Ministry of Higher Education and Scientific Research

University of Algiers 3

Faculty of Economics, Commercials And Management

Department of Economics

وزارة التعليم العالي والبحث العلمي

جامعة الجزائر3

كلية العلوم الاقتصادية والعلوم التجارية وعلوم التسيير

قسم العلوم الاقتصادية

Fintech, Financial Inclusion and Economic Development: Evidence From MENA Countries

A Thesis in Economic Development
Submitted for the degree of The Third Cycle Doctorate (L.M.D)

By
Massinissa Ameziane

Supervisor of Thesis:
Prof.Dr Othmane Touat

Co-supervisor of Thesis
Dr. Hafid Boudiaf

Thesis committee members

Prof.Dr Dahmani Smail……..……....President of expert committee

Prof.Dr Othmane Touat …….……..…..…… Supervisor

Dr. Hafid Boudiaf……..……..…….Co-supervisor

Dr Chine Lazhar…….……..…..……Member

Prof/Dr Djellal Abdelkader……...……...…… Member

Prof/Dr Daoud Saadellah ……...…..……...…… Member

2023-2024

Acknowledgments

I am deeply grateful to my thesis supervisor, Prof.Dr. Touat Othmane, whose valuable insights have significantly enriched the quality and depth of my research.

I extend my appreciation to my co-supervisor, Dr. Hafid Boudiaf, for his guidance and support.

I would like to acknowledge the members of my PhD training committee led by Prof.Dr. Ismail Dahmani, for their invaluable contributions, constructive feedback, and dedication to fostering academic excellence in my work.

Special thanks are due to Prof.Dr. Barbara Casu and Prof.Dr. Meziane Lasfer from Bayes Business School, who graciously hosted me during my research visit to the UK. Prof.Dr. Meziane's provision of valuable academic resources greatly enhanced the quality of my research, and I am grateful for their generosity and support.

My sincere gratitude goes to my family for their enduring encouragement, unwavering love, and understanding during this academic odyssey.

Dedications

This thesis is dedicated to the memory of my late father whose inspiration continues to drive my pursuit of knowledge.

To my beloved mother for her boundless love and support.

To my two sisters for their constant support.

To my brother, his wife, and their precious daughter, for their encouragement and support.

Abstract

This study aims to highlight the pivotal role of fintech in fostering economic development within the MENA region through financial inclusion.

A mixed-method approach is used, which combines theoretical and case study analysis and literature review, in addition to an empirical study. To reinforce the findings, the empirical study investigates the impact of digital financial inclusion proxied by "Percentage of Individuals using digital payments" on economic growth proxied by "GDP per capita growth". Fixed-effect panel analysis was applied spanning three distinct periods: 2014, 2017, and 2020.

The results of this thesis reveal that digital financial inclusion is an important channel through which a robust fintech ecosystem helps to promote economic development in the MENA region.

Key words: Fintech, Blockchain, digital financial inclusion, sustainable development, the MENA region

ملخص

تهدف هذه الدراسة إلى تسليط الضوء على الدور المحوري للتكنولوجيا المالية في تعزيز التنمية الاقتصادية في منطقة الشرق الأوسط وشمال أفريقيا من خلال تعزيز الشمول المالي.

تم استخدام منهج مختلط يجمع بين التحليل النظري، دراسة الحالة ومراجعة الأدبيات، بالإضافة إلى الدراسة القياسية. لتعزيز النتائج ركزت الدراسة القياسية على دراسة تأثير الشمول المالي الرقمي "نسبة الأفراد الذين يستخدمون المدفوعات الرقمية"، على النمو الاقتصادي "نمو نصيب الفرد من الناتج المحلي الإجمالي". تم تطبيق تقنية التأثير الثابت لتحليل بيانات بانل على ثلاث فترات: 2014 و2017 و2020.

كشفت نتائج هذا البحث أن الشمول المالي الرقمي هو قناة مهمة يساعد من خلالها التكنولوجيا المالية على تعزيز التنمية الاقتصادية في منطقة الشرق الأوسط وشمال أفريقيا.

الكلمات المفتاحية: التكنولوجيا المالية، بلوكتشاين، الشمول المالي الرقمي، التنمية المستدامة، منطقة الشرق الأوسط وشمال أفريقيا

Table of contents

List of tables

List of figures

List of acronyms

Acronym	Definition
ATM	Automated Teller Machine
CAGR	Compound Annual Growth Rate
CBDC	Central Bank Digital Currencies
CGAP	Consultative Group to Assist the Poorest
DeFi	Decentralized Finance
DFI	Digital Financial Inclusion
DFS	Digital Financial Services
DLT	Distributed Ledger Technology
FIARI	The Financial Inclusion for the Arab Region Initiative
FINTECH	Financial Technology
FITF	Financial Inclusion Task Force
GMM	Generalized Method of Moments
GPFI	Global Partnership for Financial Inclusion
HDI	Human Development Index
ICT	Information And Communication Technology
MEA	Middle East and North Africa
MENA	Middle East and Africa
MNO	Mobile Network Operator
MSME	Micro, Small, and Medium Enterprises
NASDAQ	National Association of Securities Dealers Automatic Quotation System
NFT	Non-Fungible Token
OBRI	One Belt and Road Initiative
OLS	Ordinary Least Squares
P2P	Peer-to-Peer
PoS	Proof-of-Stake
PoW	Proof-of-Work
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
SWIFT	Society for Worldwide Interbank Financial Telecommunications
UNCDF	United Nations Capital Development Fund
UTAUT	Unified Theory of Acceptance and Use of Technology
VC	Venture Capital

List of appendices

Introduction

Preface

Financial services play a pivotal role in driving an economy. They facilitate essential transactions, such as transfers, payments, and the extension of credit. Additionally, they connect businesses with necessary financing by bridging them with depositors and investors. Therefore, improving the access to financial services has become imperative in developing countries where a large part of the population remains excluded from the formal financial system.

Financial inclusion which refers to the access of individuals and businesses to different financial services, is considered by the United Nations Capital Development Fund a key element in achieving some Sustainable Development Goals of 2030 Agenda. In addition, the World Bank Group considers financial inclusion as a key enabler to reduce extreme poverty and boost shared prosperity.

However, despite the recognition of all countries and organizations that financial inclusion has become one of the utmost necessities, its levels in developing countries remain very low. In MENA region, above 50% of adult population remain financially excluded according to global Findex 2021 report. The main reasons of this exclusion are high costs, geographical access, lack of documentations, in addition to religious concerns. In order to enhance financial inclusion in the countries of the region by overcoming these obstacles, governments in the MENA region have launched several initiatives and programs, including FIARI, Financial Inclusion Day, Financial Inclusion Task Force etc.

Fintech is considered one of the most important elements to achieve the objectives of these programs, as it has the potential to promote sustainable economic development by overcoming these longstanding obstacles to financial inclusion. Thus, promoting the adoption of fintech is important for the economies of MENA region to enhance financial inclusion and achieving some of their sustainable development goals including, reducing poverty and inequality and boosting their economic growth.

However, although FinTech is benefic for financial inclusion and economic development, it still contains some risks related to financial stability, making its adoption challenging for some countries in the MENA region. Through this study, we will look at an in-depth understanding of FinTech, in order to be able to identify its benefits and risks, and how to deal with it to make an optimal use of FinTech. We will also try to provide evidence of its role in promoting development and economic growth through financial inclusion channel.

1. Problem statement

In many developing regions, including the MENA region, limited financial inclusion poses a significant barrier to economic development. A substantial portion of the population lacks access to basic financial services due to geographical constraints, documentation challenges, and high transaction costs. While fintech has emerged as a promising solution, its potential impact on improving financial inclusion and, subsequently, enhancing economic development remains an open question. This study seeks to address this problem by answering the following important question: **How can fintech-driven financial inclusion support economic development in the MENA region?**

To be able to address the problem properly, the following questions need to be examined;

1- How fintech is interconnected to financial inclusion and economic development, and what are its risks?
2- What is the state of fintech and financial inclusion in MENA countries?
3- To what extent fintech-driven financial inclusion can promote growth in the MENA region?

2. Hypothesis

The research will be based on the following hypotheses:

1- Adopting fintech in a responsible manner is an important factor in promoting economic development through financial inclusion channel.
2- The MENA region with its large population, represents a worldwide fintech hub, which helps the region to achieve high level of financial inclusion.
3- Fintech-driven financial inclusion could help to promote economic growth in the MENA region.

3. Importance and objectives

It is widely recognized that fintech has the potential to contribute in achieving sustainable development goals through improving financial inclusion in developing countries, including the MENA region. Therefore, understanding the intricate dynamics between fintech, financial inclusion and economic development becomes imperative.

By answering the questions of this research, we aim to explain fintech and identifying its challenges and opportunities for MENA countries for a best regulation to achieve financial inclusion. In addition, the study aims to assess the impact of digital financial inclusion on

economic growth and development in MENA countries for the purpose of providing solid evidence for decision makers in finance and politics about the interrelationship between fintech financial inclusion and economic development, to take the necessary measures for an optimal use of fintech to achieve financial inclusion and sustainable development.

4. Methodology

To achieve these objectives, an analytical and case study approaches will be used to well understand fintech and financial inclusion and their landscapes in MENA countries, in addition to an empirical study to assess the impact of digital financial inclusion on economic growth.

Panel analysis will be used in the empirical study on a panel data of a sample of countries from the MENA region and some countries from SSA region, in addition to some other emerging markets.

For the empirical study, digital financial inclusion data proxied by "made or send digital payment" is collected from world bank database"global Findex 2021" from 2014 to 2021. Economic growth data proxied by GDP per capita is gathered from world bank development indicators.

5. Literature review

Many previous researches were conducted to study the interrelationship between fintech, financial inclusion and economic development. However, only few of them are focusing to assess this interrelationship in the MENA region.

The literature review is divided into three categories based on the type of the examined relationship. We will focus on the relationship between financial inclusion and economic development, then, the effect of fintech on financial inclusion and economic development. Finally, the impact of digital financial inclusion on economic growth.

Financial inclusion and economic development

(Chinoda & Mashamba, 2021a) used panel autoregression distribution lag method to examine the impact of financial inclusion on economic growth. The researchers used data from 23 African countries for the period 2004-2018. The results show that there is a positive long-run relationship between economic growth and financial inclusion.

(Emara & El Said, 2021) applied GMM dynamic panel model to examine the relationship between financial inclusion and economic growth in MENA countries, over the period 1965 to 2016. Different measures of financial inclusion were used considering individuals and

businesses access to finance. These measures included: "the number of bank accounts per 1000 adult population, bank accounts for corporates/enterprises, the number of bank branches and ATMs per 100,000 people, the percentage of firms using banks to finance investments, and the percentage of firms using bank loans for working capital and investment."

The researchers reveal that financial inclusion has a positive impact on per capita GDP growth in the selected MENA countries. However, a robust regulatory system supported is needed to make this positive impact effective.

(Nkwede, 2015) used Ordinary Least Square to explore the relationship between financial inclusion and economic growth in Nigeria from 1981 to 2013 using extrapolated time series data. The findings reveal that the amount of loans offered by rural bank branches and the number of bank branches providing financial services has a significant positive effect on Nigerian's economic growth.

(Saed Khalil et al., 2023) explored the relationship between financial inclusion and human capital development in 12 Arab countries for the 2004-2019 period. financial inclusion was proxied by the number of bank branches. Pooled mean group (PMG) method was used for the analysis. The results reveal that financial inclusion promote the human capital development in the long-term.

Effect of fintech on financial inclusion and economic development

(James Manyika et al., 2016) argues that digital finance will help 1.6 billion unbanked adults to get access to financial services. By using McKinsey's proprietary general equilibrium macroeconomic model, the study revealed that by 2025, GDP of emerging economies could increase by $3.7 trillion, which represent 6 % increase compared to a business-as-usual scenario. One-third of this increasing would come from additional investment resulted by promoting financial inclusion of individual and micro, small, and medium-sized businesses.

In another study, (Chinoda & Mashamba, 2021b) used structural equation model (SEM) to explore the interconnection between fintech, financial inclusion and income inequality. The study used data from 25 countries from Africa for the periods 2011, 2014 and 2017.

The findings show that financial inclusion is essential in mediating the connection between fintech and income inequality.

(Deng et al., 2019) applied fixed effect model and mediation effect analysis (MEA) to explored the relationship between FinTech and sustainable development. The study looked at data of P2P platform over the period 2009-2017 covering 31 Chinese provinces. The findings

show a U-shaped relationship between fintech and sustainable development, with a negative effect on sustainable development when the level of fintech is less than a certain critical value, and a positive impact when the level of fintech exceeds this threshold.

(Demir et al., 2022) used quantile regression analysis on a sample of 140 countries, to analyse the direct effect of fintech on inequality, and its indirect effect through financial inclusion. The researchers used global Findex data for years 2011, 2014, and 2017. The findings reveal that financial inclusion plays a key role in moderating the role of fintech in reducing income inequality.

(Yoke Wang Tok & Dyna Heng, 2022) used fixed effect panel analysis to analyse the impact of fintech on financial inclusion. The findings show that fintech proxied by leapfrog and capital raised has a higher positive correlation with digital financial inclusion than traditional financial inclusion.

(Daud & Ahmad, 2023) applied dynamic panel analysis on 84 countries for the period starting from financial crisis, to examine the relationship between financial inclusion, digital technology and economic growth. The results show that financial inclusion and digital technology has a positive effect on economic growth, and digital technology plays a role in mediating the impact of financial inclusion on economic growth.

(Emara & Mohieldin, 2021) applied General Method of Moments (GMM) dynamic panel method to explore the relationship between fintech and poverty in 12 MENA countries, 45 SSA countries and 70 emerging and developing countries from other regions, over the period 2004-2018. Three different measures were used to capture FinTech adoption: "the number of mobile cellular subscriptions per 100 people, the number of fixed broadband subscriptions per 100 people, and the percentage of people in the population who use the internet." The results reveal that fintech has a positive impact on poverty reduction in all the three regions.

Digital financial inclusion and economic growth and development

(Ozturk & Ullah, 2022) examined the effect of digital financial inclusion on economic growth and environmental sustainability in 42 OBRI economies by using 3 different methods of estimation (pooled ordinary least squares, two-stage least squares (2SLS) and generalized method of moments (GMM)) on panel data for the period 2007 to 2019. The researchers used "ATMs are taken as per 100,000 adults and debit cards are measured as card holders above 15 years of age" as proxy for digital financial inclusion. The finding revealed that digital financial

inclusion has a positive effect on economic growth while it has a negative environmental impact.

(Liu et al., 2021) used Bayesian vector autoregressive model (BVAR) to explore the relationship of digital financial inclusion development and economic growth. The study used panel data from 2011 to 2019 in different Chinese provinces. The results reveal that digital financial inclusion has a positive impact on economic growth.

(Shen et al., 2021) constructed the index of digital financial inclusion using data of 105 countries from World Bank and International Monetary Fund to be able to measure the level of digital financial inclusion. Four variables used as proxies of digital financial inclusion: "Percentage of Individuals using the Internet, Internet penetration rate, used a mobile phone or the internet to access an account, and Made or received digital payments in the past year." The researchers used spatial data of 86 neighboring countries to investigate the relationship between digital financial inclusion and economic growth. The findings reveal that digital financial inclusion has a positive effect on economic growth. The result shows also that there is a spillover effects on neighboring countries.

(Thaddeus et al., 2020) applied the vector error correction model to examine the relationship between digital financial inclusion and economic growth in the long run. In addition, to determine causality, the granger causality test was used. The study focused on 22 countries in the SSA region, over the period 2011 to 2017. The economic growth was proxied by GDP per capita, and digital financial inclusion was proxied by various indicators including; "Automated teller machines (ATM), the number of commercial bank branches, loan outstanding, mobile agent outlets, and mobile money transactions." The results of the study reveal that there is a positive long-run relationship between digital financial inclusion and economic growth in sub-Saharan Africa.

(Khera et al., 2021a) Used cross-sectional data to assess the effect of digital financial inclusion on economic growth in 52 developing countries for the averaged GDP spanning from 2011 to 2018. The results suggest that digital financial inclusion has a positive impact on economic growth.

In addition, the researchers used random effects estimation to identify the main drivers of digital financial inclusion in 52 countries for two periods 2014 and 2017. The findings reveal that financial literacy and digital literacy are key drivers of digital financial inclusion.

What distinguish this study from the above researches is that in this study we used the latest available data of financial inclusion and fintech, taking into account the effect of covid-19 on the fintech industry.

In addition, there're only few studies that examined the impact of fintech and financial inclusion in the MENA region. The most relevant one is (Emara & Mohieldin, 2021), where the researchers used GMM method to analyse the impact of fintech on poverty focusing on the MENA countries. However, while (Emara & Mohieldin, 2021) relied on: " Mobile cellular subscriptions, fixed broadband subscriptions, use of internet." as proxies for fintech adoption, which is a good choice to represent the underlying technologies of fintech, in our study we used the percentage of people who used digital payments to proxy fintech and financial inclusion at the same time. We believe that "The use of Digital Payments" represents better the state of fintech adoption in a given country.

6. Contribution

Based on a robust theoretical framework and a solid empirical study, this research intends to extend literature on the impact of fintech on economic development in the MENA region through financial inclusion channel for the period 2014-2021 with the latest available data from world bank, and to fill the gap by using an appropriate and innovative variable for Fintech adoption and digital financial inclusion in order to optimize the results.

7. Thesis Structure

The study is divided into three main chapters.

In the first chapter we will discuss fintech from different perspectives including its history, benefits and challenges, then we'll explore its role in promoting sustainable development through financial inclusion channel based on theoretical framework.

In the second chapter we will explore the state and landscape of financial inclusion and fintech ecosystem in the MENA region, we will analyse the statistics from global Findex 2021.

Finally, in the third chapter an empirical study will be conducted to investigate the role of digital financial inclusion in promoting economic growth in the MENA region and some other developing and emerging countries from other regions, to reinforce the theoretical and conceptual framework with empirical evidences.

Chapter 1. The relationship between fintech, financial inclusion and economic development- The theoretical framework

Preface

Digital finance and financial technology are always associated with promoting financial inclusion and achieving some of the sustainable development goals, but we must not overlook the fact that they also contain some risks that may harm financial stability if they are not adopted with vigilance.

In order to carry out a comprehensive and solid study, building a robust theoretical framework about the interrelationship between fintech, financial inclusion and economic development is a necessary stage, as it represents the foundation of the study.

In this first chapter, we will first provide in the first section a detailed explanation of financial technology, starting with its definition, history, and then the most important emerging technologies that have greatly affected financial services. Then, in the second section, we will discuss the most important theories that emphasize the interrelationship between fintech, financial inclusion and economic development. At the end of the chapter, we will build a conceptual framework explaining how financial technology affects economic development through the channel of financial inclusion, while identifying the risks and obstacles of fintech avoid and overcome them.

1.1. Fintech overview

In this section we will investigate the history and different segments of fintech for the purpose of providing an in-depth understanding of fintech.

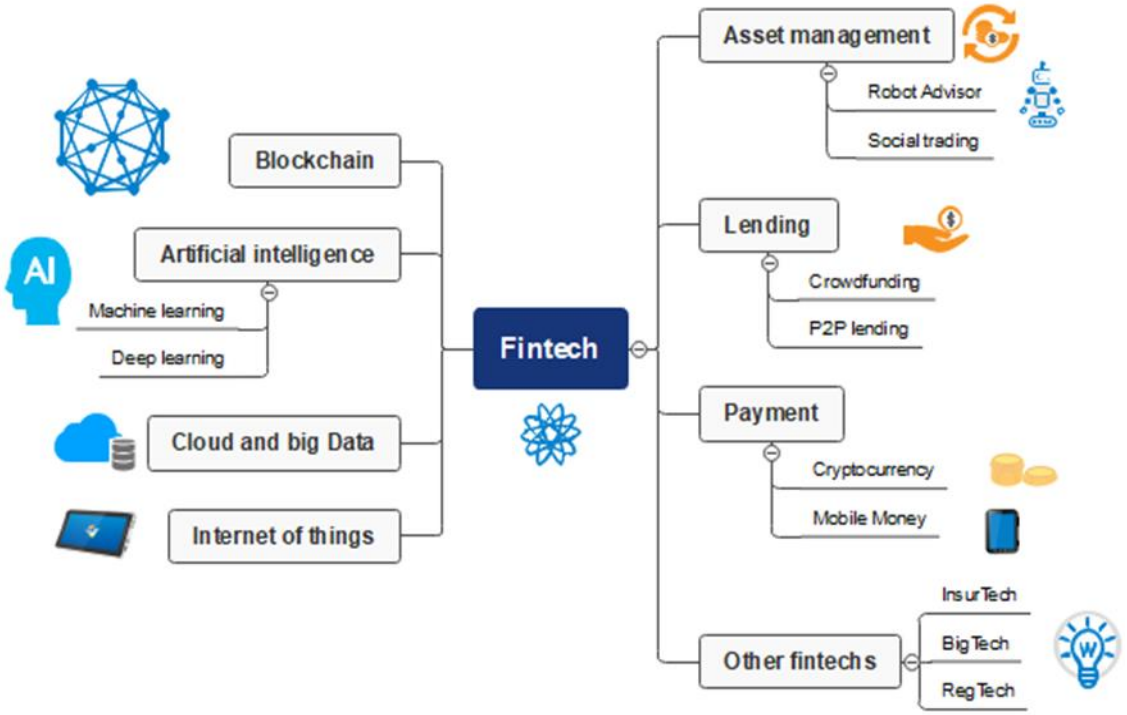
1.1.1. Definition of fintech

Fintech which is the contraction of financial technology, is defined by Investopedia as emergent technologies adopted by financial services companies to automate and facilitate the provision and use of financial services. (Julia Kagan, 2023)

Fintech is a catch-all term, it encompasses a variety of new technologies, new business models and products that have the potential to disrupt the financial services industry, it covers all innovative business models, such as mobile payment, crowdfunding, cryptocurrencies, high-frequency trading, in addition to the emerging technologies, such as Blockchain, Internet of things and Artificial intelligence (IOSCO, 2017, p. 4). By extension, fintech is also used for start-up companies that use financial technologies to provide digital financial services.

Fintech is driven by two main segments, the technological advancements and innovative business models. The figure below illustrates the different segments of fintech.

Figure 1. 1: Fintech Segments



Source: Created on EdrawMax by the researcher based on (IOSCO, 2017)

1.1.2. History of fintech

Although the popularity of fintech term is recent, it started only after the emergence of blockchain, cryptocurrencies and new payment methods like google pay and Alipay. The concept of fintech can be traced back to the 1860's, after succeeding in laying the first permanent trans-Atlantic cable in 1866.

