it} - 0.5012\, POP_{it} + \varepsilon_{it}$$

In summary, we found that the hypotheses were released digital inclusion and financial development drive long-run economic growth and has a positive and significant impact on it. In addition, the error correction term at the short and long-run coefficients are negative and significant at 5 percent level of significance, then any deviation from equilibrium is corrected at an adjustment speed around 49 percent, which indicate a strong cointegration between fintech, financial inclusion and economic growth. Meanwhile, in the short-run effects, variables are mostly insignificant, which is expected and common that digital financial inclusion takes time in order to affect GDP growth in macro panels, where adjustments take time, except for the DCPS that shows a negative and significant impact in the short term across the panel countries. This is interpreted by the fact that even when credit is productive in the long run, it's not the case in short-run, because their returns and outputs are long. The results were aligned with many literatures (*Meshesha, et al., 2023 ; Tough, et al., 2024 ; Nadjet, et al., 2023*) that applied similar studies in the African context, they found that inclusion does not affect GDP growth in short term, in addition, in terms of the significance, inverse relationship of bank deposits variable additionally, ATMs, access to credit and financial development index variables significance and positive impact with economic growth.

- **Residual diagnostic tests**

Residual diagnostic tests play a pivotal role in panel ARDL model in order to assess the validity of the estimated relationship. Among these tests, we have the normality distribution test to determine whether residuals across different units are normally distributed. Proper residual diagnostic allows to validate the model results providing reliable and economically meaningful interpretations.

Figure 3.22: Normality test Jarque-Bera



Source: prepared by the researchers based on EViews 14 outcomes.

This figure shows the results of Jarque-Bera test, the findings confirms that the estimated model follows a normal distribution, as the p-value>0.05, this supports the acceptance of the hypothesis stating that the residuals are normally distributed.

Conclusion

Fintech has become a driving force in advancing financial inclusion and fostering economic growth, this chapter has explored the fintech and inclusion landscape in the selected countries, analysing key trends and their implications through a rigorous methodology and data-driven approach. As explored in this chapter, fintech has reshaped access to financial services in the chosen panel nations, providing innovative solutions to bridge economic gaps and empower underserved populations.

By applying an Auto-Regressive Distributed Lag (ARDL) model on a panel data, this empirical study has identified substantial long-term connections between fintech, financial inclusion, and economic growth. However, fully realising digital inclusion potential requires collaboration among policymakers, financial institutions, and technology providers to establish inclusive and sustainable frameworks that ensure equitable access to financial services.

General conclusion

General conclusion

This research has explored the journey of financial technology and how it has emerged as an advanced digital solution that simplifies financial operations and reshaping financial systems worldwide. Its agility and efficiency have created new economic opportunities, enabling individuals and businesses to participate more actively in the financial ecosystem by empowering individuals who were previously excluded from formal financial systems and give them access to a wide range of financial services through a simple mobile phone which has evolved into a powerful financial tool, enabling users to save, transfer money, invest, and access an expanding array of fintech services. Moreover, fintech remains a necessary innovation for achieving financial inclusion in all its dimensions and accelerating economic growth by enhancing efficiency in transactions, reducing costs, and fostering innovation in financial intermediation. However, alongside its advantages, fintech presents notable risks such as cybersecurity threats including data breaches and hacking as well as regulatory and legal challenges, it is crucial to find the right balance between innovation and regulation to ensure stability and security while driving sustainable growth.

In this research, we have studied the case of Africa which presents the transformative role of fintech in fostering financial inclusion and economic growth. In developed markets, fintech complements existing banking services, while in Africa it serves as the primary gateway to financial access. It enables individuals and businesses to perform essential transactions, unlock new economic opportunities, and drive innovation. This study offers an in-depth examination of the evolution of financial technology, its contribution to financial inclusion, and its influence on economic growth. It explores the fundamental principles of fintech and financial inclusion and their contribution to economic growth, supported by an empirical analysis of ten African nations, detailing their financial and economic systems, alongside the state of digital inclusion adoption within these countries.

Following this, by employing an integrated methodological approach to examine the financial ecosystems of the selected African countries and conducting comprehensive analyses of Africa's economic landscape, we concluded that, Africa presents a complex landscape characterised by both significant challenges and promising opportunities. Historically, financial exclusion has shaped economic disparities across the continent, but the ongoing digital transformation is redefining access to financial services and becoming a fundamental driver of economic progress and inclusive growth. Despite resource constraints, Africa has

demonstrated exceptional creativity in developing remarkable digital models that have not only transformed financial services but also redefined financial inclusion itself. Africa has established itself not merely as a consumer of technological advancements but as an innovator, actively shaping its own development.