According to (Arner et al., 2015, pp. 1–28), fintech can be split into three major eras. Fintech 1.0, this era started from 1866 until 1967, then Fintech 2.0 from 1967 until 2008 and finally, Fintech 3.0 and Fintech 3.5 since 2008 to the present. Each of these eras has its own characteristics in term of geographical spread, key players and shift origin.

The table 1-1 explain the characteristics of each era:

Table 1. 1: Fintech Major Eras

Date	*1866-1967*	*1967-2008*	*2008 - current*	
Era	Fintech 1.0	Fintech 2.0	Fintech 3.0	Fintech 3.5
Geography	Developed	Global	Developed	Developing
Key player	Infrastructure	Banks	Start-ups	
Shift origin	Globalization	Digitalization	2008 financial crisis	Market reform

Source: By the researcher modified from (Mohamed & Ali, 2019, p. 16)

Fintech 1 (1866-1967)

This era is marked by two major revolutionary changes in infrastructure that supported the financial globalization. The first one is laying the first successful trans-Atlantic cable in 1866 that allowed to make electronic international financial transactions, and the second one is the implementation of Fedwire by Federal Reserve of the USA in 1918, to connect the 12 Reserve Banks and to make electronic fund transfer by telegraph, using a Morse code system. (Zimmerman, 2016)

Fintech 2.0 (1967-2008)

This phase started in 1967 with the introduction of the first automated teller machine (A.T.M.) by Barclays bank, allowing customers to withdraw cash anytime anywhere. Followed by the establishment of NASDAQ _ National Association of Securities Dealers Automated Quotations, it is the first digital stock exchange in the world. (Zimmerman, 2016)

In 1972, the term Fintech was coined for the first time in an article of Abraham Bettinger, "FINTECH: A Series of 40 Time Shared Models Used at Manufacturers Hanover Trust Company", where he explained how he solved daily banking problems in the bank Manufacturers Hanover Trust. In this article, Bettinger, mentions that "FINTECH is an acronym that stands for financial technology, combining banking expertise with modern techniques of management science and the computer". (Schueffel, 2016, pp. 32–54)

1973 knew the establishment of SWIFT (Society for Worldwide Interbank Financial Telecommunications), facilitating the large volume of cross-border payments between financial institutions. (Zimmerman, 2016)

However, it is only in the early 1990s that fintech's popularity began, where it was used as a reference to the "Financial Services Technology Consortium", a project launched by Citigroup in order to assist technological cooperation efforts. (Schueffel, 2016, pp. 32–54)

In the 1990's, with the rise of the internet, the majority of banks moved towards digital banking, providing flexibility to their connected customers in managing their money, and in 1998 PayPal was launched as an online payment system. (C2FO, 2023)

Fintech 3.0 (2008-Current)

Although the popularity of fintech started in the early 1990's, it was only after the financial crisis of 2007 (subprime crisis), that it became a buzzword. Lack of trust in banks caused by the financial crisis, in addition to new regulatory frameworks, helped to bring fintechs as new players besides financial institutions to the market. (Kaji et al., 2021, p. 1)

In 2009, Satoshi Nakamoto created Bitcoin, the first and largest cryptocurrency, using blockchain technology to make decentralized fund transfers.

In 2011, Google launched google wallet, allowing customers to make payment directly from their google accounts, by using their smartphones. This marked a new era of payment and for the first time, in 2015, the use of mobile banking surpasses the use of physical branches(Zimmerman, 2016), and since this date fintech industry keep acceleration exponentially, where many fintech start-ups became a unicorn. (C2FO, 2023)

The global fintech market valuation reached $131,95 billion in 2022, and expected to surpass $400 billion at a growing rate CAGR of 25.18%. (Josh Howarth, 2023)

The recent fintech developments in Asia and Africa, supported by the continuation of economic development and the emergence of nascent technologies, is defined as **fintech 3.5** era. (Mohamed & Ali, 2019, p. 22)

The following figure summarizes the development of fintech through time:

Figure 1. 2: History of Fintech

Source: Created on EdrawMax by the researcher based on (Zimmerman, 2016)

1.1.3. Fintech segments

Emerging technologies and new model businesses are the main segment of fintech.

1.1.3.1. Emerging technologies and their application in finance

In fintech industry, the most prominent technology enablers that have the potential to disrupt the financial industry are AI and blockchain.

1.1.3.1.1. AI and machine learning

Artificial intelligence is a technique designed to make computers work in an intelligent way. There exist three main types of artificial intelligence; Machine learning, computational intelligence and soft computing. (Moloi & Marwala, 2020, p. 2) Machine learning as the most fundamental type of artificial intelligence, can make computers and smart devices capable to learn from available data through different algorithms, and then make predictions based on what they learned. (Nishith Pathak & Anurag Bhandari, 2018, p. 8)

The utilization of artificial intelligence techniques in the finance sector brings several advantages, including, helping to address customer questions and inquiries comprehensively, and assisting customers in fulfilling their various needs such as, credit and investment advice.

Assistance and support:

To address their customers' questions and inquiries, Bank of America is providing an AI assistant called Erica. Also, Tokyo Bank has implemented in some of its branches an AI assistant called Nao, which is assisting customers side by side the bank staff. (Sabir et al., 2023, p. 2)

Robo advisors

A robo-advisor is an online platform that uses algorithms to provide an automated portfolio management system services for investors. A robo-advisor helps investors to optimize the return/risk ratio of their portfolio, by automatically allocating the assets to different financial instruments such as, bonds and stocks. (Sabir et al., 2023, p. 2)

Robo-advisors can contribute in achieving sustainable and inclusive economy through profit optimisation. (Sabir et al., 2023, p. 2)

Credit worthiness evaluation

Credit applications for loans used to take several days for banks and lenders to process them. However, with the advent of artificial intelligence, credit worthiness evaluation has changed. Now, lenders evaluate credit applications by computer programs, that review the customer's credit history, payment records, and any other relevant information that may help to assess their eligibility for getting the loan approved. This makes the process of credit evaluation faster and more efficient. (Musleh Al-Sartawi, 2022, pp. 10–11)

1.1.3.1.2. Blockchain and its application in financial industry

The first blockchain network was introduced in 2008 by Satoshi Nakamoto as an underlying technology for Bitcoin. Nakamoto released bitcoin whitepaper in 2009, where he explained bitcoin and blockchain technology architecture. (Kaji et al., 2021, p. 144)

Blockchain which is a decentralized distributed ledger technology, has revolutionized the way financial transactions are recorded and verified, it has paved the way for cryptocurrency industry and CBDC. In this sub-section we will focus on blockchain overview and how it is applied in financial industry.

I- Definition of blockchain

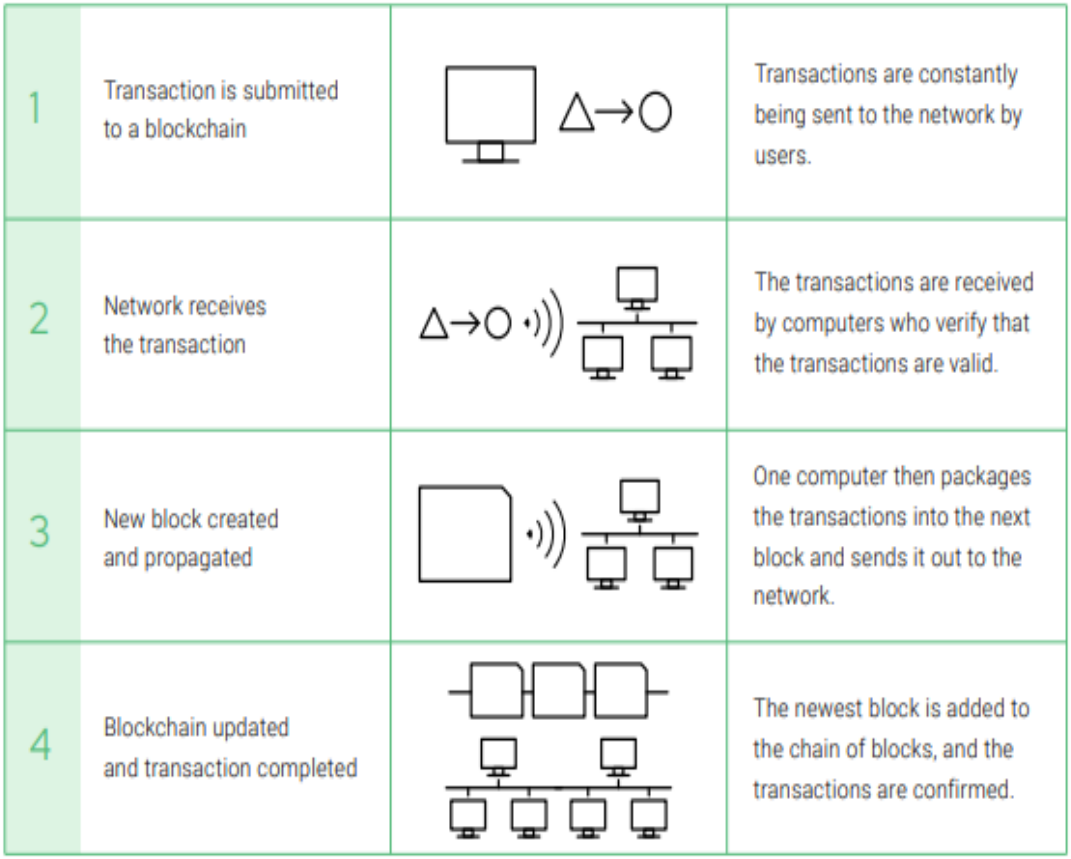
Blockchain is a decentralized technology that lies on distributed ledger technology to securely record transactions in a transparent and cost-effective manner. (Zhu & Zhou, 2016, pp. 1–11).

Transactions are organized into blocks that are connected to the previous blocks, creating a sequential chain, that serves as a record of all the transactions. To ensure the security of the chain, the blocks are sealed using cryptographic techniques called hash functions. These functions convert the information in the blocks into a unique and encrypted output of a fixed length, known as the "hash." Once encrypted, the original input cannot be retrieved from the hash, providing a secure and tamper-proof way to store and verify transaction data. (Martino, 2021, p. 11)

The computers connected to the network, known as nodes, maintain a complete record of transactions, representing an entire blockchain. Once transactions are added to the blockchain, they cannot be removed or edited, ensuring the integrity and immutability of the data.

The figure 1.3 explains how blockchain works

Figure 1. 3: How Blockchain works



Source: (UN Innovation Network, n.d., p. 1)

II- Type of blockchains

There are two major categories of blockchain networks; Public and private blockchain; Between the two types there is a third classification know as hybrid blockchain, which combines the characteristics of both public and private blockchain.(Martino, 2021, p. 18)

Each type has distinctive features in terms of decentralization, read permission, and consensus decision-making. (CPA Canada & AICPA, 2017, p. 3)

1) Public blockchains

In this type of blockchain, any individual that has a computer connected to internet along with the proper software, is allowed to join the network. These computers are called nodes, they can store a copy of the ledger and submit transactions to other nodes to approve them. In addition, they can be miners, which means they can validate and write blocks. Examples of this type of networks are Bitcoin and Ethereum blockchains. (Roman Beck et al., 2019, p. 38)

2) Private blockchains

Unlike public blockchain, private blockchain doesn't allow all nodes to read, submit and validate transactions, but these tasks are limited to predefined nodes. Financial institutions and organizations utilize this type of blockchain due to its cost-effectiveness. In addition, it offers greater protection against external attack, and gives the company complete control over who may access data, making it more effective for internal recordkeeping. (Girasa, 2018, p. 32)

3) Hybrid blockchain

A hybrid blockchain combines the characteristics of private and public blockchain. Like private blockchain, hybrid blockchain doesn't allow all nodes to create and validate the transactions. The validating process is limited for predefined nodes. However, other parts of the process like reading transactions is available for the public. Thus, on one hand, it offers low transaction fees and more security. On the other hand, it provides more transparency by making part of the consensus process publicly visible.(Martino, 2021, p. 32)

Each of the three styles have unique characteristics and provides solutions under different circumstances, every business can choose the type of blockchain that suits it best. (Ahmed Mansour et al., 2021, p. 21)

Table 1. 2: Types of Blockchain and their properties

	Public	**Private**	**Hybrid**
Access rights	Anyone can participate in reading, submitting and validation transactions	Only preselected nodes can participate in consensus process.	Only preselected nodes can read blockchain create and validate transactions. Anyone can read transactions
Cost and power	Needs high level of power	Low transaction fees	Low transaction fees Requires low level of power
Use case	Bitcoin and Ethereum	Blockstack	Ripple (XRP)

Source: Prepared by the researcher based on (Ahmed Mansour et al., 2021, p. 21) and (Nafis Alam et al., 2019, p. 84)

III- Characteristics of blockchain

To create a secure and decentralized system for recording and verifying transactions, blockchain integrates various computer technologies, such as, digital ledger, distributed data storage, peer-to-peer communication, consensus mechanisms, and encryption protocols. (Al Tilooby, 2018, p. 21)

The most fundamental and relevant concepts that make blockchain unique are:

1) Consensus

To ensure transparency and trust in blockchain system, adding a new block to the chain requires that the majority of nodes agree on the validity of the transactions in the block. The consensus mechanism is the verification process that ensures this agreement among network validators.

Different blockchain consensus mechanisms are designed. The most popular mechanism is Proof of Work (PoW), where participants try to solve a complex mathematical puzzle before they can add new blocks. Once the majority agrees on the solution, the new block will be validated and added to the chain. Miners who successfully solve the problem receive cryptocurrency as a reward.

Another mechanism is Proof of Stake (PoS), where miners must prove ownership of a certain amount of cryptocurrency, to be able to participate in transaction validation. (PoS) mechanism consumes less energy compared to (PoW), as instead of relying on computing power, (PoS) depends on a node's stake in the system. (Martino, 2021, pp. 13–14)

2) Decentralization

By allowing all nodes on the net to participate in the network using their computers, blockchain eliminates many-to-one traffic flows, and helps to avoid the problem of single point of failure. (Atlam et al., 2018, p. 42)

3) Immutability

One of the properties that distinguishes blockchain is its irreversibility, which means that it is nearly impossible to change what has already been saved, and if someone tries, the attempt is exceedingly easy to discover. Unlike a regular database, blockchain does not allow for data modification or deletion. Therefore, if a mistake is made in a registered transaction, it cannot be reversed. However, in order to amend the initial transaction, a new one must be issued, thus both are registered. (Roman Beck et al., 2019, pp. 35–37)

4) Transparency

Transactions published to a public blockchain are available to read by anyone at any time. All records are accessible through a web-based browser. With this feature, blockchains create a new level of transparency of information. (UN Innovation Network, n.d., p. 3)

5) Near real-time settlement

Blockchain helps to reduce the time of transaction processing, it makes the settlement of transactions almost real-time. (CPA Canada & AICPA, 2017, p. 4)

With all these unique features, blockchain technology may be applied in many areas, including, financial industry, which takes the largest market share in blockchain market.

IV- Benefits of Blockchain

Blockchain is an excellent means of storing and organizing data, without the need for a trusted authority. It brings efficiency, transparency, immutability, security, cost reduction, alternative trust systems, and reliable identification and verification methods to various industries. (Nishith Pathak & Anurag Bhandari, 2018, pp. 205–206)

V- Blockchain and digital assets

The first application of blockchain was for bitcoin, but since then, blockchain technology is used to execute various financial transactions such as, smart contracts in trade and financial markets, in addition to social applications beyond currency such as, healthcare applications and voting systems. (Zhu & Zhou, 2016, p. 2)

One of the majors blockchain application is the creation of digital assets such as; Cryptocurrencies, NFTs and CBDC.

1) Cryptocurrencies

A cryptocurrency is a digital currency that is cryptographically secured, which makes it nearly impossible to make fake transactions or double-spend. Cryptocurrencies are not issued nor controlled by any central authority, making them resistant to government manipulation.(Jake Frankenfield, 2023)

As per 11th July 2023, there are 26306 cryptocurrencies. Among all of them, only 41 had a market capitalization higher than $1 billion. The total capitalization of the crypto market is

1.19 trillion dollars, of which bitcoin accounted for 592 billion dollar which represents 50% of the global market. (CoinMarketCap, 2023a)

Bitcoin

Bitcoin is the world's first decentralized cryptocurrency that uses blockchain as an underlying technology. Launched on Jan. 3, 2009, by an anonymous computer programmer under the pseudonym "Satoshi Nakamoto". Bitcoin is purely a digital currency, it does not have any physical form, the value is transacted between senders and receivers without any third-party intermediaries. (Coindesk, 2023)

The market capitalization of bitcoin increased from only 1$ billion in 2013 to over 1$ trillion in April 2021, before falling down to 592 billion in July 2023. (CoinMarketCap, 2023a)

Ethereum

Ethereum was launched in 2015, and unlike bitcoin that is used only in payments, Ethereum is an open-source platform that allows people not only to make digital payments, but also to build smart contracts and their own cryptocurrencies on Ethereum Blockchain. In addition, it has its own programming language that enables developers to create custom applications. (Nishith Pathak & Anurag Bhandari, 2018, p. 207)

Ethereum has also its own cryptocurrency known as ether (ETH). Users can send it instantly to anyone anywhere. Similar to Bitcoin, Ethereum (ETH) operates in a decentralized and transparent manner with its supply not subject to control by any government or company.

With its 224$ billion market cap, representing almost 20% of global crypto market cap, Ether is the second biggest cryptocurrency in the world just behind bitcoin. (CoinMarketCap, 2023b)

2) CBDC

The central bank Digital currencies (CBDCs) are digital currencies, issued by a country's central bank as a central bank's liability. The central bank sets its value, which is equivalent to the nation's fiat currency. (Shobhit Seth, 2023)

Despite the fact that CBDC is a digital money, it differs from cryptocurrencies; Firstly, cryptocurrencies are issued privately, while CBDCs are issued by the central bank or the government. Secondly, the value of a cryptocurrency is volatile, but the CBDC's value is equivalent to the CB's fiat currency. (Bank Of England, 2023)

Benefits of CBDC

Financial service providers can potentially save $400 billion annually in direct costs, by reallocating their expenditure from physical infrastructure to digital banking solutions, which helps to reduce costs of financial services. However, the large expenditures in new technology that CBDCs will need to make, must be weighed against lowered expenses.

CBDCs offer more accessibility for individuals without bank accounts. Moreover, CBDCs available on mobile platforms might improve financial inclusion. (McKinsey, 2023)

3) NFTs

NFTs are unique digital assets. Although, they are built on blockchain which the same underlaying technology of cryptocurrencies, NFTs are distinct from other cryptocurrencies, as they are non-fungible, which means each NFT have its unique identity. (Kumar & Padakandla, 2023, p. 2)

NFTs represent digital versions of physical items on the blockchain such as, real estate and artwork. Unlike cryptocurrencies or fiat currencies, NFTs offer proof of ownership and authenticity, addressing the challenges of verifying the origin and trustworthiness of digital assets. They can be securely traced and transferred, enabling decentralized marketplaces where buyers and sellers can directly transact without relying on intermediaries. This eliminates the need for trusted third parties and facilitates more efficient transactions. (Yilmaz et al., 2023, p. 1)

NFTs gained popularity with the introduction of CryptoPunks in 2017, and since then, they have attracted investments from celebrities like Stephen Curry, Jay-Z, and Paris Hilton.

However, it was in 2020 when the NFT market experienced significant growth with Beeple's digital artwork selling for a staggering $69.3 million at Christie's auction house. Apart from the art world, NFTs related to profile pictures, game objects, virtual real estate, and collectibles have also become popular investment choices. For example, an investment firm purchased 2000 acres of virtual real estate in The Sandbox metaverse for $4 million. These assets, being non-fungible and guaranteed by a blockchain like Ethereum, have created a resale market using specific currencies within the respective platforms. (Belk et al., 2022, p. 200)

1.1.3.2. New model business

Fintech brought various new business model that disrupt the financial services industry, including, mobile money and crowdfunding.

1.1.3.2.1. Mobile money

Mobile money is defined by (Shaikh et al., 2023, p. 1) as "the provision of banking and payment services through a network of agents on a cell phone with a GSM connection", and by (Johnen et al., 2023, p. 1) as "an innovation that allows mobile phone users to deposit, transfer, and withdraw money without needing a bank account."

Depending on the jurisdiction in the given country, mobile money can be issued by non-banks such as MNOs, financial services institutions, or a mixture of both. In Kenya, for example, Safaricom, the MNO, has been authorized to issue mobile money without an official collaboration with a bank.

By contrast, in Uganda, the new mobile money regulation requires a formal partnership between a regulated financial institution and an MNO. All individuals with a mobile phone subscription, even those without a bank account, are allowed to open a mobile money account, as long as they can meet "know your client" processes by providing identification. In Kenya, mobile money subscribers can make different financial operations in their mobile money accounts, including, deposit and storing, they can also transfer money between each other's via codes in text messages, and withdraw physical cash from any operator agent that support mobile money services. (Aron, 2015, p. 7)

Advantages of mobile money:

Mobile payments significantly lower the transaction costs of transferring and receiving money over often long distances, particularly in areas with weak and expensive transportation links**.** (Aron, 2015, p. 28)

Banked and unbanked customers can undertake everyday retail financial operations, such as deposits and transfers, at designated mobile money agents or third-party stores using mobile money. Given their significance in reaching the unbanked and underbanked, mobile money services represent an important segment of the financial inclusion programs launched in developing and emerging economies. Furthermore, during the pandemic, mobile money services mainly assisted distant financial-service provision. Therefore, some countries have

established policies to encourage and promote the adoption of mobile money technology services. (Shaikh et al., 2023, p. 3)

The main obstacle that makes the formal banking sector fail to provide credit to poor customers who cannot provide collateral and financial history is the asymmetric information. However, with mobile money every financial transaction recorded in a customer's account is used to establish a financial history. Mobile money providers can use algorithms that help them to generate credit scores based on the types and the frequency of mobile payments transactions, facilitating credit issuance**.** (Aron, 2015, p. 29)

1.1.3.2.2. Crowdfunding

Crowdfunding has emerged as a new alternative financing strategy that enables individuals or startups to request funds from a big number of investors through online platforms. (Tian & Zhang, 2023, p. 1) It is a public solicitation, throughout the internet, for the allocation of financial resources.

I- Types of crowdfunding

Crowdfunding comes in different forms, including, reward, equity, lending and donation. (Okine et al., 2023, p. 1)

1) Reward-based:

The most common type of crowdsourcing is reward-based crowdfunding, in which investors receive non-monetary recompense in exchange for their contributions. (Tian & Zhang, 2023, p. 1)

2) Equity crowdfunding:

The concept of equity crowdfunding is similar to buying and selling of common shares on a stock exchange or venture capital. However, equity crowdfunding entails raising smaller amount of money from a bigger number of small investors. Potential investors may be able to participate by offering equity in exchange for revenue. (Michelle Black & Jordan Tarver, 2022)

3.) P2P lending:

Debt crowdfunding, also known as peer-to-peer lending, 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.

Unlike equity crowdfunding, where investors receive ownership stakes in exchange for their investment, debt crowdfunding involves investors lending money to borrowers with the

expectation of receiving both their initial investment and interest payments in return. (True Tamplin, 2023)

4) Donation-based crowdfunding:

This form of crowdfunding involves raising money for a project from a large number of people without expecting anything in return from the backers.(Will Kenton, 2023)

II- Advantages of crowdfunding

Crowdfunding as an alternative source of funding, contributes in reducing the cost of capital. It can help small and micro businesses to raise funds and bring new products to market, which contributes to solving problems of societies.(Wangchuk, 2021, p. 59)

1.2. Fintech, financial inclusion and sustainable development

Financial inclusion has a potential to resolve many problems in developing countries including, poverty and inequality, in addition to boosting economic growth. In this section we will try to explain what is financial inclusion before constructing a conceptual framework base on theories and relevant researches.

1.2.1. Financial inclusion: In-depth understanding

To gain a comprehensive understanding of the implications of financial inclusion, we need to examine its various facets. In this sub-section, we will focus on definitions, dimensions, pillars and indicators of financial inclusion.

1.2.1.1. Definition of financial inclusion

Different organizations and authors provide various definitions of financial inclusion. Here are a few examples:

World bank defines financial inclusion as: “the access of individuals and businesses to different financial services including; Payments, savings, investment, credit and insurance provided in a responsible and sustainable manner”. (World Bank, 2022)

The Central Bank of Egypt and Banking Law No. 194 of 2020 defined Financial Inclusion as: “Availing of various financial products for use by all segments of the society through the formal channels, with adequate quality and cost while protecting the rights of the consumers of these services, which enables them to manage their finances effectively”. (Central Bank of Egypt, n.d.)

(Mhlanga, 2022) defines financial inclusion as: "The situation where an individual, individual businesses, and communities at large have equal access, and usage of beneficial, affordable financial services and products that satisfy their various requirements such as performing transactions like payments, withdrawals, depositing savings, acquiring credit, and insurance delivered through a sustainable and a responsible way". (Mhlanga, 2022, p. 43)

According to (Le et al., 2019) "Financial inclusion implies that all adult members of the society are granted access to a range of proper financial services, designed based on their needs and provided at affordable costs." (Le et al., 2019, p. 310)

Although there are some differences in these definitions, they all share a common objective of emphasizing the importance of ensuring that individuals and businesses have access to a range of financial services that are affordable, appropriate, and meet their needs.

However, with the emergence of new technologies and innovation in finance industry, new concepts of financial inclusion have raised, including Islamic financial inclusion and digital financial inclusion.

Digital financial inclusion:

CGAP defined digital financial inclusion as "affordable digital access to and use of formal financial services delivered responsibly". (Timothy Lyman & Kate Lauer, 2015) and according to world bank, digital financial inclusion entails the use of digital tools to provide formal financial services to unbanked and underserved individuals. (World Bank, n.d.) Digital financial inclusion is also referred as fintech-enabled financial inclusion.

Furthermore, digital financial inclusion is defined by AMF as "The utilization of digital technologies to provide access to formal financial services for individuals who are currently excluded from the traditional financial system. It entails offering financial services that are tailored to the specific needs of customers, delivered responsibly and sustainably, and within a legal framework". (Financial Inclusion for the Arab Region Initiative, 2021, p. 29)

Digital financial inclusion focuses more on the use of information and communication technologies (ICT) to increase the reach and use of financial services by underprivileged individuals. (Mhlanga, 2020, p. 3)

Overall, digital financial inclusion refers to the use of digital technologies, such as mobile phones, internet, and other electronic devices, to access and use financial services.

Islamic financial inclusion:

Financial inclusion in Islamic finance has the same definition as traditional financial inclusion except that in Islamic finance the financial services must be compliant with Shari'ah.

Financial inclusion in Islamic finance is defined by IFSB as follows: "state where individuals and businesses in a society have access to, and usage of, a range of affordable and quality Shari'ah-compliant financial products and services that appropriately meet their needs; and are delivered by formal financial service providers in a transparent, and simple manner while duly complying with the rules of Shari'ah, thus enabling an informed understanding by the customer." (Fazle Kabir & Nor Shamsiah Mohd Yunus, 2019, p. 16)

Islamic financial inclusion extends beyond increased access to financial services to include social inclusion, which enables people and businesses to participate more actively in the real economy. (Ali, 2022, p. 49)

1.2.1.2. Dimension of financial inclusion

Financial inclusion includes three dimensions: access, usage, and quality. (Sharma & Changkakati, 2022, p. 1239) World bank defined the three dimensions as follow (World Bank, 2015):

Access: Access to financial services refers to the ability of individuals and organizations to purchase financial products and use financial services. It entails reducing demand-side restrictions that users must overcome in order to access financial institutions, such as geographical restrictions, identification requirements, documentations, and high costs.

Usage: Usage refers to the active and regular use of financial services by individuals and businesses. It is not enough to merely have access to financial services. It is important that people are able to use them effectively. Usage is crucial in ensuring that financial services are utilized to their full potential to improve financial well-being and support economic growth.

Quality: Quality refers to the level of financial knowledge among users, and the quality of financial products and services. It involves ensuring that financial services are delivered in a responsible and sustainable manner that meets customer's needs and his understanding of financial products, taking into consideration the social, environmental, and ethical impacts.

Addressing all three dimensions of financial inclusion is essential to ensure that individuals and businesses have equal opportunities to access, use, and benefit from financial services.

1.2.1.3. Pillars of financial inclusion

Four pillars of financial inclusion have been identified. These pillars can serve as key focus areas for promoting and advancing financial inclusion within developing countries.

The four pillars according to Bank of Algeria are; Strengthening of financial infrastructure, consumer financial protection, developing financial solutions that cater to the diverse needs of all social classes, and finally, enhancing the financial literacy.(Bank Of Algeria, n.d., pp. 3–6)

Strengthening of financial infrastructure:

A strong and robust financial infrastructure is considered as one of the fundamental pillars for establishing a favorable environment to achieve financial inclusion. Strong financial infrastructure can be achieved through regulatory framework, network implementation, the development of payment and settlement systems, and taking advantage of emerging technologies and fintech.

Consumer financial protection:

Due to the evolution of digital financial instruments that made the innovative financial products and services provided to customers more complex, consumer financial protection has become a priority.

Developing financial solutions that meet the needs of all social classes:

This involves ensuring that individuals from different income levels and socioeconomic backgrounds have access to appropriate and tailored financial solutions.

Financial literacy:

Financial culture helps individuals to make sound and informed investment decisions in their various financial transactions with the lowest degree of risk. Thus, the objective of financial education is to establish an integrated financial education system to build a financially literate society, where individuals and businesses are able to understand and to assimilate financial products and services.

1.2.1.4. Financial inclusion Indicators

Financial inclusion is considered as an important development goal by the World Bank. To measure the level of financial inclusion and its progress in the world, World Bank has developed a wide range of indicators that are used by policy makers, researchers and other players to assess the economic and financial impact of financial inclusion and digital financial inclusion.

The flowing table summarize some important indicators within the three dimensions of financial inclusion and digital financial inclusion of individuals according to world bank and GPFI.

Table 1. 3: Traditional and Digital Financial Inclusion Indicators

Traditional financial inclusion		Digital financial inclusion	
indicator	Dimension	indicator	Dimension
% of adults with an account at a formal financial institution	Usage	% of adults who has a mobile account	usage
% of adults who saves at a financial institution	Usage	% of adults who uses mobile phone to make utility payments	Usage
% of adults with debit cards	Usage		
Number of ATMs per 100,000 adults	Access	% of population who has access to e-money	Access
Number of Branches per 100,000 adults	Access	% of population who has access to internet	Access
Financial knowledge score (Knowledge about basic financial concepts; Inflation, Interest rate…)	Quality	Digital finance knowledge (Level of understanding fintech like mobile money, blockchain, bitcoin…etc)	Quality
Average cost of opening a basic current account.	Quality	Average cost of opening a basic mobile money account.	Quality

Source: (GPFI, n.d.-b)& (Khera et al., 2021b, p. 8)

Traditional financial inclusion indicators include metrics such as, number of branches per 100,000 adults, number of ATMs per 100,000 adults and percentage of adults with an account at a formal financial institution.

In terms of digital financial inclusion, the World Bank indicators include metrics such as, the percentage of adults with access to the internet and mobile phones, the usage of mobile money and digital payment services, the number of registered mobile money accounts, and the availability of digital infrastructure for financial transactions. These indicators provide insights into the extent to which digital technologies are being used to facilitate financial access and transactions, especially in underserved or remote areas.

1.2.2. Financial inclusion and development from theoretical perspectives

Sustainable development is defined by (IISD, n.d.) as “the development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. In 2015, all United Nations Member States adopted 2030 agenda to end poverty, protect the planet, and ensure all people enjoy peace and prosperity. Within 2030 agenda, UN countries are attempting to reach 17 Sustainable Development Goals (SDGs) by 2030.(United Nations, n.d.)

Financial inclusion doesn’t appear as a goal itself in the 2030 agenda. However, it’s considered as a key enabler of at least 8 out of these 17 goals.

According to (CGAP, n.d.) Consultative Group to Assist the Poor , financial inclusion is considered a key element in achieving some Sustainable Development Goals of 2030 Agenda. Indeed, according to (UNCDF, n.d.) eight out of seventeen goals are targeted. These goal include; Poverty eradication (SDG 1); Good health and well-being (SDG 3); Gender equality and women's economic empowerment'(SDG 5); Promoting economic growth and employment (SDG 8); reducing inequalities (SDG 10). (Leora Klapper et al., 2016, pp. 2–9)

Furthermore, (United Nations- Department of Economic and Social Affairs & Poverty, n.d.) argues that enabling youth to access various financial services such as, savings and well-designed loans for business ventures or education is crucial for empowering them to make independent economic choices and break the cycle of poverty. Moreover, G20 recognizes that financial inclusion is a key enabler for poverty alleviation.(GPFI, n.d.-a)

In addition to the above theoretical studies that explain the relationship between financial inclusion and economic growth and development, there are various theories that can be used as

foundation for building a strong theoretical framework of the study, including, Finance-growth nexus theory, Mercy corps theory and finally endogenous theory that may explain the role of fintech and digital financial inclusion in promoting economic growth and development.

- **Financial development theory**

Finance-growth nexus theory highlights the relationship between financial development and economic growth, it suggests that financial markets and institutions can promote economic growth by providing financing for investment and entrepreneurship, allocating capital to the most productive uses, and reducing information asymmetries between investors and entrepreneurs.

According to Joseph Schumpeter, financial intermediaries play a vital role in technological innovation and economic development, by providing crucial services such as, mobilizing savings and facilitating transactions. (King & Levine, 1993, p. 717)

- **Mercy corps theory**

Mercy Corps' financial inclusion theory of change is another theory that can provide a strong foundation for the study, the theory states that "within inclusive financial systems, participants are able to access, use, and afford a range of financial services and products.

In doing so, they will better manage economic assets to cope with shocks and stresses, adapt to changing circumstances, and transform their lives." (Mercy Corps, n.d.)

- **Endogenous theory**

According to innovation growth theory, economic growth is not solely determined by factors such as, capital accumulation and labour force growth, as suggested by earlier neoclassical growth theories.

The economist Paul Romer argues that technological progress and innovation are seen as endogenous factors that will lead to economic growth. Endogenous growth economists believe that advancements in productivity are closely linked to rapid innovation. (Daniel Liberto, 2020) Endogenous theory may explain the strong relationship between fintech-driven financial inclusion and economic growth.

1.2.3. Fintech and financial inclusion

Among different regional and national financial inclusion initiatives, fintech is considered as the main enabler to achieve high level of financial inclusion fast. However, fintech can pose some risks related to financial stability.

In this subsection we will investigate the role of fintech in promoting financial inclusion and discussing its potential risks and challenges.

1.2.3.1. Role of fintech in promoting financial inclusion

Fintech has the potential to address both voluntary and involuntary exclusion from financial services. It offers an opportunity to address demand-side constraints and promote financial inclusion by providing affordable, convenient, and accessible financial services that cater to the unique needs of the poor and underserved populations.

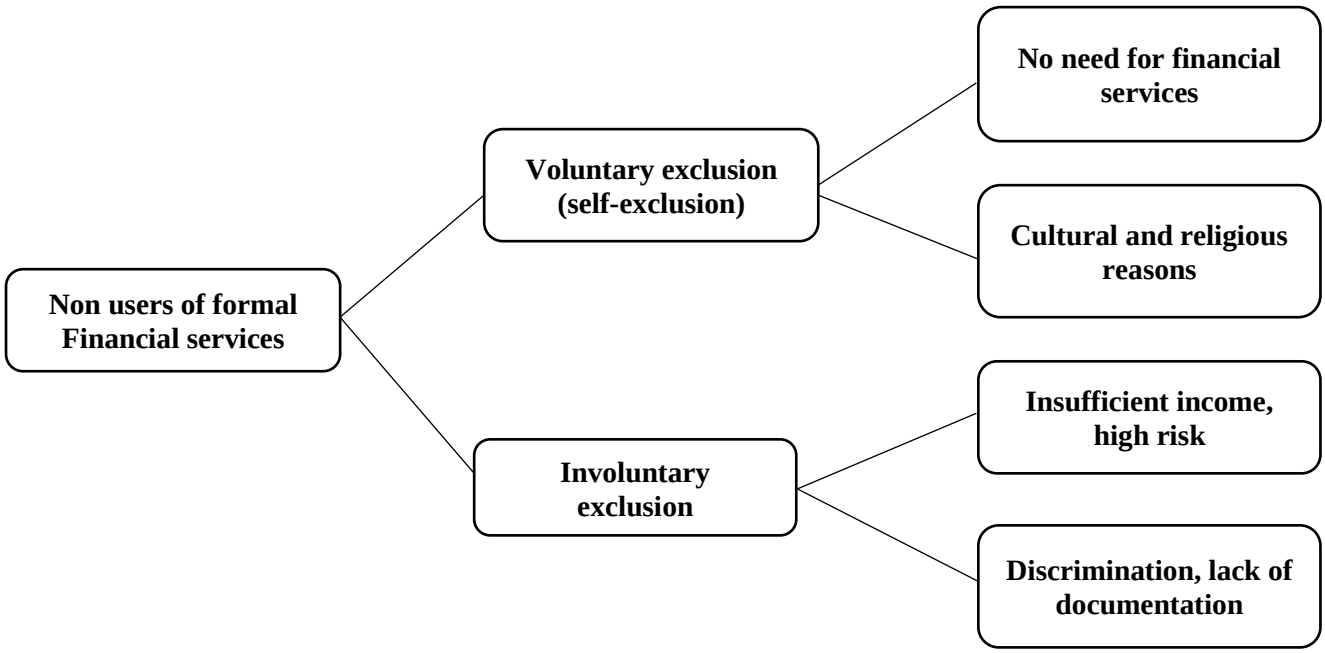
In this sub-section we will discuss what international organizations say about the role of fintech in promoting financial inclusion, in addition to explain how emerging technologies and innovation like blockchain and Islamic fintech can help unbanked people to integrate the formal financial system.

To strengthen the theoretical framework, the study will rely on some previous theoretical studies that have highlighted the role of fintech in promoting financial inclusion.

These studies, including KPMG's study and (Ceyla Pazarbasioglu et al., 2020, pp. 3–4) from World Bank that have provided valuable insights into the transformative power of fintech in expanding access to financial services for underserved populations.

World bank distinguish between voluntary exclusion and involuntary exclusion. The diagram 1-4 summarizes the difference between voluntary and involuntary exclusion.

Figure 1. 4: Dimensions of Financial Exclusion

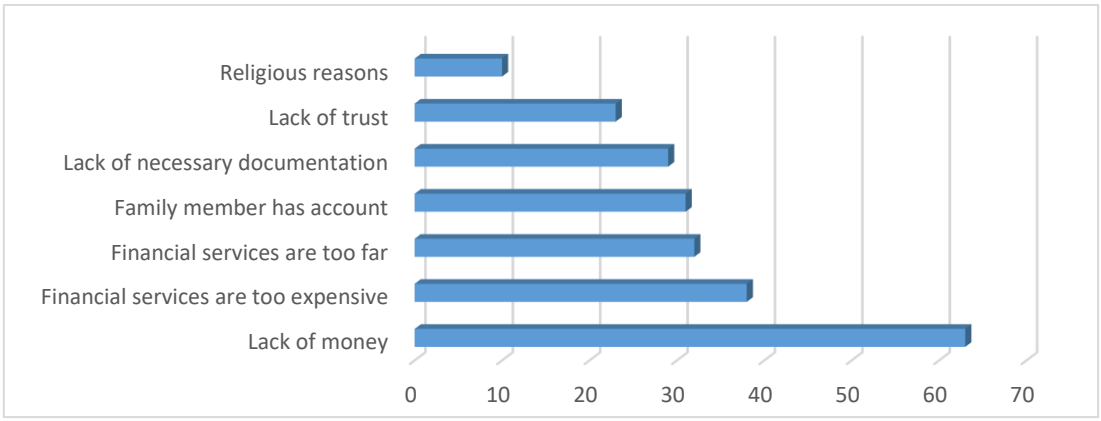


Source : By the author based on (Amidžić et al., 2014, p. 6)

voluntary exclusion refers to when some individuals or firms choose not to use financial services due to reasons like lack of need or cultural/religious beliefs. On the other hand, involuntary exclusion occurs when individuals or firms are unable to access financial services due to factors like low-income, high-risk profile, discrimination, or market failures.

Furthermore, the global Findex 2021 reveals that lack of money followed by high cost, geographic barriers, lack of documentation and lack of trust constitute the main obstacles to financial inclusion in the world.

Figure 1. 5: Reasons for Having No financial institution Account 2021



Source : (Demirgüç-Kunt et al., 2022, p. 36)

However, according to the World Bank, digital financial services driven by fintech, have the potential to address persistent challenges in delivering affordable and appropriate financial services.

By leveraging economies of scale, these services can reduce costs, while also improving transaction speed, security, and transparency. Additionally, fintech enables the provision of tailored financial services that cater to underserved populations.

Long-standing barriers that can be addressed by digital financial services (DFS) include (Ceyla Pazarbasioglu et al., 2020, pp. 3–4) :

Unstable and low incomes: Individuals with low incomes, particularly those working in informal and agricultural sectors, often face unpredictable earnings. They heavily depend on small-value remittances and government transfers to meet their financial needs. DFS can help by providing affordable, low-value financial services that cater to these income patterns.

Geographical barriers: In developing economies, distance to financial institutions can be a barrier to account ownership, particularly in countries like Brazil, Indonesia, and Kenya. DFS, by leveraging mobile technology and agent networks, made financial services more accessible, reducing the necessity for individuals to travel to physical service centers.

Informality and lack of documentation: Individuals with low incomes often engage in the informal sector, lacking proper identity verification and leaving minimal records of their economic activities and assets. This makes it challenging for them to access financial services. DFS can overcome this obstacle by using digital means of authentication and transaction initiation, reducing costs and simplifying documentation requirements.

Literacy and trust: New users of formal financial services may lack financial service knowledge and may have limited financial literacy. Additionally, they may have distrust towards financial services. Thus, strong financial consumer protection frameworks along with financial literacy programs are necessary to promote financial inclusion, particularly for MSMEs who may exhibit weaker financial management skills.

Moreover, KPMG argue that digital financial solutions have great potential to expand access to financial services by improving their availability and affordability.

As an example, emerging commercial lenders may determine that a physical presence is no longer essential for opening bank accounts and make transactions, which can significantly affect the costs, structure, and expansion plans of banks.

Furthermore, advancements in artificial intelligence and data analytics enable lenders to evaluate the creditworthiness of prospective borrowers based on various metrics, such as call history, spending patterns, and social media behavior instead of relying only on financial statements. (Andrew Weir & Lee George Lam, 2018, p. 5)

(Kaji et al., 2021, p. 18) reveals that with the availability of big data and the evolution of fintech, now it is possible to make more accurate credit risk analysis, by analyzing performance of companies seeking loans.

1.2.3.1.1. Blockchain and financial inclusion

Blockchain technology has the potential to solve numerous problems related to access to financial services. According to to (Charles Gallo et al., 2017, p. 9) some of the potential benefits of blockchain technology in this context include:

Accessibility: Individuals can avoid the need to travel to a physical financial institution by opening an account or depositing cash through their mobile phones. This eliminates the expenses associated with setting up an account in person. Additionally, they can deposit money into the account via third-party agents.

Fast and low-cost transfers: One of the key differences between the current payment infrastructure and blockchain is the near-instantaneous transfer of value. Blockchain transfers may take a few minutes, which is faster than payment systems in developing countries. In addition, transfers through blockchain technology do not require a minimum payment amount, making blockchain useful for underbanked and unbanked individuals to make transactions, especially for smaller payments.

Digital services and alternative methods: Payments via blockchain do not require the use of national payment system and do not need physical branches. Financial institutions (FIs) can offer more digital services, reducing the need for client-facing staff.

Lower transaction costs: The cost to transfer funds via blockchain is very low, making smaller payments more appropriate compared to traditional payment systems that may have high fixed fees. This can lower the overall transaction costs for individuals, especially those with lower incomes who may not be able to afford high transaction fees.

1.2.3.1.2. Islamic fintech and financial inclusion

Shari'ah-compliant Fintechs, which offer financial services in accordance with Islamic principles, have the potential to benefit millions of underbanked Muslims by providing them access to savings, investments, insurance, and other financial products that align with their beliefs. (The Economist Intelligence Unit Limited, 2020, p. 1)This could help to bridge the gap between traditional financial services and the specific requirements of the Islamic community.

Mohamed Damak, the global head of Islamic finance at S&P Global Ratings, believes that Fintech has the potential to further enhance the Islamic finance industry by improving efficiencies and reducing costs. For instance, technologies such as artificial intelligence (AI) can be used to automate processes, streamline operations, and enhance compliance with Shari'ah principles, thereby reducing the risk of human error and improving overall compliance. Additionally, blockchain technology, if deployed at scale, could offer benefits to the Islamic finance industry. (The Economist Intelligence Unit Limited, 2020, p. 3) Blockchain's distributed and transparent nature could potentially reduce the risk of fraudulent transactions and increase trust in financial transactions, which aligns with the principles of transparency and fairness in Islamic finance.

The integration of Fintech solutions into the Islamic finance industry has the potential to enhance accessibility, efficiency, and compliance, benefiting millions of underbanked Muslims, by providing them with access to a wider range of Shari'ah-compliant financial services.

1.2.3.2. Risks and challenges of fintech

Despite all the benefits of DFS (Digital Financial Services), they still pose various risks and challenges that need to be mitigated to explore their full potential. Some of these risks and challenges include: (Nafis Alam et al., 2019, p. 21)

Data protection and privacy: DFS involve the collection, storage, processing, and exchange of consumer data, which may potentially put consumers at risk of unauthorized disclosure and misuse of their personal data. This highlights the need for comprehensive consumer data protection frameworks, to ensure that data is managed in a secure and privacy-compliant manner.