The findings of this study, derived from an analysis of the economic and financial structures of our panel nations, have clearly demonstrated that the integration of financial technology has profoundly reshaped global financial accessibility, promoting economic inclusion, empowering underserved populations and eliminated conventional obstacles to financial services. This vision of leveraging technology to address human needs serves as a common ground and a foundational framework for building a more inclusive and equitable financial future.

However, this progress is accompanied by several critical concerns, as financial technology ecosystems across the continent are not progressing at the same pace. In fact, it is found that significant disparities exist among countries in terms of digital infrastructure, regulatory readiness, and the level of coordination between government entities and the private sector.

Therefore, the development of financial technology ecosystems in Africa goes beyond merely creating digital tools, it requires a holistic approach that takes into account human, institutional, and developmental dimensions. Such an approach must strive to strike a balance between innovation and regulation, as well as between expansion and equity, in order to achieve a genuine financial transformation that meets the aspirations of the continent's individuals.

The empirical evidence -derived from a range of quantitative variables such as the number of automated teller machines, the volume of credit extended, population growth rate, and the gross domestic product- demonstrates statistically and economically significant results that highlight the vital role of financial technology in expanding the scope of financial inclusion and economic growth in the long term, which is consistent with the initial hypothesis. It became evident that the expansion of digital services and increased reliance on fintech tools directly contribute to the improvement of financial inclusion indicators. This study has shown that the presence of banking mechanisms in underserved rural areas contributes to reducing the financial gap and enables individuals and small enterprises to access financial services more easily. This, in turn, helps stimulate economic activity by increasing the volume of financial transactions, encouraging savings, and facilitating access to finance, which positively impacts

local investment rates and improves living conditions which provides confirmation of the supposed hypothesis proposing that ATMs in underserved and rural areas has a positive impact on financial inclusion and growth. Besides that, the increase of financing opportunities for marginalized groups empowers them to invest in economic activities, thereby stimulating economic growth. This evidence supports the hypothesis that credit access significantly boosts financial inclusion and economic growth. Furthermore, the study found that improving financial infrastructure, helps integrate a larger portion of society into the formal financial system. This, in turn, allows individuals and businesses to invest and produce, relatively driving economic growth. Eventually, these findings confirm the final hypothesis that financial development positively contributes to financial inclusion and economic growth. Finally, the evidence gathered affirms the validity of the three hypotheses of this research, demonstrating their significance within the analysed context.

Ultimately, it can be concluded that the current analysis affirms a positive relationship between the use of financial technology, greater financial inclusion, and economic growth. However, these findings also highlight the need for further research using broader comparative studies to better understand this dynamic. As digital finance continues to evolve rapidly, this research is expected to guide future economic policies and deepen academic investigations on economic modernization in Africa and beyond.

Recommendations

Based on the insights gained from this research, which confirms the positive and significant impact of fintech on inclusive economic growth, we can recommend:

- Expanding and providing a strong financial infrastructure in the African countries including more digital payment adoption and fintech diffusion which provide a larger impact and improve financial services delivery in rural and undeserved areas.
- Focus on financial inclusion strategies and credits allocations mechanisms to enhance access to credit, especially for productive sectors in an effort to promote economic growth.
- Strengthening financial development by improving financial sector depth, access and efficiency, and ensuring that financial services are affordable and reliable for individuals.
- The need for policies that balance demographic trends with economic capacity to help mitigate the effect of population growth on economic resources.
- Developing a clear regulatory framework, with the aim of facilitating the expansion of fintech companies, encouraging a sustainable growth.
- Encouraging cross-border collaboration between in the African region in term of technology and regulations.
- Long-term policies orientation focusing on long-term growth strategy rather than expecting immediate effects.

Future perspectives

The research focused more on the critical role of digital financial inclusion on economic growth, examined the long-run and short-run relationships in ten African countries from 2004-2021 using a panel ARDL model. Giving this dynamic and evolving nature of this topic, several potential prospects for future studies can be explored. Firstly, future research could integrate governance indicators to analyse how financial institutional quality moderates this relationship. Also, we could investigate how this impact affects a specific sector of the economy to help design a targeted policy. Finaly, in terms of panel ARDL models, future analyses could investigate this relation using non-linear econometric models to explore these effects in the African economies.

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