Cybersecurity and operational risks: DFS may rely on data infrastructures that are vulnerable to cyber-attacks, system failures, and over-reliance on third-party service providers, such as cloud storage and analytics. This can compromise business continuity and financial stability, and is closely related to data governance concerns. It is important to have robust cybersecurity measures in place to protect against these risks.

Financial integrity: DFS, such as crowdfunding platforms, electronic money and crypto assets can be used for illicit financial activities. It is important to have effective regulatory frameworks, such as Know Your Customer (KYC) requirements, to prevent illicit activities and ensure financial integrity.

Regulatory and risks beyond supervision: Risks beyond supervision refer to risks arising from activities that are outside the scope of traditional supervision or regulatory frameworks. For example, the rapid development of new financial technologies, such as cryptocurrencies or decentralized finance (DeFi), may pose risks that are not fully understood or regulated by existing supervisory frameworks.

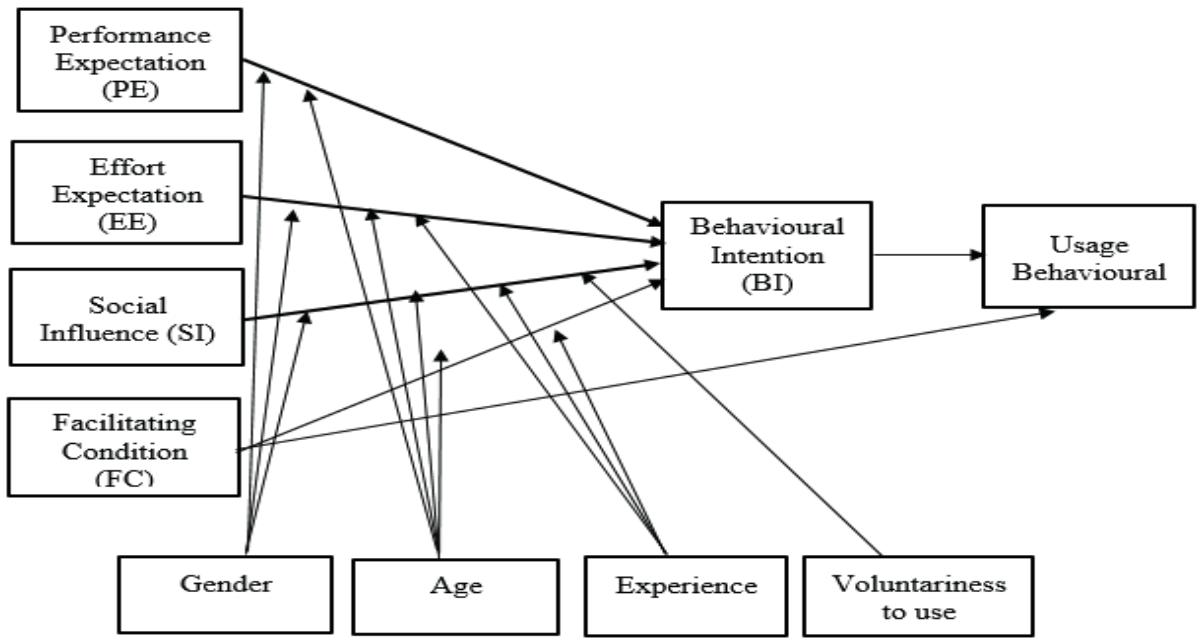
Financial literacy and acceptance of digital financial services:

Another challenge of fintech is the acceptance and its use by the audience.

The Unified Theory of Acceptance and Use of Technology (UTAUT) may explain how to create an appropriate environment for people to adopt fintech easily.

The UTAUT, proposed by Venkatesh et al. in 2003, integrates elements from several other technology acceptance models and argues that the acceptance and use of technology are influenced by four key factors: performance expectancy, effort expectancy, social influence which is defined as "the degree to which an individual perceives that important others believe he or she should use the new system", and finally, facilitating conditions.(Savvas Papagiannidis & Davit Marikyan, 2022)

Figure 1. 6: UTAUT diagram



Source: (Savvas Papagiannidis & Davit Marikyan, 2022)

Addressing these risks and challenges is crucial for the sustainable growth and development of DFS, and to allow the potential of digital technologies to be fulfilled. To mitigate these risks smart public policies are mandatory.

It requires comprehensive regulatory frameworks, robust cybersecurity measures, effective data governance and privacy protection, and fair competition policies to ensure that DFS are safe, secure, and beneficial for consumers, businesses, and the overall financial system.

Various policy foundations that policymakers can implement to address the constraints hindering the efficient growth of DFS. These policy foundations can be classified into three main categories:(Jon Frost et al., 2021, p. 17)

Regulatory frameworks and data privacy: This includes establishing regulations and policies that create a favorable environment for digital finance to grow. This may involve simplifying regulations, ensuring clear and transparent rules, and fostering innovation while also safeguarding consumer protection and financial stability.

Enabling inclusive digital infrastructures: This involves building the necessary infrastructure to support DFS. This may entail improving the efficiency and accessibility of payment systems, establishing credit bureaus and expanding digital connectivity to reach underserved areas.

Government support systems: This encompasses implementing supportive government systems such as data platforms, digital ID systems, and financial management platforms. These systems can facilitate the collection and analysis of data, enable digital identification for individuals, and provide tools for managing personal finances.

By addressing these three clusters of policy foundations, policymakers can alleviate the obstacles that hinder the development and growth of DFS, ultimately creating an environment conducive to the safe and efficient expansion of digital financial services.

1.2.4. Fintech, financial inclusion and economic development: Conceptual framework

Digital financial services provided by fintech companies have the potential to address many issues related to financial exclusion in developing countries. By elevating obstacles to access to financial services, fintech will contribute in promoting financial inclusion.

Based on the previous theoretical and empirical studies, the following table demonstrate how fintech can help to resolve some financial inclusion problems.

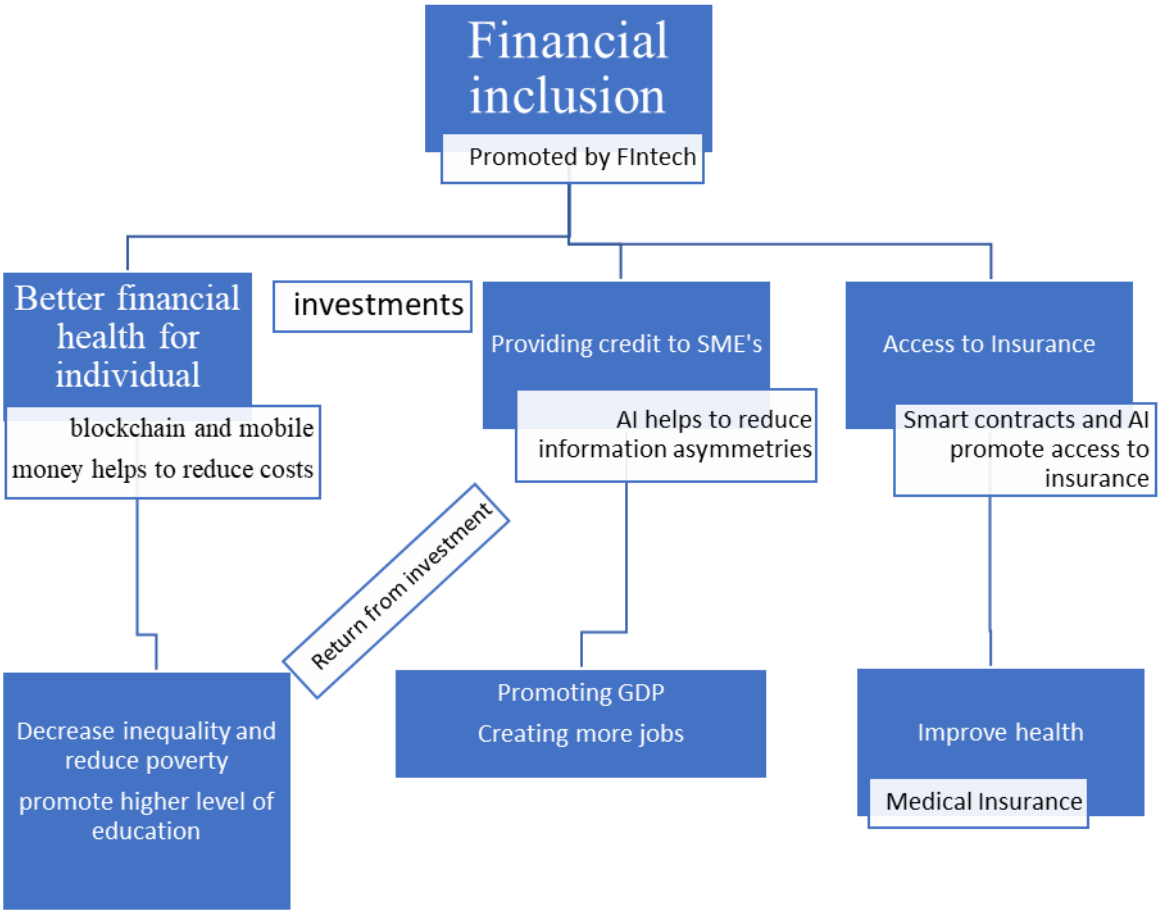
Table 1. 4: Fintech as a solution for financial inclusion problems

Problem	Solution
Geographical access problem	Mobile banking, Blockchain solution and digital payments enable transactions in areas where traditional payment methods are unavailable or unreliable
Financial exclusion due to religion believes	Islamic finance can be a solution for these segment of population, and fintech ca help Islamic finance to be affordable and accessible for everyone.
Lack of information	AI and Machine Learning: Fintech companies can use AI and machine learning algorithms to develop credit scoring models that can provide access to credit for people who are traditionally considered "unbanked" or "underbanked". By using alternative data sources such as mobile phone data, fintech companies can offer credit to those who lack a traditional credit history.
Insufficient income	Lowering transaction fees will make financial transactions affordable for low-income individuals

Source: By the researcher theoretical framework

Based on the previous theoretical framework, the following diagram explains how digital financial inclusion will boost economic growth and help to reduce poverty and inequality.

Figure 1. 7: Fintech-driven financial inclusion and sustainable development



Source: By the researcher based on the theorethical framework

Fintech is a catalyst for improved financial health for individuals and businesses, reducing inequality and poverty while stimulating economic growth. By facilitating efficient financial management and promoting inclusive economic participation, fintech contributes to job creation, particularly through SME financing. Smart contracts, integral to fintech, not only streamline financial processes but also hold potential for transforming healthcare transactions, promoting better health outcomes.

Conclusion

There are several theories to which we can associate the role of financial technology and financial inclusion in achieving development, such as the new growth theory and the finance-growth nexus theory, and there are other theories that were created specifically to understand the role of financial inclusion, such as MERCY theory of financial inclusion.

By analyzing these theories, in addition to studies conducted by, scholars and international organizations, a conceptual framework for the study was established. The conceptual framework summarizes the ability of financial technology to achieve development and growth through financial inclusion by overcoming most of the obstacles that prevent access to financial services such as geographical distance, lack of documentation and high costs.

To make the best use of fintech to enhance financial inclusion and achieve development, the different risks and challenges that may make the adoption of financial technology difficult has been identified. In addition, the solutions to avoid and reduce risks and overcome challenges were discussed in this chapter.

In order to go deeper into the subject, we will discuss in the second chapter the landscape of Fintech and financial inclusion and their interrelationship in MENA countries.

Chapter 2. Landscape of fintech and financial inclusion in the MENA region

Preface

Despite the hard efforts made by the MENA countries to promote financial inclusion, due to their recognition of the importance of financial inclusion in promoting economic development, the level of financial inclusion in the region remains very low, where more than half of adult individuals are excluded from owning a formal bank account. For the purpose of acceleration their efforts in promoting financial inclusion, countries and governments in the region have established initiatives and programs that focus on strategies to strengthen the financial technology ecosystem and spread its use among individuals, in addition to raising the level of financial literacy.

In this chapter, we will make an in-depth analytical study of the financial inclusion landscape based on the statistics of the Global Findex 20221 World Bank report, comparing the level of financial inclusion in the MENA region with the global level. We will also focus on studying the state of the fintech industry and its impact on digital financial inclusion in the MENA region, through the available data and some successful case studies.

2.1. landscape of financial inclusion in the MENA region

In this section, we will examine the state of financial inclusion and digital financial inclusion in the MENA region. We will also analyse the main barriers to financial inclusion and how governments are involved in promoting financial inclusion.

2.1.1. State of financial inclusion in the MENA region

When assessing the level of financial inclusion in a country, it is crucial to examine not just the availability of financial services but also how they are used. Therefore, we will examine both access to and usage of formal financial services as significant components of financial inclusion in the MENA region

2.1.1.1. Access to financial services

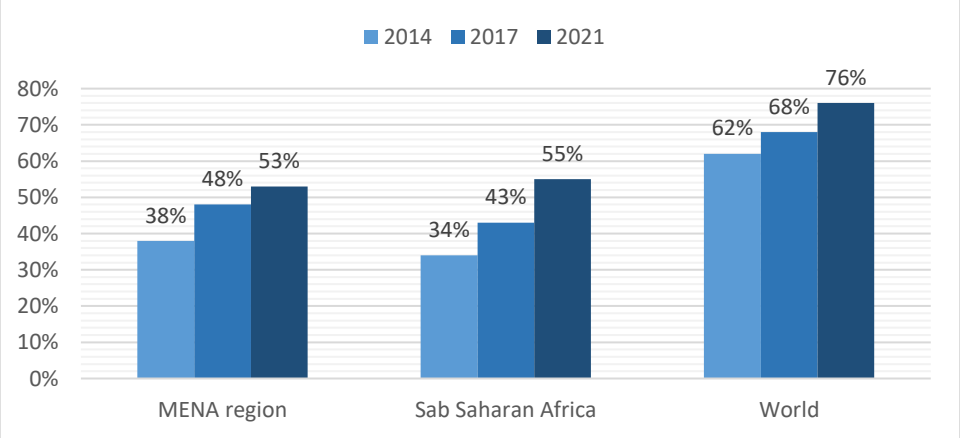
Financial inclusion in the MENA region is evolving, with both progress and room for improvement. Efforts have been made to enhance access to financial services, but challenges persist in promoting widespread usage and engagement.

Account penetration and mobile money account are crucial indicators to measure the level of financial inclusion in a given country. Therefore, in this study we will focus on these two indicators.

Account penetration in the MENA region

By analyzing the evolution of account penetration rate from 2014 to 2021 in the MENA region, we will gain insights into the advancements made in enhancing financial accessibility and promoting a more inclusive financial system.

Figure 2. 1: Evolution of Account penetration rate by region (2014 to 2021)



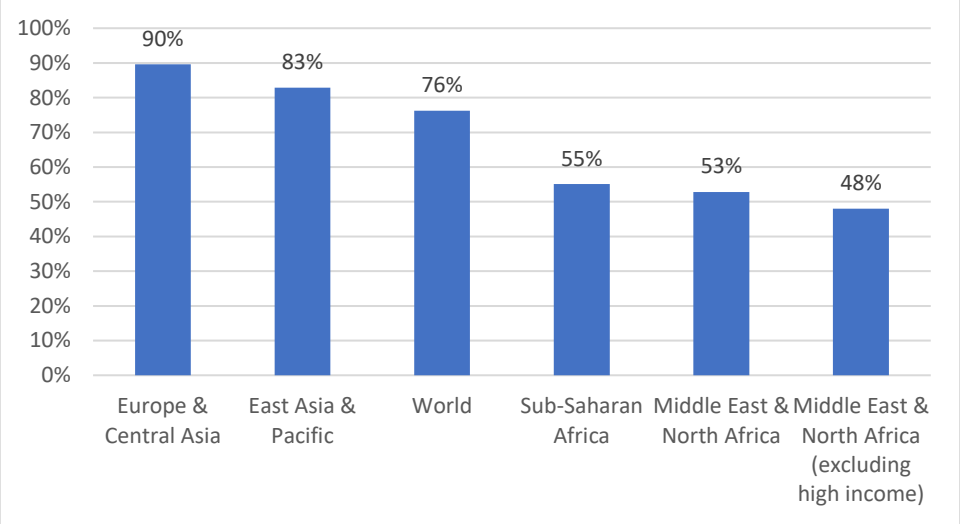
Source: By the researcher based on (*The Global Findex Database 2021*, 2022)

Account penetration in MENA has shown significant growth, increasing from 38% in 2014 to 53% in 2021.

However, despite this improvement, MENA region has the lowest penetration rate in the world, after getting surpassed by Sub-Saharan Africa that experienced a faster pace of improvement increasing from 34% in 2014 to 55% in 2021.

MENA region is the region with the lowest rate of account penetration (53%) with a wide gap compared to Europe and Central Asia (90%). If we exclude high-income countries, the rate is even worse with account penetration rate of 48%. This suggest that income level explain partially the variation in financial inclusion across economies and regions.

Figure 2. 2: Account penetration rate by region



Source: (*The Global Findex Database 2021*, 2022)

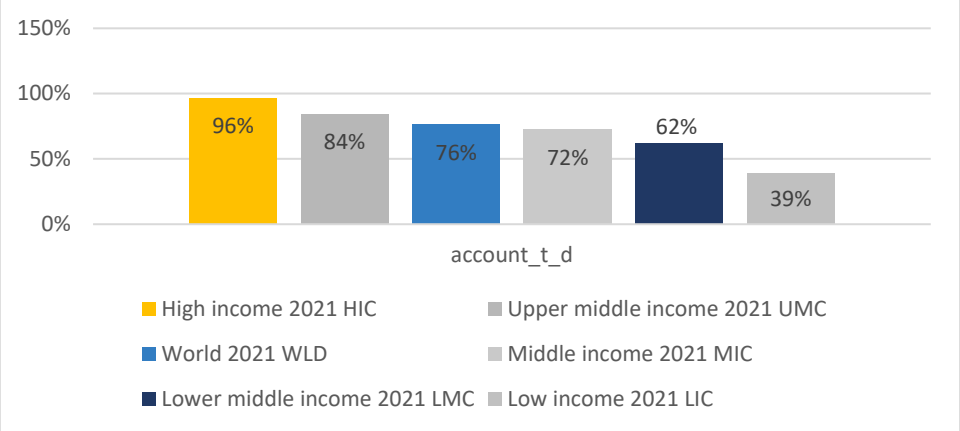
Low-income countries in the MENA region encounter obstacles such as, limited banking infrastructure and socioeconomic factors that impede widespread adoption of bank accounts. In contrast, Sub-Saharan Africa has made commendable strides in advancing financial inclusion, thanks to initiatives like mobile banking and innovative technologies.

To narrow the disparity and enhance access to formal financial services, low-income countries in MENA should earnestly tackle these challenges and prioritize the promotion of financial inclusion. By drawing lessons from successful models and harnessing technology, they can effectively expand financial access and empower their populations.

Variation in financial inclusion by national income

Account penetration varies widely across economies. The global Findex 2021 report reveals that more than 1.4 billion adults are financially excluded. While account penetration is almost for everyone (96% of adult population) in high income economies, only 39% have an account at a formal financial institution in low-income economies.

Figure 2. 3: Account penetration rate by region

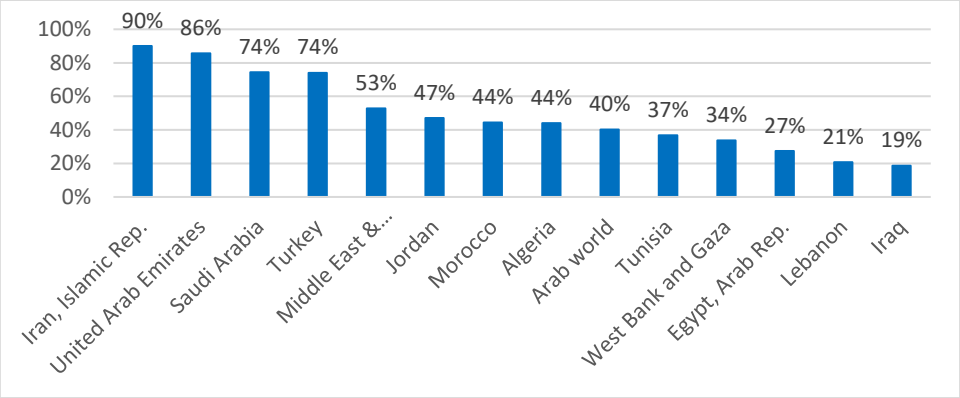


Source: (*The Global Findex Database 2021*, 2022)

Moreover, while 90% of the adult in Europe and central Asia have account, only 53% in MENA region, and if we exclude high income only 48% have a formal account in MENA.

Furthermore, the following graph shows that high income including (UEA, Saudi Arabia and Turkey) are above the mean (53%) 86% for UAE while lower income countries are below the mean, only 19% for Iraq.

Figure 2. 4 Account penetration rate by country in MENA (2021)



Source: (*The Global Findex Database 2021*, 2022)

The variation between high income and low-income economies, in addition to the variation between MENA and MENA (excluding high income) provide evidence that this variation can be explained by national income.

High level of account penetration can be attributed to a well-established banking infrastructure in high income economies.

However, some countries with low income such as Iran and Jordan have a higher account penetration (90% and 47% respectively) compared to other countries with same income level.

If we exclude higher income economies in MENA, we see that most low-income countries have close income level but the account penetration rate varies widely, which means the income level doesn't explain solely the variation in account penetration.

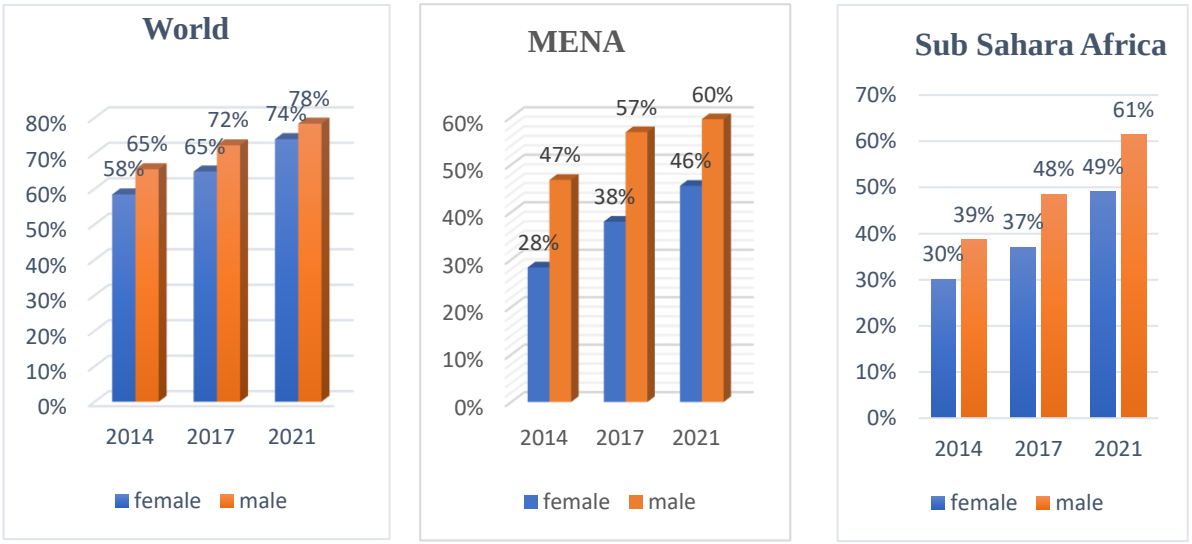
This variation in account penetration beside the income level, can also be explained by the level of financial literacy and financial education that are important in an era where complex financial products are available, making it challenging for individuals to make well-informed financial decisions. (Union of Arab Banks, 2017, p. 16) In addition, technological advancement which is the foundation of fintech development can also explain the variation in financial inclusion between countries with same level of income.

Variation in financial inclusion by individual characteristics:

Account penetration also differ considerably by individual characteristics such as age, education level, gender and individual income.

By gender:

Figure 2. 5: Account penetration



Source:(*The Global Findex Database 2021*, 2022)

While MENA region shows progress in reducing the gender gap in financial inclusion from 19% in 2014 to 14% in 2021, indicating an improvement in women's access to financial services, the gender gap in Sub-Saharan Africa increased slightly from 9% in 2014 to 12% in 2021.

However, although there was some improvement, the gender gap in the MENA region remains significantly higher compared the global average with 8% in 2014 and only 4% in 2021.

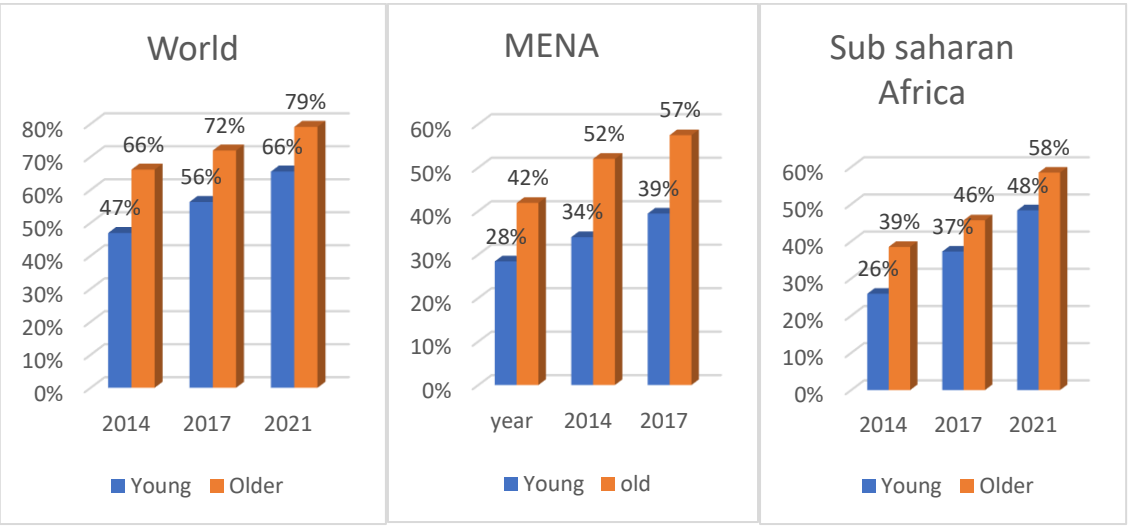
Targeted interventions are necessary to address the unique challenges faced by women in each region to ensure equal access and opportunities for financial empowerment.

By age:

In the MENA region, there is a notable age gap in financial inclusion, with older individuals (+25) having higher account penetration rates compared to younger individuals. Despite progress in account penetration, the disparity in financial inclusion between young and older individuals in MENA region increased from 14% in 2014 to 20% in 2021.

While in Sub-Saharan Africa, a similar trend is observed, with older individuals having higher account penetration rates compared to the younger population, the age gap narrowed from 13% in 2014 to 10% in 2021, indicating progress in reducing the disparity in financial inclusion by age.

Figure 2. 6: Account penetration variation by age



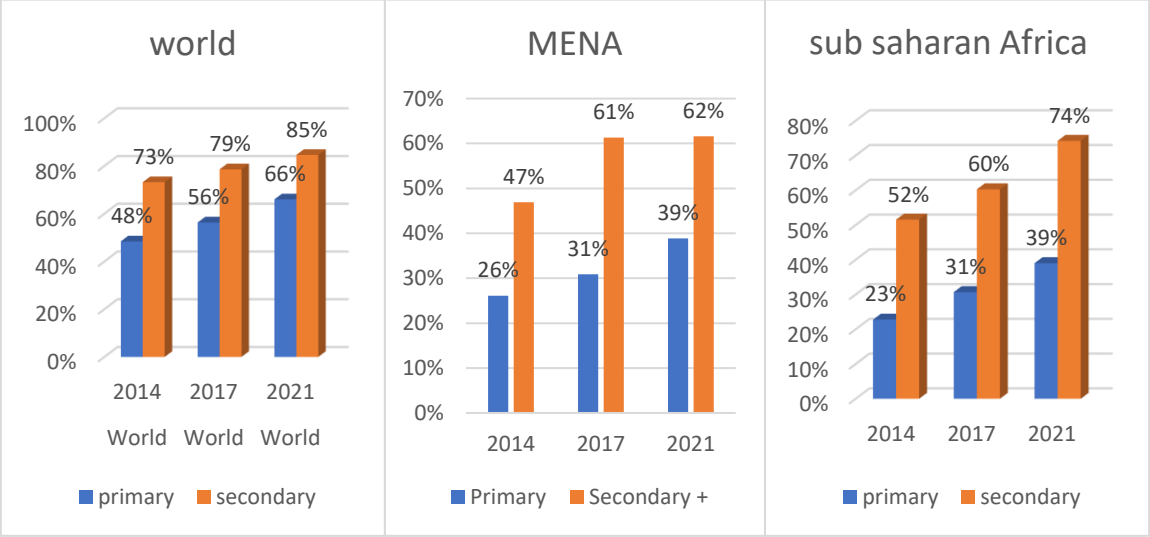
Source: (*The Global Findex Database 2021*, 2022)

Globally, there is also a significant age gap in financial inclusion, with older individuals having higher account penetration rates compared to younger individuals. However, the age gap decreased from 19% in 2014 to 13% in 2021, suggesting positive strides in improving financial inclusion for the younger population worldwide.

By education level:

In the MENA Region, Sub-Saharan Africa, and globally, there is a clear education gap in financial inclusion, with individuals with higher levels of education having higher account penetration rates compared to those with lower levels of education.

Figure 2. 7: Account penetration variation by education level



Source: (*The Global Findex Database 2021*, 2022)

Over time, there has been noticeable progress globally in reducing the education gap in financial inclusion, indicating positive strides in expanding financial access among individuals with lower levels of education.

However, it is important to acknowledge that the MENA region and Sub-Saharan Africa witnessed a widening of this gap between 2014 and 2021.

In comparison, Sub-Saharan Africa exhibits a more significant education gap in financial inclusion when compared to both the MENA Region and the global average.

This highlights the pressing need for targeted efforts that specifically promote financial inclusion among individuals with primary education.

To reduce the education gap in financial inclusion, it is important to implement inclusive policies and initiatives that prioritize financial education for individuals regardless of their

educational background. This can be achieved through tailored educational programs and accessible resources.

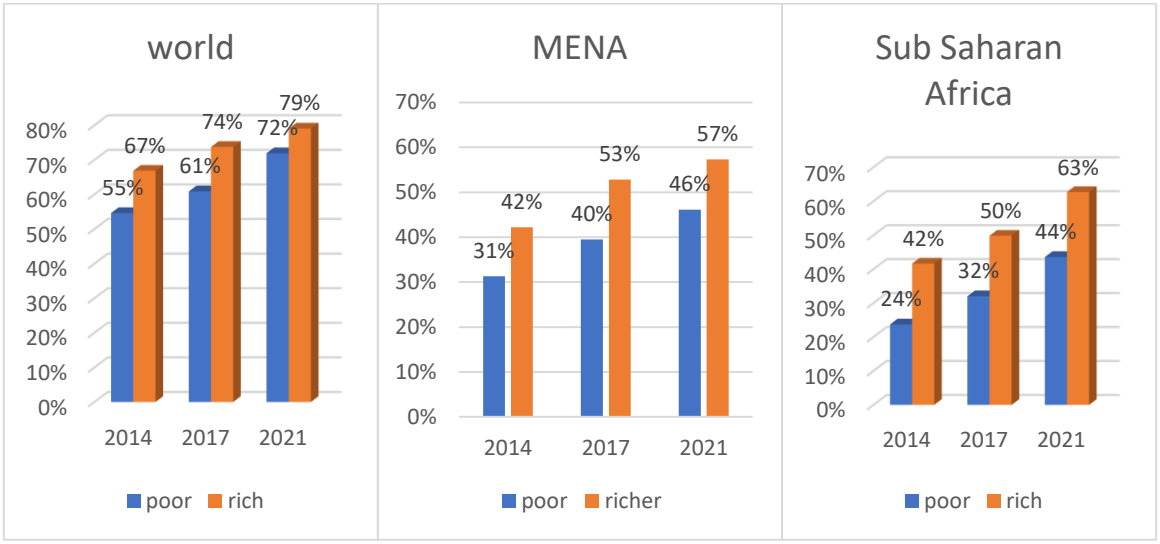
By individual income:

Over time, there has been noticeable progress globally in reducing the income gap in financial inclusion, signifying advancements in providing financial access to individuals with lower incomes.

However, it is important to note that the income gap in the MENA region remained unchanged between 2014 and 2021, indicating similar progress in financial inclusion for both the economically disadvantaged and wealthier individuals in the region.

MENA region has a narrow income gap in financial inclusion compared to Sub-Saharan Africa, explained by the disparities in income distribution in the two regions, with a significant proportion of the population falling into lower income brackets in Sub-Saharan Africa.

Figure 2. 8: Account penetration variation by income level



Source: (*The Global Findex Database 2021*, 2022)

To address the income gap in financial inclusion, it is important to focus on expanding access to affordable banking services by designing inclusive financial products and services that cater to the specific needs and constraints of individuals with lower incomes.

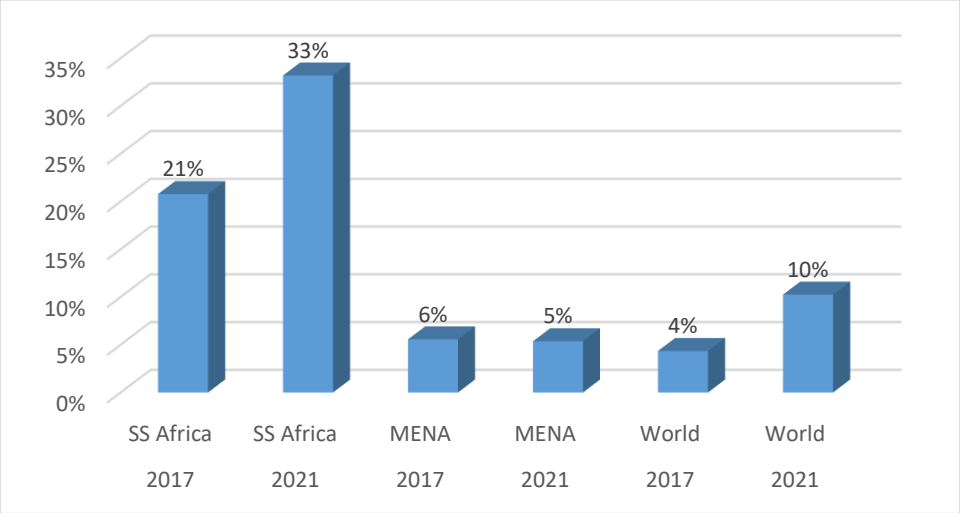
Mobile money penetration

Mobile money has the potential to provide greater access to financial services, especially for underserved populations, by offering convenient, secure, and cost-effective financial transactions through mobile devices.

By leveraging mobile technology, countries can bridge the gap in financial inclusion and empower individuals with greater control over their financial lives. From 2014 to 2021, the adoption of mobile money accounts in developing economies led to an 8% rise in the number of individuals with access to financial accounts. (Demirgüç-Kunt et al., 2022, p. 36)

Globally, the adoption of mobile money has increased over time, with a higher penetration rate in 2021 compared to 2014. However, the global average remains lower than the rates observed in Sub-Saharan Africa. This indicates that while mobile money has gained traction globally, there is still significant room for growth and adoption in many regions.

Figure 2. 9: Percentage of Individuals with Mobile Money Account



Source: (*The Global Findex Database 2021*, 2022)

Sub-Saharan Africa has been a global leader in mobile money adoption, with a significantly higher penetration rate compared to the MENA region and the global average in both 2014 and 2021. This can be attributed to various factors, including a higher prevalence of mobile phone usage and a relatively greater need for mobile-based financial services in the region.

MENA region has shown considerably lower mobile money penetration rates compared to Sub-Saharan Africa. This could be due to factors such as limited awareness and understanding of mobile money services, and a relatively stronger presence of traditional banking services in the region.

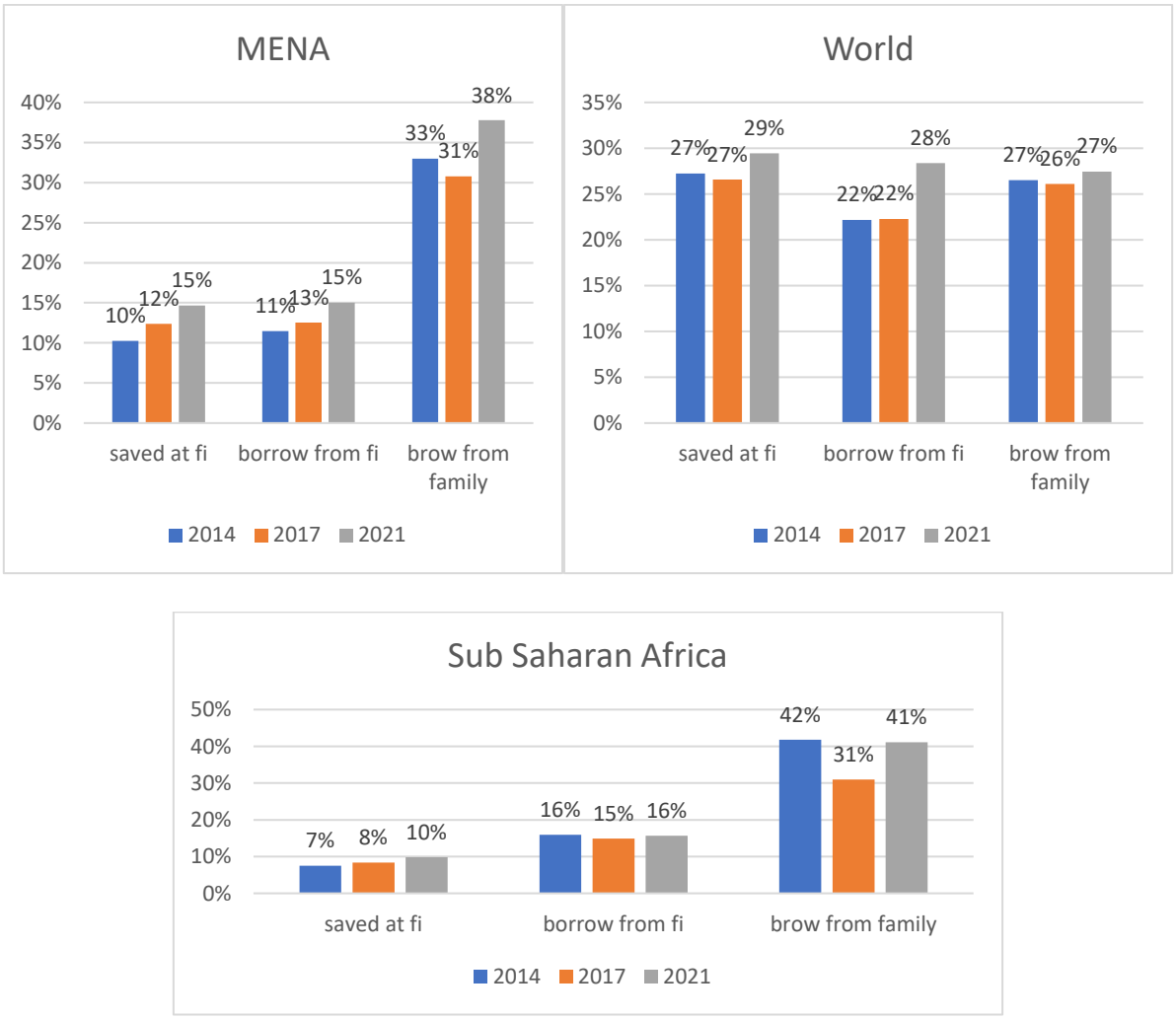
Fostering partnerships between mobile network operators and financial institutions, and creating an enabling regulatory environment in MENA region can help drive the adoption of mobile money and improve financial inclusion.

2.1.1.2. The usage: Saving, borrowing and digital payments

Saving and borrowing at financial institutions, in addition to using digital payments are important metrics for measuring the usage of financial services.

State of Saving and borrowing in the MENA region

Figure 2. 10: Percentage of Individual that borrow from family, from financial institution and saved at financial institution



Source: (*The Global Findex Database 2021*, 2022)

The MENA region and Sub-Saharan Africa show similar levels of borrowing from financial institutions, which remain slightly lower than the global average.

Factors such as limited access to credit, high interest rates, and strict loan requirements can affect borrowing behaviour from formal financial institutions in these regions.

Saving rates at financial institutions in Sub-Saharan Africa is lower compared to the MENA region. In 2021, the saving rate in Sub-Saharan Africa was 10% compared to MENA's 15%. This can be attributed economic disparities, income inequality, and varying levels of economic development.

However, MENA region have lower rates of saving at financial institutions compared to the global average. This may be due to factors such as limited access to formal banking services, and religious and cultural preferences for alternative savings method.

Both the MENA region and Sub-Saharan Africa exhibit higher rates of borrowing from family compared to the global average. Strong social networks, reliance on informal financial systems, and cultural norms surrounding familial support contribute to this trend.

MENA region and Sub-Saharan Africa face challenges in promoting saving at financial institutions and encouraging borrowing from formal financial institutions. These challenges may stem from limited financial access, inadequate financial literacy programs, and a preference for informal support networks. Addressing these barriers is crucial to promote financial inclusion.

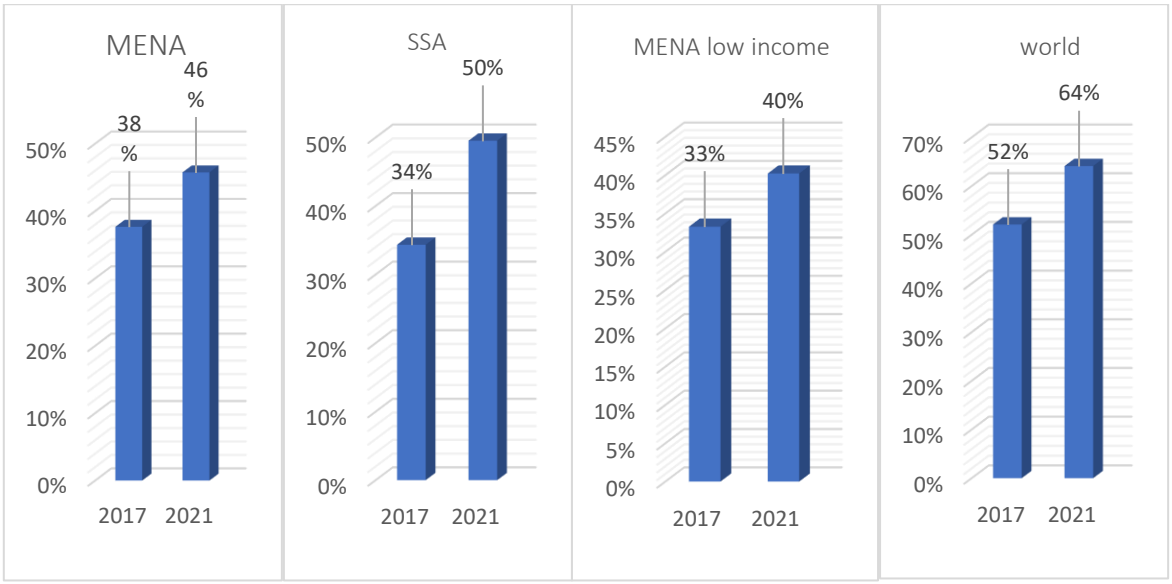
The higher rates of borrowing compared to saving can be influenced by economic and individual circumstances. Individuals with lower incomes may find it difficult to allocate a portion of their limited funds towards saving. Meeting daily expenses and covering basic needs often take priority over saving. In such cases, borrowing becomes necessary to address immediate financial needs or unexpected expenses

Digital payment

Sub-Saharan Africa shows significant growth in digital payment adoption, with a notable increase from 34% in 2017 to 50% in 2021. This growth can be attributed to the rise of mobile money platforms.

MENA region also experienced growth in digital payment adoption, though at a slightly slower pace compared to Sub-Saharan Africa and the global average. Excluding high-income countries reveals a lower adoption rate compared to the overall adoption rates in MENA. This variation could be due to differences in infrastructure, regulatory frameworks, and access to digital financial services within the MENA region.

Figure 2. 11: Percentage of Individuals who Made or Received Digital Payment



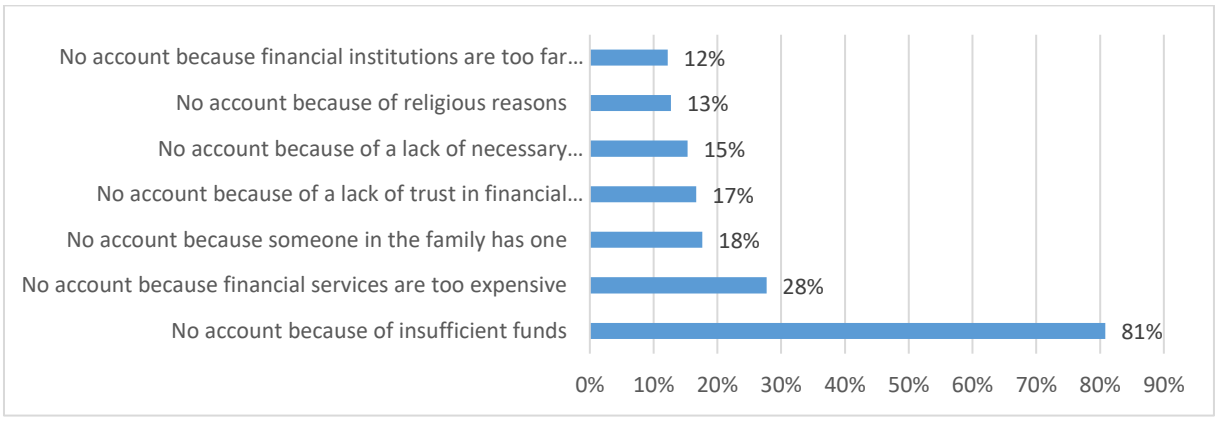
Source: (*The Global Findex Database 2021*, 2022)

Policymakers, financial institutions, and technology providers can work together to improve digital payment adoption, promote financial inclusion, and unlock the benefits of digital financial services for individuals and businesses in MENA region and Sub-Saharan Africa.

2.1.2. Barriers to financial inclusion

The following graph shows the different main reasons behind financial exclusion in The MENA region.

Figure 2. 12: Barriers to financial inclusion in MENA region



Source: (*The Global Findex Database 2021*, 2022)

Insufficient Funds (81%): A very high percentage of unbanked individuals in the MENA region faces financial constraints, limiting their ability to open and maintain financial accounts.

This highlights the need for initiatives that promote financial inclusion through improved income generation, poverty reduction, and targeted financial assistance programs.

Expensive Financial Services (28%): While not as high as insufficient funds, the cost of financial services remains a concern. This calls for efforts to enhance affordability through the development of low-cost products, reduced transaction fees, and increased competition among financial service providers.

Lack of Trust (17%): A moderate percentage of individuals in the MENA region cited that lack of trust in financial institutions is a reason for not having an account. Building trust in financial institutions is essential to increase account ownership. Strengthening consumer protection regulations, ensuring transparent and ethical practices, and enhancing financial literacy initiatives can help address the trust deficit and encourage more individuals to utilize formal financial services.

Lack of Documentation (15%): A relatively low percentage of individuals in the MENA region that mentioned a lack of necessary documentation as a barrier to account ownership suggests relatively better documentation processes in the region. Howerver, efforts should still be made to simplify documentation requirements and enhance the processes for account opening. Providing alternative means of identification and implementing digital onboarding can improve access for individuals who may face challenges in meeting traditional documentation criteria.

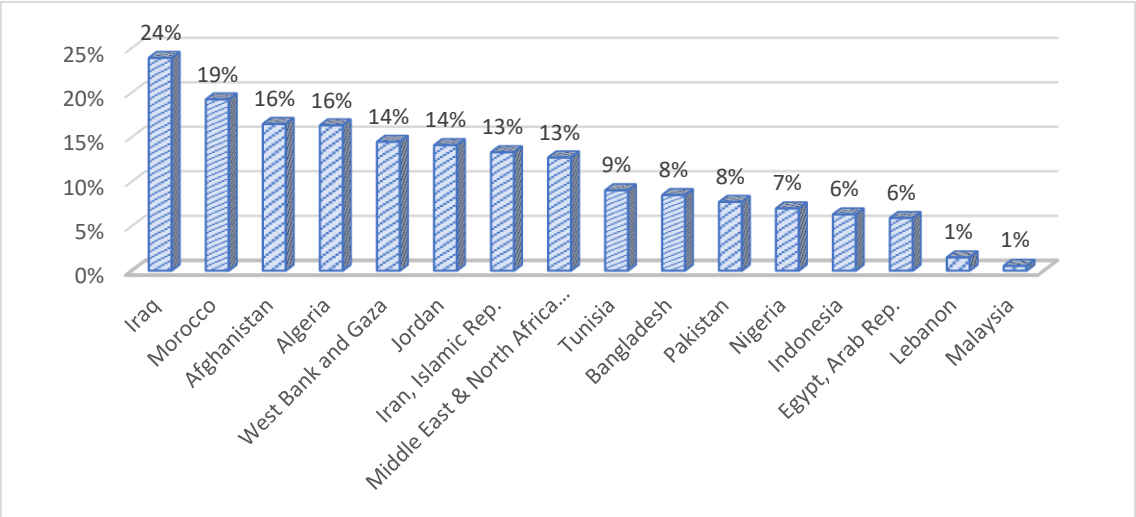
Lack of Accessibility (12%): The relatively low percentage indicates that physical access to financial services is not a significant barrier in the MENA region. However, efforts to expand financial service coverage and digital infrastructure can further improve accessibility, particularly in rural and remote areas.

Religious Reasons (13%): Religious considerations play a notable role in account ownership. A notable percentage of individuals in the MENA region (13%) cite religious reasons for not having an account. This can be attributed to cultural and religious practices that may influence financial behaviors and preferences.

Understanding and respecting cultural and religious practices, as well as offering Islamic banking products that comply with Shariah principles, can help address this barrier and increase trust in financial institutions.

However, within MENA region there is wide variation between countries from 24% in Iraq to only 1% in Lebanon.

Figure 2. 13: No account because of region concerns



Source: (*The Global Findex Database 2021*, 2022)

The variation in the percentages of individuals citing religious reasons for not having an account can be influenced by cultural and religious practices in addition to financial infrastructure.

Different countries have diverse cultural and religious practices that may influence individuals' financial behavior and preferences.

Furthermore, The availability and accessibility of formal financial services, particularly Islamic banking services, can play a role in mitigating the impact of religious reasons on account ownership. Countries with well-developed Islamic banking systems may offer viable options within the formal financial sector that align with religious principles.

2.1.3 Policies for financial inclusion in MENA

Recognizing the importance of providing access to financial services for all individuals, regardless of their economic background or geographical location, governments and organizations have implemented several national and regional initiatives in the MENA region to promote financial inclusion by reducing disparities.

"Financial Inclusion Task Force" (FITF)

In order to leverage the experience gained in prompting financial inclusion in the MENA region, in 2012 the Arab Monetary Fund (AMF) created a regional initiative "Financial Inclusion Task Force" (FITF) that operates under the Council of Arab Central Banks Governors. (Habib Attia & Carol Coye Benson, 2018, p. 27)

The main objective of FITF is to contribute in promoting financial inclusion in MENA countries, by providing support and assistance to national authorities in enhancing their regulations, raising financial awareness within the Arab region, and promoting collaboration between supervisory authorities and relevant international institutions.(Arab Monetary Fund, n.d.-a)

The Financial Inclusion for the Arab Region Initiative (FIARI): It is a regional initiative that aims to promoting financial inclusion in the MENA region. It was launched on September 2017, during the 2017 AFI Global Policy Forum held in Sharm El Sheikh. FIARI is a result of collaboration between governments, central banks, financial institutions, and development organizations. It is supported by the Arab Monetary Fund, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, the Alliance for Financial Inclusion, and the World Bank. (Arab Monetary Fund, n.d.-b)

FIARI recognises the importance of financial inclusion in promoting inclusive growth and sustainable development.(Habib Attia & Carol Coye Benson, 2018, p. 29).

Therefore, it aims to implement an inclusive and robust financial system and address the barriers to financial inclusion in the Arab world, allowing unbanked and underserved individuals and firms will get access to responsible financial products that meet their real needs. (Arab Monetary Fund, n.d.-c)

The main activities of FIARI tend to support the establishment of national financial inclusion strategies in the region. It provides technical assistance, peer exchange to facilitate knowledge sharing and collaboration among countries, in addition to providing advisory services to national regulators and policymakers.(Habib Attia & Carol Coye Benson, 2018, p. 29)

Arab financial inclusion day:

In the context of enhancing financial inclusion to support inclusive and sustainable economic development, the Board of Governors of Central Banks and Arab Monetary Institutions adopted April 27 of each year as an occasion to commemorate the Arab Day for Financial Inclusion, recognizing the importance of financial inclusion in achieving inclusive and sustainable economic growth and enhancing economic and financial stability. (Habib Attia & Carol Coye Benson, 2018, p. 28)

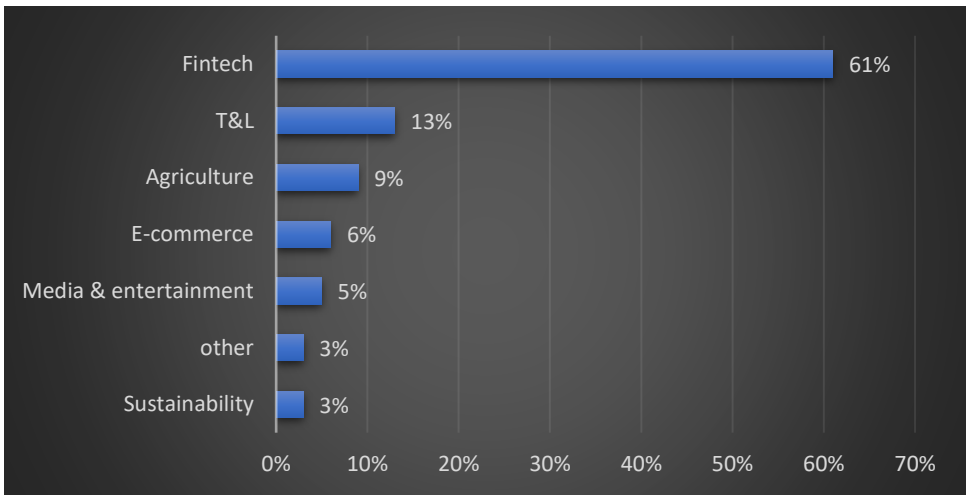
2.2. Fintech in the MENA region

Countries in the MENA region consider fintech as a catalyst for achieving the goals of their various financial inclusion programs and initiatives. In this section, we will discuss the state of fintech in MENA countries, focusing on investments, government's intervention, in addition to the ranking of countries according to the strength of their fintech ecosystems.

2.2.1. Fintech funding

In the MENA region from 2018 to 2022, the fintech industry emerged as the dominant sector in terms of total value of venture debt funding, accounting for a significant share of 61%. Other industries with notable venture debt funding include, transportation & logistics (T&L) with a share of 13%, agriculture with 9%, e-commerce with 6%, media & entertainment with 5%, and sustainability and other sectors each with a share of 3%.

Figure 2. 14: Total Value of Funding in MENA from 2018 to 2022 by Industry

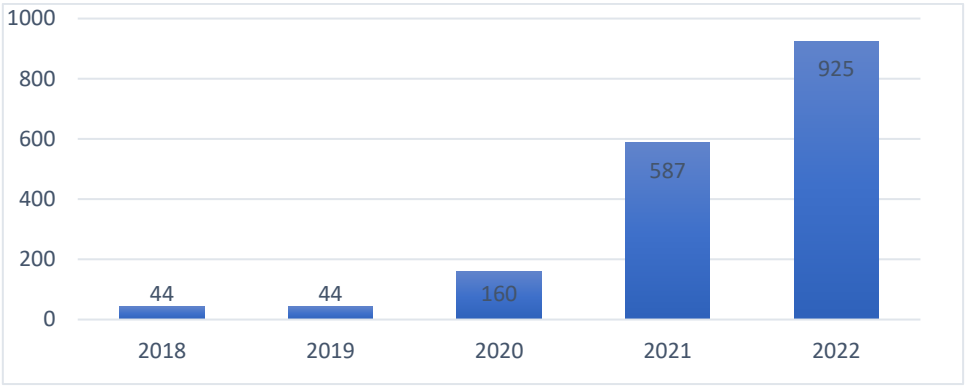


Source: (Magnitt, 2023a)

The high percentage of venture debt funding allocated to fintech reflects the increasing demand, and the recognition of the fintech sector's potential in transforming financial services and addressing the evolving needs of businesses and consumers in the MENA region.

The fintech funding in the MENA region has shown a consistent growth trend over the years. The funding increased from $44 Million in 2018 and 2019 to $160 Million in 2020. There was a significant jump in funding in 2021, reaching $587 million, and further growth in 2022 with $925 million. This indicates a positive trajectory in fintech investments in the MENA region, reflecting increased interest and maturation of the regional fintech ecosystem.

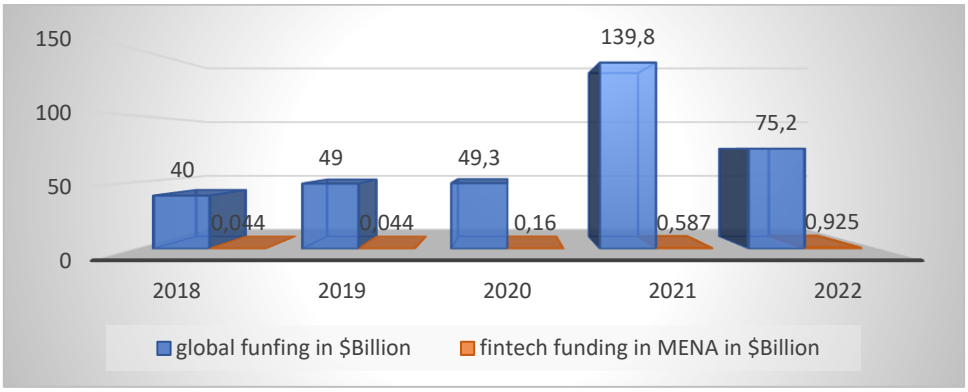
Figure 2. 15: Fintech Funding in MENA (in $Million)



Source: (Magnitt, 2023b)

In 2022, while the global fintech funding amounts saw a significant drop to $75.3 billion, the fintech funding in the MENA region surpassed the previous year's amount, reaching $925 million.

Figure 2. 16: Fintech Funding MENA vs World (in $Billion)



(Magnitt, 2023b) and (Selim Yuksel, 2022, p. 15)

The MENA region represents a smaller share of the global fintech landscape, it accounted for approximately 1.2% of the global fintech funding in 2022, suggesting potential opportunities for further development and investment in the region.

However, the proportion of MENA funding compared to global funding has shown an increasing trend over the years. While the proportion was relatively small in earlier years (0.11% in 2018 and 0.09% in 2019), it has gradually increased, reaching 0.32% in 2020, 0.42% in 2021, and 1.23% in 2022. This suggests that the MENA region is gaining more prominence and attracting a larger share of global fintech investments.

Evolution of fintech funding in MENA during COVID-19 period (2020 – 2021)

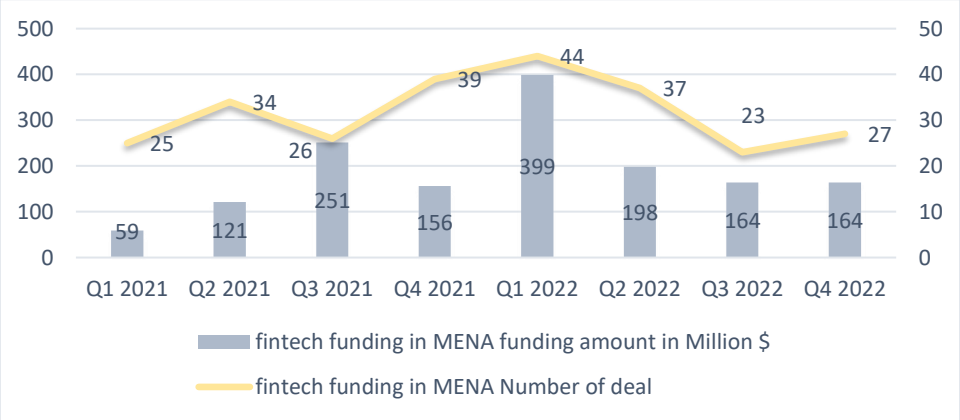
The COVID-19 pandemic has had a profound impact on the global fintech landscape, catapulting its growth by threefold worldwide. The increased demand for digital solutions, contactless transactions, and remote financial services during the pandemic propelled the fintech sector to new heights. Similarly, the MENA region experienced an even more substantial surge, with fintech funding increasing by four times.

The pandemic accelerated the adoption of fintech in the MENA region, as individuals, businesses, and governments sought secure and convenient digital alternatives for banking, payments, and financial management. This remarkable growth in both the global and MENA fintech sectors underscores the crucial role played by fintech in providing innovative solutions amidst challenging circumstances.

Evolution of fintech funding in MENA (quarter data for 2021- 2022)

In 2021, we observe a gradual increase in funding from Q1 to Q3, indicating growing interest in the MENA fintech sector.

Figure 2. 17: Fintech Funding (in $Million) & Number of Deals



Source: (Magnitt, 2023b)

However, funding dropped in Q4 compared to the previous quarter. The total funding in 2021 amounted to $587 million.

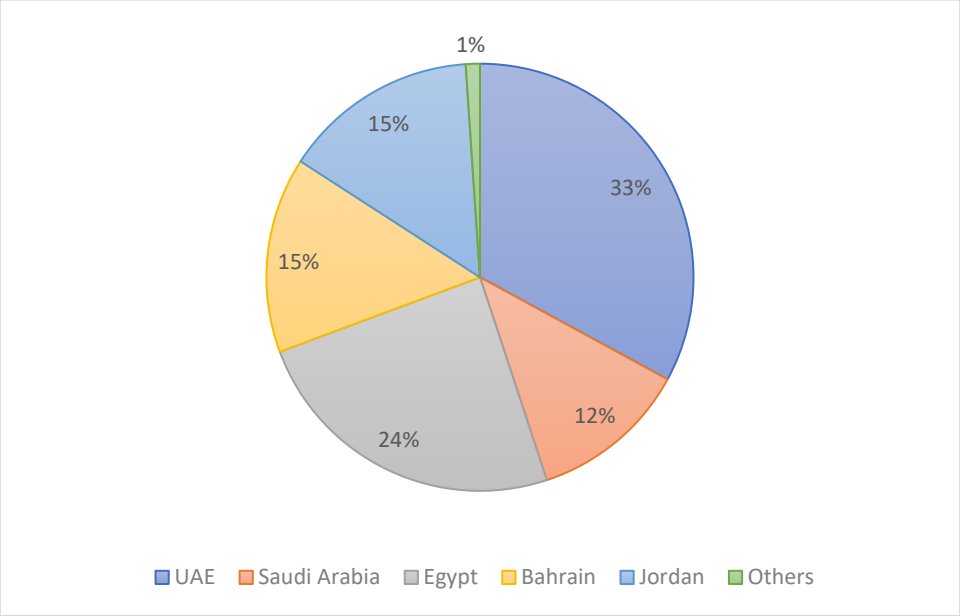
In 2022, Q1 stands out with a significant spike in funding, reaching $399 million. This suggests a strong interest from investors in the MENA fintech ecosystem, possibly due to the growth potential and market opportunities in the region. However, funding decreased in Q2 and remained stable in Q3 and Q4, with each quarter receiving $164 million. The total funding in 2022 amounted to $925 million.

Overall, there was a substantial increase in funding from 2021 to 2022, indicating a positive trend in the MENA fintech sector. Q1 2022 saw the highest funding amount, reflecting a particularly strong period of investment.

Fintech funding split by countries

In 2021, the UAE received the largest share of fintech funding in the MENA region, accounting for 33%. Egypt followed closely with 24%, while Bahrain and Jordan each secured 15% of the funding. Saudi Arabia accounted for 12%, and the remaining countries collectively received 1% of the funding.

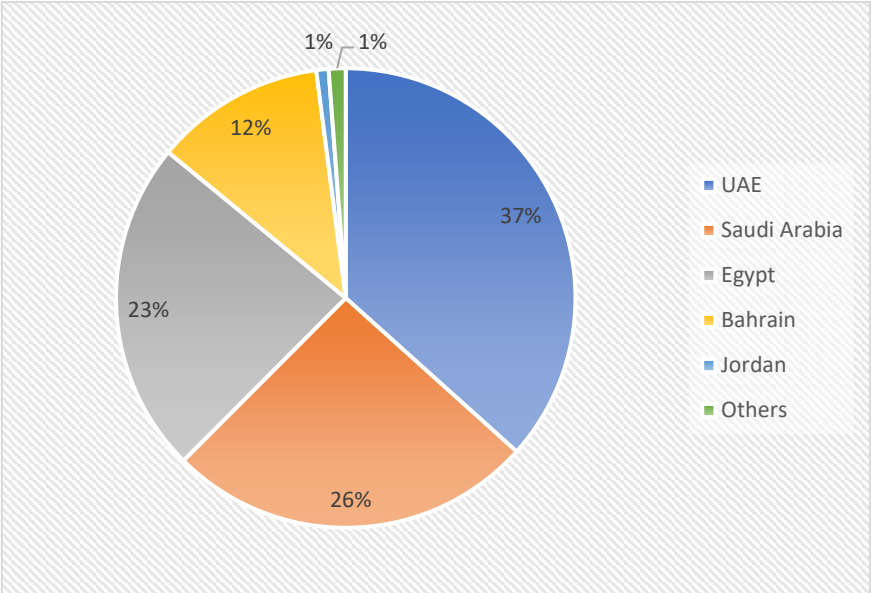
Figure 2. 18: Fintech Funding by country (2021)



Source: (Magnitt, 2023b)

In 2022, the UAE remained the top player in fintech funding across the MENA region, securing the larger part at 37%. Saudi Arabia had a notable upswing, getting a solid 26% of the funding. Egypt held on to a good portion with 23%. Bahrain's share dropped to 12%, and Jordan's share went down to just 1%. All the other countries combined received 1% of the funding.

Figure 2. 19: Fintech Funding by country (2022)



Source: (Magnitt, 2023b)

UAE Dominance: The UAE stayed ahead in fintech funding throughout 2021 and 2022, showing that its fintech scene is really thriving. This could be attributed to friendly rules, solid support systems, and a vibrant startup environment.

Saudi Arabia's Progress: Fintech funding in Saudi Arabia jumped from 12% in 2021 to 26% in 2022. The fintech industry in Saudi Arabia is expanding largely, likely due to new regulations and more interest from investors.

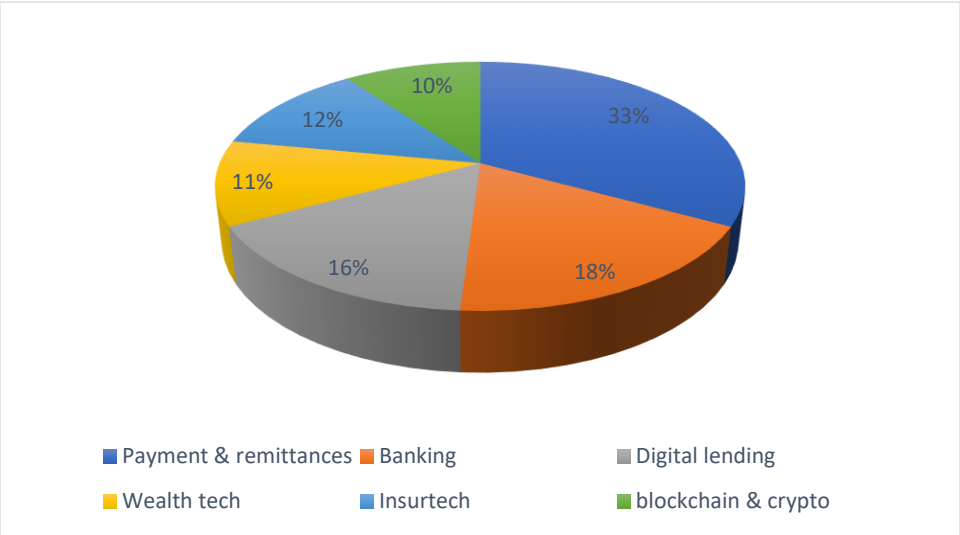
Egypt's Stability: Egypt maintained a strong position in fintech funding with a relatively consistent share of 24% in 2021 and 23% in 2022. This stability indicates the presence of a mature and evolving fintech landscape in Egypt.

Bahrain and Jordan: Bahrain experienced a decrease in its share of fintech funding from 15% in 2021 to 12% in 2022. Jordan's share also dropped from 15% in 2021 to 1% in 2022. These fluctuations may be influenced by various factors such as local regulations, investment climate, and emerging fintech ecosystems in other countries.

Fintech funding split by sub-industry

The fintech industry is composed of various sub-industries, each with its own funding dynamics.

Figure 2. 20: Fintech Funding in MENA by Industry (2022)



Source: (Magnitt, 2023b)

In the MENA region Payment & Remittances received the highest share of funding in 2022 at 33%. This reflects the increasing demand for digital payment solutions and the need for efficient cross-border remittance services in the region. Followed by Banking-focused fintech companies which received a significant share of funding at 18%. This includes neobanks, digital banking platforms, and other innovative solutions aiming to enhance banking services and customer experiences.

Digital lending platforms including crowdfunding, buy now pay later and P2P lending, offering alternative lending solutions and streamlined borrowing experiences, captured 16% of funding in the MENA region. The growth in digital lending signifies the demand for accessible and efficient credit solutions for individuals and businesses.

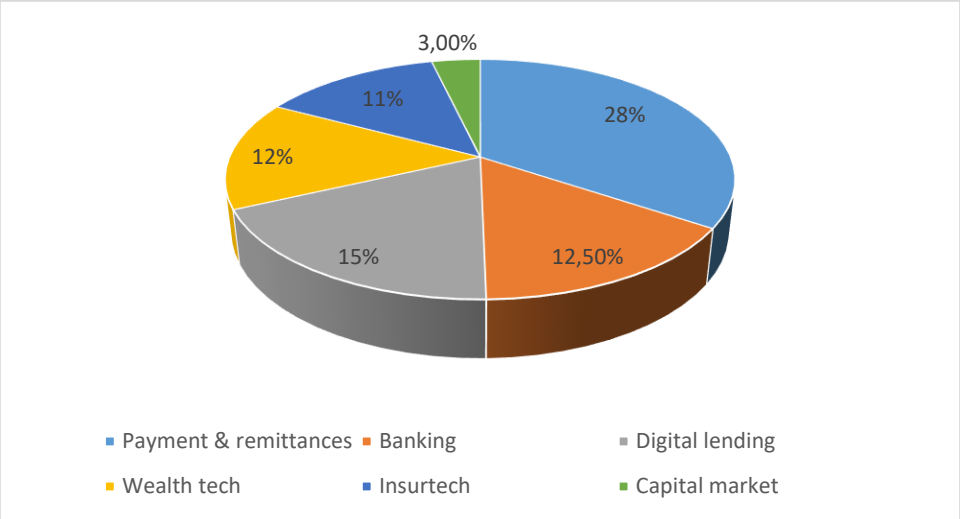
Wealth tech, encompassing robo-advisors, investment platforms, and wealth management solutions, secured 11% of funding. This indicates the increasing interest in digital wealth management and investment services in the region.

Insurtech, focusing on technology-driven insurance solutions, received 12% of funding. This reflects the drive to modernize the insurance sector, improve customer experiences, and enhance the efficiency of insurance processes.

Finally, the Blockchain & Crypto sub-industry captured 10% of venture debt funding in the MENA region. This highlights the growing interest in blockchain technology, cryptocurrency, and decentralized finance (DeFi) solutions within the region.

When comparing the MENA region to the global fintech landscape, some variations can be observed in the sub-industry distribution of funding. Notably, the MENA region has a higher allocation of venture debt funding for Payment & Remittances (33% in MENA vs. 28% globally) and Banking (18% in MENA vs. 12.50% globally).

Figure 2. 21: Global Fintech Funding by Industry (2022)



Source: (Selim Yuksel, 2022, pp. 55–120)

These differences can be attributed to several factors, including regional market dynamics, specific demands and challenges within the MENA market, and regulatory frameworks. The MENA region has a large population of unbanked individuals and a high volume of remittance flows, driving the need for innovative payment and banking solutions. As a result, more funding is directed towards these areas to address market gaps and capture the untapped potential.

In 2021, data reveals that the United Arab Emirates (UAE) secured the second spot as a major source country for remittance outflows, with a staggering amount of $43 billion. Saudi Arabia followed closely in third place, surpassing $34 billion. On the other hand, Egypt emerged as the top country in the Middle East and Africa (MEA) region for receiving remittances, ranking fourth globally. This signifies that the remittance corridors for both sending and receiving money in the MEA region are among the busiest in the world. (Richie Santosdiaz, 2022, p. 24)

2.2.2. Fintech ecosystem in the MENA region

Across the MENA region, governments have taken proactive steps to promote the growth and acceptance of fintech innovations. They have established a range of support mechanisms to encourage the development of fintech solutions.

However, **w**hile fintech has been gaining significant traction across the region, it is important to recognize that each country's ecosystem exhibits distinct features, challenges, and opportunities. These differences arise from variations in market dynamics, regulatory frameworks, cultural factors, and levels of technological adoption.

Understanding the nuances of the fintech ecosystems in different MENA countries is crucial for grasping the diverse landscape and unlocking the potential for innovation and growth. In this subsection, we will examine a series of case studies to explore the distinct characteristics of the fintech ecosystems in selected MENA countries.

To gain a deeper understanding of the key drivers of fintech growth in the MENA region, we will showcase the countries that boast strong fintech ecosystems, including Egypt, the United Arab Emirates (UAE), and Saudi Arabia. We will also investigate the evolution of fintech ecosystems in Maghrebin countries.

Fintech ecosystem in Egypt

Financial inclusion is considered a key enabler to support the achievement of some sustainable development goals of Egypt.

Therefore, in the context of promoting financial inclusion by expanding access of individuals and firms to sustainable and affordable financial services, the Central Bank of Egypt (CBE) has introduced The Financial Inclusion Strategy 2022-2025. The strategy aims to:(Central Bank of Egypt, n.d., p. 2)

1. Enhancing Consumer protection and improving consumers’ trust in the national banking system.

2. Expanding financial literacy.

3. Facilitating access to different financial services for individuals and firms, and encouraging the small enterprises to integrate the formal sector.

4. Promoting Fintech and Digital Financial Infrastructure, and encourage the adoption of digital financial services.

The Financial Inclusion Strategy 2022-2025 relies on four key pillars to drive innovation and meet evolving consumer needs: (Central Bank of Egypt, n.d., p. 3)

- Consumer empowerment
- Customer centric diversified products and services
- Ecosystem for SMEs and startups
- Digital financial services.

These pillars, in turn, are underpinned by three critical enablers: a robust legal and regulatory framework that balances innovation and protection, advanced financial technology coupled with resilient digital infrastructure, and a commitment to sustainable finance for economic stability and long-term growth.

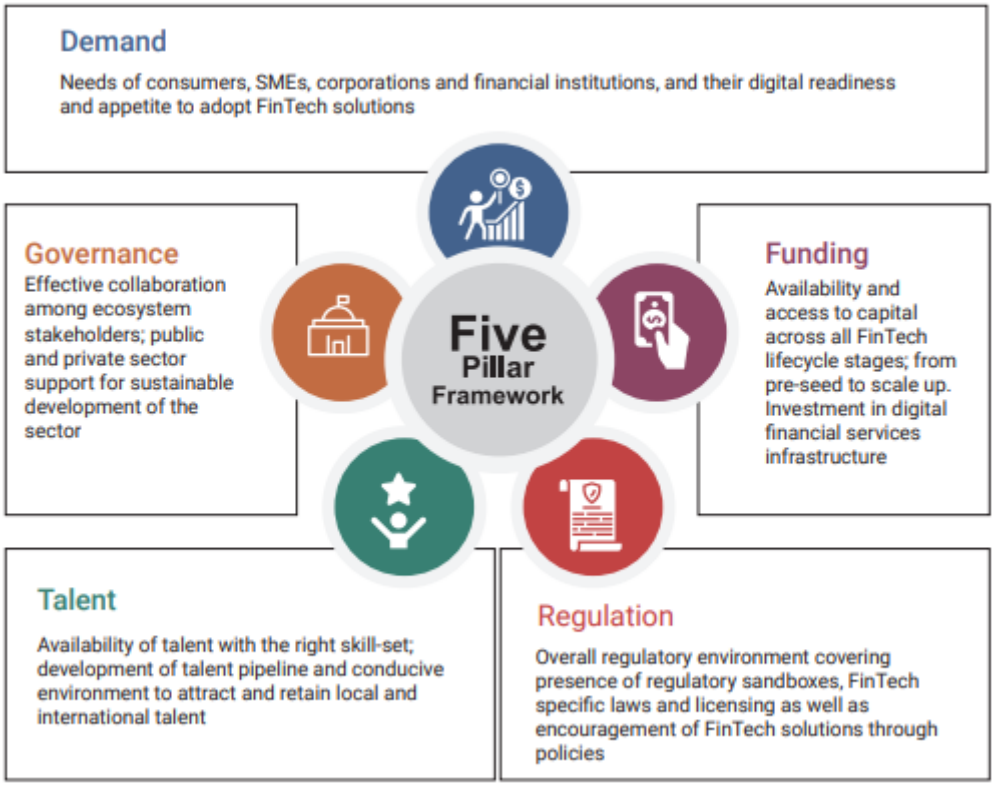
Egypt has taken significant strides in its digital transformation journey, aiming to transition towards a digital less-cash economy, which presents new opportunities. To guide its digital transformation and innovation agendas, the Arab Republic of Egypt has implemented various national-level policy frameworks and initiatives.

Notably, Egypt's national vision 2030, launched in February 2016, serves as a strategic roadmap to achieve sustainable development objectives across all sectors. Additionally, the country has established the less cash transformation framework, resulting from the establishment of the National Payment Council in February 2017.

The objectives set by the National Payment Council include developing a secure and efficient national payment system, enhancing financial inclusion by enrolling more individuals from both the formal and informal sectors into the banking system, protecting the rights of payment system for stakeholders and consumers, reducing the cost of fund transfers, and promoting a competitive payment services market while overseeing existing entities in the market. Through these initiatives, Egypt is proactively working towards a more inclusive, efficient, and secure financial ecosystem. (Fintech Egypt, 2021, p. 7)

Egypt’s Fintech strategy is based on five pillars; Demand, governance, funding, talent and regulation. The pillars are explained in the following figure:

Figure 2. 22: Egypt's Fintech Strategy (Pillars)



Source: (Fintech Egypt, 2021, p. 19)

Sandbox:

In May 2019 CBE (Central Bank of Egypt) has introduced the regulatory Sandbox established to serve as a controlled testing environment for startups to experiment with innovative business models and delivery methods. It provides a space where these startups can test their ideas with relaxed regulatory requirements, allowing them to manage the risks associated with disruptive technologies.

The primary goals of the regulatory sandbox include fostering fintech and innovation, addressing regulatory uncertainties, streamlining time and cost to market for new solutions, and building trust among investors.

By creating this supportive environment, the CBE aims to encourage entrepreneurial endeavours, facilitate market entry for new players, and promote a culture of innovation in the financial sector. (Fintech Egypt, 2021, p. 58)

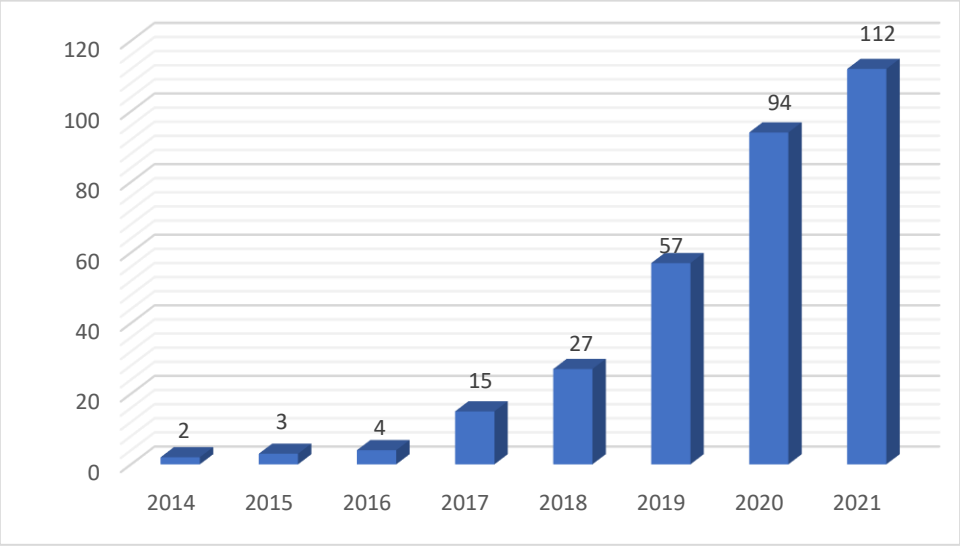
Financial literacy and talent: (Fintech Egypt, 2021, p. 37)

Addressing the limited digital proficiency among Egypt's population is crucial for enhancing FinTech adoption. Recognizing the importance of improving digital financial literacy, the CBE (Central Bank of Egypt) has prioritized it within its National Strategic Agenda. To foster talent development in the FinTech sector, the CBE launched the "FinYology - FinTech for Youth" initiative in February 2020.

This initiative, supported by the Egyptian Banking Institute and involving participation from various universities and banks, aims to enhance knowledge about FinTech and digital solutions among students while also identifying and nurturing young talents in the field. By focusing on educational programs and empowering the younger generation, the CBE is actively working to bridge the digital knowledge gap and cultivate a skilled workforce that can drive FinTech innovation and its adoption in Egypt.

As a result of the efforts made by Egypt's government, Egypt ranks among the top four active African countries in terms of the concentration of FinTech startups on the continent, and 3rd in the MENA region. The industry has witnessed remarkable growth, with the number of Egyptian FinTech and FinTech-enabled startups skyrocketing from a two FinTech companies in 2014 to an impressive count of 112 by 2021, as depicted in the graph below.

Figure 2. 23: Evolution of fintech startups in Egypt



Source: (Fintech Egypt, 2021, p. 24)

In addition, around 9 million of the Egyptian population are being served by those FinTech and FinTech-enabled startups, as reported by 75 Startups. (Fintech Egypt, 2021, p. 25)

Case study (Fawry):

Fawry is an Egyptian FinTech company, it was established in 2008 by Ashraf Sabri. In 2021 the fintech reached 32 billion EGP of market cap around 2$ billion making it the first unicorn in Egypt's fintech ecosystem. (Paracha, 2021)

Currently, it is listed on Egyptian Exchange EGX as Fawry for banking technology and payment, it's current market cap per June 29th is 19 EGP billion. (Reuters, 2023)

Fawry provides various digital financial services for consumers and businesses including, payments, transfers and remittances, digital lending etc.

With its 310k POS terminals, Fawry allows 50 million consumers to make 4 million EGP of transaction in daily basis contributing in fostering financial inclusion in Egypt by providing access to different financial services to unbanked and underserved individuals.(Fawry, n.d.)

Fintech ecosystem of UAE

The UAE has implemented various strategies to drive its fintech growth, including UAE Centennial 2071, UAE Vision 2021, Abu Dhabi Vision 2030, Smart Dubai 2021, Emirates Blockchain Strategy 2021, UAE National Strategy for Artificial Intelligence (AI) 2031, and Dubai Metaverse Strategy. (Richie Santosdiaz, 2022, p. 104)

In order to position themselves as globally interconnected FinTech hub, The UAE government has decentralized its approach to FinTech by introducing more than 40 “free zones” among the seven Emirates. (Mueller Jackson & S. Piwowar Michael, 2019, p. 22)

Furthermore, UAE has implemented regulatory sandboxes to attract international investors. The first sandbox in the region known as RegLab, it was launched by the Financial Services Regulatory Authority (FSRA) in November 2016. It has become the second most active fintech sandbox worldwide and aims to foster innovation within the UAE's fintech market. (Richie Santosdiaz, 2021, p. 31) Subsequently, both the Dubai Financial Services Authority and the Central Bank of the UAE established their own regulatory sandboxes in the following year. The UAE has also introduced regulatory frameworks to govern specific aspects of the fintech industry. (Mueller Jackson & S. Piwowar Michael, 2019, p. 37)

In Dec 2020, CBUAE has started its fintech office to foster Fintech activities in the banking sector and support the creation of a UAE approved regulatory framework in

collaboration with other FinTech authorities in the UAE (including in the DIFC and ADGM).(Fintech Middle East, n.d.)

Collaboration

The UAE has actively collaborated with various countries on innovative projects. A notable example is the successful completion of Project Aber in November 2020, which involved a cross-border central bank digital currency (CBDC) pilot conducted by the UAE and Saudi Arabian central banks.

This groundbreaking initiative utilized cutting-edge distributed ledger technology (DLT) to facilitate seamless cross-border payments. (Michael Magrath & Gabrielle Inhofe, 2022, p. 17)

In addition, the UAE has joined the Multiple Central Bank Digital Currency (m-CBDC) Bridge Project alongside the Digital Currency Institute of the People's Bank of China. The primary objective of this collaborative effort is to explore the potential of CBDCs and DLT in enabling instant cross-border payments, while prioritizing crucial aspects such as scalability, interoperability, privacy, and governance.

By participating in these initiatives, the UAE aims to simplify the complexities of cross-border fund transfers, reduce transaction costs, enhance operational efficiency, and effectively address regulatory compliance issues. (Michael Magrath & Gabrielle Inhofe, 2022, p. 17)

Th United Arab Emirates (UAE) has established itself as a prominent fintech hub within the MENA region and beyond, boasting a robust fintech ecosystem that encompasses 465 fintech startups. US$18.5 billion Digital Payment Transactions was made in UAE in 2020 and 97% Of consumers stated that they plan to use at least one new method of digital payment within next year, and 50% of UAE population plan to use cryptocurrencies within next year. (Fintech Middle East, n.d.)

The adoption of non-cash payments in the UAE is expected to witness substantial growth, with projections indicating that by 2023, non-cash transactions will make up approximately 73 percent of the total transaction volume.

This demonstrates a significant increase from the 39 percent recorded in 2018. (Richie Santosdiaz, 2022, p. 104)

This achievement can be attributed to the UAE's favorable regulatory environment, government support, and a range of initiatives aimed at nurturing entrepreneurship and attracting global players.

Case study (Beehive):

Beehive is a sharia compliant crowdfunding platform launched in 2014, based in Dubai and regulated by the DFSA. Beehive is the first regulated peer to peer (P2P) lending in the UAE and MENA region. (Fintech Middle East, n.d.)

Beehive lending platform offers an investment opportunity for small investors starting from 100 AED only with average return of 10% which is very attractive. This helped businesses to get fast access to funds with less cost to finance their projects from a crowd of investors.

Since its launch, Beehive funded more than 1000 businesses with total of more than 1.5 billion AED from 15 K investors. (*Borrow Fast, Low-Cost Finance*, 2018)

Fintech in Saudi Arabia

The Financial Sector Development Program (FSDP) of Saudi Vision 2030 was initiated in 2017. Initially it comprised three pillars, the three pillars aimed to empower financial institutions, fostering the growth of the private sector and establishing a developed capital market. Fintech strategy emerged in the beginning under the first pillar.

However, with the crucial role of fintech in the development of the financial services industry, the Fintech Strategy was incorporated as the fourth pillar of the FSDP. (Fintech Saudi, 2022, p. 5)

The fintech strategy has set ambitious economic targets to be achieved by 2030.

These targets include the creation of 18,000 fintech jobs, the establishment of 525 fintech players, a cumulative venture capital investment of 12.2 billion SAR, and a direct contribution of 13.3 billion SAR to the GDP. (Fintech Saudi, 2022, p. 8)

The fintech strategy consists of six drivers of transformation and eleven specific initiatives that aim to strengthen the fintech ecosystem in Saudi Arabia. The following table summarizes different driver and initiatives of Saudi’s fintech strategy

Table 2. 1: KSA Fintech Strategy (Drivers)

Driver	Initiatives	Objectives
Positioning	KSA global fintech positioning	Becoming fintech hub regionally and globally
Talent	Nurture Fintech Knowledge in KSA	Gaining strong knowledge in fintech
Technology	- Accelerate cloud for fintech - Develop emerging technology policies and accelerators - Implement and activate open banking practice in KSA	Enhancing technology drivers of fintech such as blockchain, cybersecurity, AI etc….
Regulatory framework	- Enhance fintech innovation withing Saudi central bank - Fintech regulatory enablement in the central bank and the capital market authority	Enhancing trust by mitigating risks relation to fintech operations
Market and funding	- Enable Fintech Saudi as the market driver - Determinate financial support mechanism for fintech in KSA	Attract investors and providing funding to fintech companies
Collaboration	Collaboration locally and globally	Enhancing collaboration in fintech industry

Source: (Fintech Saudi, 2022, p. 6)

Regulation:

In 2018, the Capital Market Authority (CMA) introduced the FinTech Lab, aimed at fostering fintech growth within the capital market. This initiative established a simplified regulatory framework to facilitate the testing of innovative business models and emerging technologies.

So far, the CMA Board has granted 33 ExPermits to companies involved in various activities like equity crowdfunding, robo-advisory, real estate crowdfunding, debt fractionalization, DLT utilization for securities offering and custody, social trading, and more. The FinTech Lab continually seeks to expand its scope by permitting a wider range of business models.

Notably, companies like Afaq and Manafa have successfully graduated from the FinTech Lab and obtained full regulatory status to offer equity crowdfunding services.

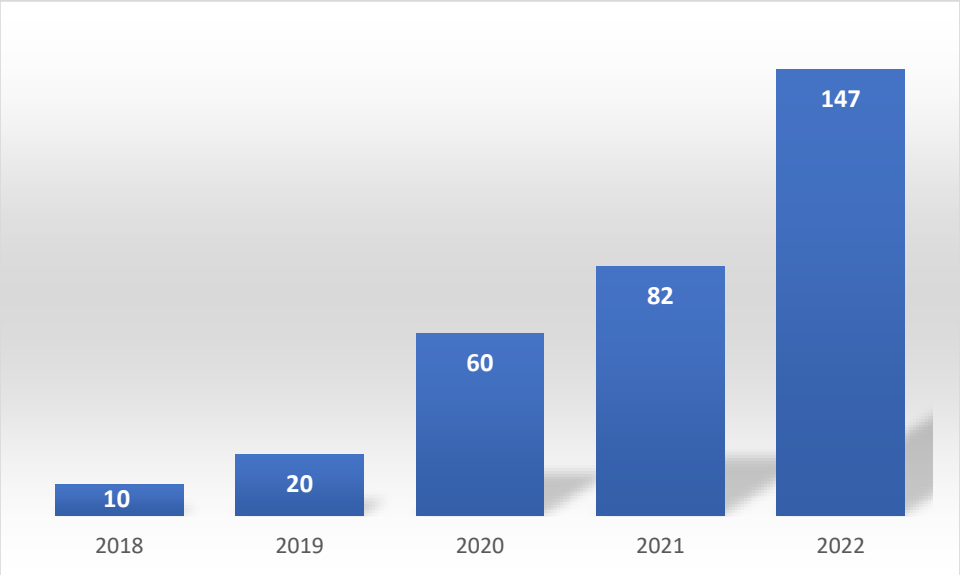
As a key stakeholder in the Fintech Strategy, with the newly established fourth pillar of the Financial Sector Development Program, the CMA is committed to adhering to best practices that facilitate regulatory support for fintech in the capital market. (Fintech Saudi, 2022, p. 11)

Additionally, in September of 2022 the Capital Market Authority approved a regulatory framework specifically for equity crowdfunding, with the aim of encouraging more fintechs to operate in this domain. The CMA, in collaboration with the Saudi Central Bank (SAMA), actively supports fintech innovation through initiatives like Fintech Saudi, which aims to promote the growth of the fintech industry in Saudi Arabia.

Furthermore, according to the National Fintech Adoption Survey conducted by Fintech Saudi in 2021, 51% of the respondents expressed a desire for solutions that facilitate easier investment. This consumer demand acts as a significant motivator for capital market companies to invest in innovation. (Fintech Saudi, 2022, p. 13)

As a result of these efforts, the Saudi's fintech ecosystem has seen a 14,7 X increase in the number of active fintechs from 2018 to 2022.

Figure 2. 24: Evolution of the Number of Fintech Startups in Saudi Arabia



Source: (Fintech Saudi, 2022, p. 24)

Case study (Tamara):

Tamara is a Buy Now Pay Later (BNPL) fintech, launched in 2020 by Abdulmajeed Alsukhan, Turki Bin Zarah and Abdulmohsen Albabtain in Saudi Arabia, Tamara was the first registered fintech under Regulatory Sandbox of Saudi Central bank.

As a beginning, In January 2021, Tamara closed a $6 million seed funding round. In April 2021, Tamara has raised a $110 million in Series A led by Checkout.com, the largest fundraising recorded in the MMENA region, followed by a $100 million Series B in August 2022, led by Sanabil Investments**,** making the total funding $216 million in equity and debt.

With its free interest BNPL service Tamara allows over 3 million customers to split the payment for their shopping in over 4,000 Tamara's partner merchants including, leading brands such as, IKEA and Adidas.(Tamara, n.d.)

Fintech ecosystem in Morocco

Morocco's Bank Al-Maghrib and Ministry of Economy and Finance introduced the National Financial Inclusion Strategy (NFIS) in 2018 with the objective of significantly improving the country's financial inclusion rate.

By setting ambitious goals, the NFIS aims to reach a 50% financial inclusion rate by 2023 and a 75% rate by 2030, emphasizing Morocco's dedication to developing a more inclusive financial system.(unsgsa.org, 2023)

The strategy recognizes the potential of financial inclusion as a key enabler for promoting inclusive growth and sustainable development. By expanding the access of underbanked individuals and firms to a range of financial services, such as payment, credit, insurance, Morocco aims to foster greater economic participation and empower marginalized populations. This comprehensive approach to financial inclusion aligns with the broader goals of promoting social equity. (Bank Al-Maghrib, 2019, p. 16)

Morocco recognizes the importance of fintech and digital payment in fostering financial inclusion. Thus, government launched initiatives including regulatory changes in banking laws, and crating regulatory framework for international money transfer by mobile money providers. The government is also planning to launch an open banking framework.

This regulation support from the government contributed in the growth of fintech industry in Morocco with 40 fintech companies, that helped to reduce the cash usage by 43% in 2020. (Richie Santosdiaz, 2022, p. 87)

Since 2017, cryptocurrencies has been prohibited in Morocco. (Richie Santosdiaz, 2022, p. 89) However, it's interesting to note that despite the ban, Morocco has emerged as a significant player in the region when it comes to crypto trading, where 3.1% of population possess cryptocurrencies in 2022, the highest rate in North Africa (CVJ.CH, 2023), highlighting the strong interest and adoption of digital currencies within the Moroccan population, despite the government's stance on the matter.

Fintech ecosystem in Algeria

To promote financial inclusion in Algeria, a right to an account was introduced in 2010 by a provision inserted into the new banking law. The law allows any citizen who does not have a bank account to access a free current account. This system, which was implemented by the Bank of Algeria in 2012, also provides for a certain number of operations to be free of charge.

In terms of access to credit, the Bank of Algeria instructed banks, in January 2013, to ensure compliance with the processing times for credit applications submitted by customers. These deadlines must not exceed fifteen (15) days for households and forty-five (45) days for small and medium-sized businesses. (Mohammed Laksaci, 2014, p. 2)

To promote digital payment, the action of the Bank of Algeria has extended in 2018 to oblige all businesses to install electronic payment terminals. (Riley et al., 2020, p. 33)

In term of funding, Algeria has launched in October 2020, Algerian Startup Fund ASF with the aim of developing the entrepreneurial and innovation ecosystem in Algeria by offering financing services that meet the needs of startups. 1.2 DZD bn funds raised for the benefit of startups since its creation. (ASF, n.d.)

Sandbox:

In Sep 2021, The Securities and Investments Organization and Monitoring Commission has launched the first fintech regulatory sandbox in Algeria “GIE-Algeria FinLab” to enable fintech companies to develop their solutions for the purpose of digitalizing the banking services. (Michael Magrath & Gabrielle Inhofe, 2022, pp. 225–226)

Like Morocco, the Algerian government has decided to ban cryptocurrencies. According to the draft finance law for 2018, virtual currencies such as Bitcoin are prohibited from transaction and even possession. (Chloe Orji, 2022) Encouraging illegal practice in crypto and exchange in the parallel market.

Fintech ecosystem in Tunisia

Two-thirds of the population in Tunisia are internet users, in addition the country has a smartphone penetration of 66 per cent. However, Tunisia remains a mainly cash-based society where only two per cent has a mobile money. (Richie Santosdiaz, 2022, p. 100)

Furthermore, more than 60 per cent of adults do not have a bank account, which represent a higher level of financial exclusion compared to 50 per cent average in MENA. (*The Global Findex Database 2021*, 2022)

With its fintech ecosystem that has 27 fintechs (Richie Santosdiaz, 2022, p. 100), CBT launched its fintech website, a fintech accelerator which aims to promote financial inclusion and as part of the official launch of the "BCT-FINTECH", the BCT organized an online conference on June 12, 2020, to start the opening of online registrations to the Regulatory Sandbox that was launched with the aim of fostering financial inclusion while supporting financial stability. (BCT fintech, n.d.)

2.2.3 MENA Fintech Ranking

There are several factors that determine the strength of fintech ecosystem, including the extent to which governments are involved in encouraging the adoption of fintech by providing all means for a favorable investment and regulatory environment.

In this sub-section, we will discuss two different rankings that rank MENA countries according to the strength of their fintech ecosystems; The first is FinxAR constructed by AMF and the second one is Fintech hub of MENA created by fintech-times.

Ranking FinxAr

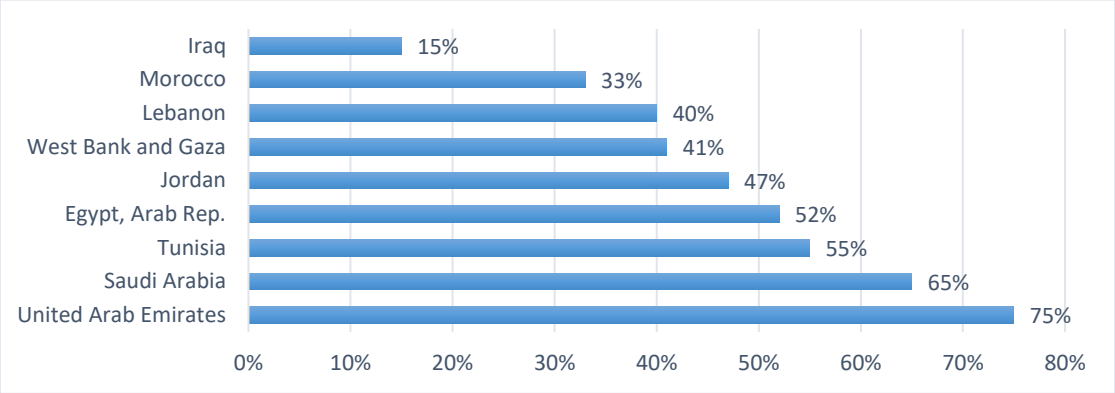
The General Index of Arab New Financial Technologies (FinxAr) consists of six main indicators that represent the dimensions of the supportive environment of modern financial technologies, including: policies and legislation, the demand side, availability of financing, financial infrastructure, talent development to support innovation, and finally collaboration and partnerships.

The results of the indicator reflect the interest and efforts actions undertaken by Arab governments in cooperation with the private sector to promote the growth of financial technologies and their use. (Nouran Yousef, 2021, p. 3)

The data in the graph below indicates that the United Arab Emirates (UAE) is leading the index with an impressive rate of 75%. Followed closely by Saudi Arabia with a rate of 65%. UAE strategic location, strong infrastructure and supportive regulatory environment have contributed to its success in attracting fintech startups, investors, and talent.

Saudi has placed significant emphasis on fintech development in its Vision 2030 plan.

Figure 2. 25: FinxAR rate 2018-2020



Source: (Nouran Yousef, 2021, p. 6)

What stands out is the relatively high rate (55%) achieved by Tunisia. The fact that Tunisia has managed to make significant strides in developing its fintech ecosystem demonstrates its commitment to fostering innovation and technological advancements in the financial sector.

Similarly, Egypt has also achieved a noteworthy rate of 52%, further indicating its dedication to improving its fintech landscape. Egypt, with its large population and growing economy, has recognized the importance of embracing fintech to drive financial inclusion and enhance its overall competitiveness in the region.

Fintech hub in MENA:

This index is created by the fintech Times to measure the strength of fintech ecosystems in MEA region, it is based on 12 indicators including; Gross Domestic Product (GDP) per capita, Higher education enrolment, Entrepreneurship, Ease of doing business, population, Human Development Index (HDI), Number of tech/startups (factoring in population), VC,

Regulatory sandbox, Unicorns, Number of fintech companies and Number of fintech companies (factoring in population). A 10-point scoring is done for all the indicators.

The report divided the countries on different categories as follow: (Richie Santosdiaz, 2022, pp. 72–73)

Tier-One 'Premier Global Fintech Hubs' it includes UAE

Tier-Two 'Emerging Fintech Hubs' which is divided into 3 levels:

- Higher-level – Saudi Arabia

- Middle-range: Bahrain, Qatar, Kuwait, Egypt, Jordan, Oman, Tunisia

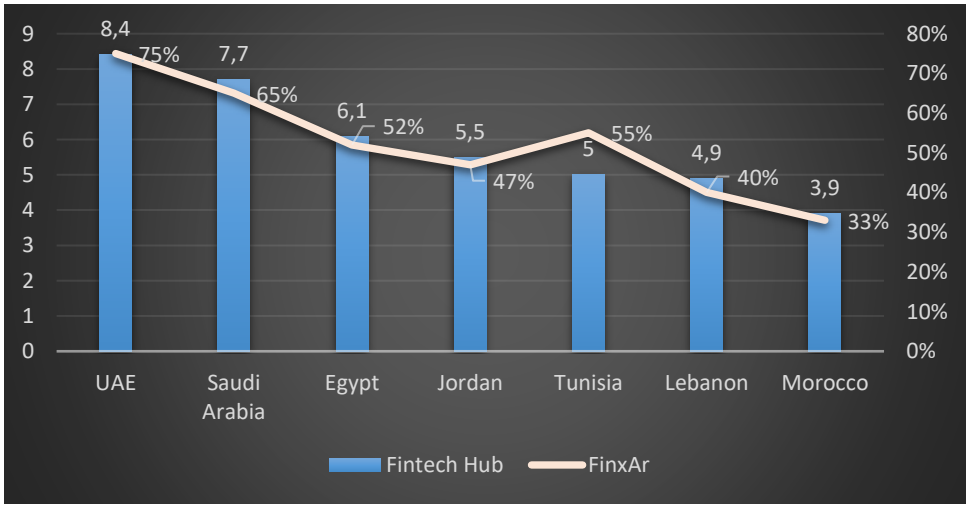
- Lower-level – Lebanon,

Tier-Three 'Early-Stage Fintech Hubs' Higher-level 'Markets to Watch' Morocco

Based on the graph bellow, we can observe a positive correlation between the efforts of governments (as represented by the FinxAR ratings) and Fintech Hub of MEA score.

This indicates that the more a country makes efforts to support fintech industry the stronger fintech ecosystem it gets.

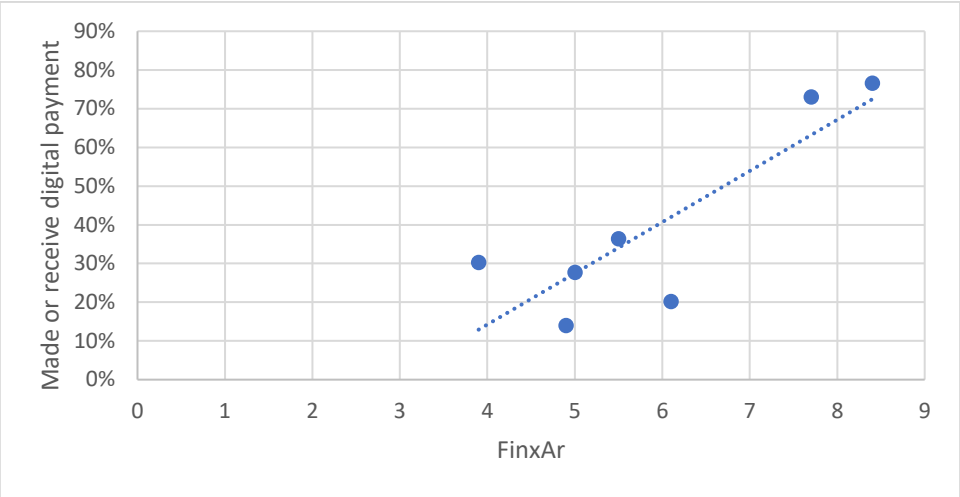
Figure 2. 26: Fintech hub vs FinxAR



Source: (Richie Santosdiaz, 2022, p. 75) and (Nouran Yousef, 2021, p. 6)

Furthermore, we can observe on the graph bellow a positive correlation between Fintech Hub of MEA score and digital financial inclusion represented by digital payment. It suggests that countries with strong fintech ecosystem have higher level digital financial inclusion.

Figure 2. 27: FinxAr and digital financial inclusion



Source: (Richie Santosdiaz, 2022, p. 75) and (*The Global Findex Database 2021*, 2022)

However, we observe some countries including Egypt and Lebanon, despite their higher efforts in supporting fintech and their strong fintech ecosystem, they could not manage to achieve a certain level of digital financial inclusion. This can be explained by other barriers that have hindered the desired outcomes, including limited digital knowledge in Egypt, and economic collapse in Lebanon.

Conclusion

Despite the intensive efforts to enhance financial inclusion in the MENA countries, the region ranks last in the global ranking of financial inclusion level in term of account penetration rate, with only 50% of individuals with a formal account.

It is worth noting that there is a large disparity between the Gulf countries that have high levels of account penetration and other low-income countries with lower level of account penetration, except for some countries like Iran that has high account penetration rate. This disparity can be explained by the level of income on one hand, financial knowledge, financial development, and the availability of a strong financial infrastructure on the other hand.

With regard to financial technology, the region attracts only 1,2% of the total global investments in financial technology, which are concentrated in a few countries, where more than 80% of investments are concentrated in three countries led by UAE, Saudi Arabia and Egypt. The main drivers for the development of fintech industry are; The economic power, large young and educated population, the availability of a favorable investment climate and regulatory environment that attract investors.

By analyzing the available data, it's worth noting that the more the governments of MENA countries are involved in supporting fintech ecosystem, the stronger the ecosystem is. In addition, there is a positive relationship between the robustness of fintech ecosystem in the MENA region and the level of digital financial inclusion.

After concluding that a strong fintech ecosystem has a positive impact on digital financial inclusion in the MENA region; In the next chapter, we will investigate the role of digital financial inclusion in promoting growth, through an empirical study.

Chapter 3. The impact of digital financial inclusion on economic growth in the MENA region and beyond

Preface

Promoting financial inclusion by improving the access of unbanked individuals and businesses to different financial services such as payments, credit, insurance, investment, is seeing as a catalyst enabler to promote economic development in developing countries.

In the era of digital technology, the way how individuals' access to financial services has drastically disrupted. Financial services and transactions witnessed great developments, as financial technology such as, blockchain and artificial intelligence, in addition to smart devices contributed to facilitating financial operations and access to various financial services by eliminating the obstacles to financial inclusion in developing countries including, the geographical distance, high costs, lack of documentation.

As a result of this relationship between fintech and financial inclusion, a new concept for financial inclusion which is known as digital financial inclusion or fintech-driven financial inclusion was emerged.

In this study we will investigate how adoption of digital finance can promote economic growth in MENA, SSA and emerging countries.

The result of the study will serve as evidence for decision makers about the importance of individuals' access to digital financial services in achieving sustainable economic growth.

Related studies

Although many previous researches were conducted to study the interrelationship between fintech, financial inclusion and economic development, only few studies are focusing on the impact of digital financial inclusion on economic growth.

The literatures that examined the impact of digital financial inclusion on economic growth include, (Ozturk & Ullah, 2022), (Liu et al., 2021), (Thaddeus et al., 2020), (Shen et al., 2021) and (Khera et al., 2021a). (See Literature Review Section in the introduction for more details)

When it comes to the MENA region, there are few studies that examined the relationship between fintech, financial inclusion and economic growth, and no study focuses on the impact of digital financial inclusion.

Therefore, on one hand, this study will contribute to existing literatures on the impact of digital financial inclusion on economic growth in developing countries. On the other hand, by using the latest available data from 2011 to 2021, and using innovative indicator (Made or Received Digital Payment) as a proxy for digital financial inclusion, this study aims to fill the gap in the literatures focusing on the impact of digital financial inclusion in the MENA region.

In addition, by using dummy variable for Covid 19 and assessing the impact of its interaction with digital financial inclusion on economic growth, this research will provide another evidence about covid 19 and its implications on the relationships between digital financial inclusion and economic growth.

3.1. Methodology and data

According to (Daud & Ahmad, 2023) and (Chinoda & Mashamba, 2021b), there's a high positive relationship between fintech and financial inclusion. In addition, (Yoke Wang Tok & Dyna Heng, 2022) finds that fintech has high positive impact on digital financial inclusion. Therefore, Fintech-driven financial inclusion or digital financial inclusion, which refers to the use of digital mean and emerging technologies to access different financial services, was chosen as the main independent variable in the model as it captures at the same time the fintech development and financial inclusion level.

"Made or received digital payment in the las year % adult population" which is one of the digital financial inclusion indicators of World Bank Global Findex, was used as proxy for the digital financial inclusion, and this aligns with (Shen et al., 2021) that used "Made or received

digital payment in the las year % adult population" along with other indicators, including use of internet and mobile phone to calculate a digital financial inclusion index.

On one hand the proxy captures both fintech and financial inclusion. On the other hand, it captures two of financial inclusion dimensions; access and usage.

There are other indicators that can be used as proxies for digital financial inclusion including, mobile money accounts and using mobile for payment, but due to lack of data for these indicators in the MENA region, only “Digital payment” indicator is used, and this approach is not uncommon when proxying financial inclusion, for example (Saed Khalil et al., 2023) used only bank branches as a proxy of financial inclusion, (Ozturk & Ullah, 2022) used ATMs per 100,000 adults and debit cards card holders above 15 years of age separately to measure the level of digital financial inclusion in a given country.

Moreover, (Deng et al., 2019) used number of P2P platforms in China to proxy digital financial inclusion.

Dependent variable is economic growth, which is a solid indicator of development. Economic growth is proxied by GDP per capita growth rate and this aligns with studies of (Emara & El Said, 2021), (Thaddeus et al., 2020), (Daud & Ahmad, 2023), in addition to (Liu et al., 2021) who used GDP per capita to proxy economic growth.

To control the impact of other independent variables that affect GDP per capita, a set of control variables including, trade openness proxied by the total trade (import + export) % of GDP, population growth, gross capital formation and finally inflation rate are added to the model.

The selection of control variables is based on different previous studies examining the impact of financial inclusion on economic growth, including, (Emara & El Said, 2021), (Daud & Ahmad, 2023), (Demir et al., 2022), (Ozturk & Ullah, 2022) and (Saed Khalil et al., 2023).

Data of control variables and Dependent variable are collected from development indicators of World Bank.

For the independent variable (Digital financial inclusion proxied by “made or received digital payment”, the data is collected from global Findex 2021 of world bank, available for periods 2014, 2017 and 2021. (Chinoda & Mashamba, 2021b), (Thaddeus et al., 2020) and (Demir et al., 2022) used global Findex data for periods 2011, 2014 and 2017. (Yoke Wang

Tok & Dyna Heng, 2022) and (Khera et al., 2021a) used only two periods 2014 and 2017 for digital financial inclusion.

The latest Global Findex report 2021 was released by the World Bank in 2022. Thus, in this study we will use the data of the new Global Findex report 2021. However, 2011 data was dropped from the analysis due to the lack of digital financial inclusion data in the sampled countries for this year.

Global Findex is a triennial report in nature. Therefore, to match the frequency of digital financial inclusion without losing important information, we chose to convert annual data to 3-years interval data, using geometric mean for data presented as compound rates (GDP and population growth), and arithmetic average for data presented in simple rates (Trade and gross capital formation). The approach aligns with (Khera et al., 2021a) who used average GDP growth to assess the impact of digital financial inclusion on economic growth.

Due to covid, 2020 report was postponed to 2021. Therefore, to avoid uneven spaced data challenge, we employed linear interpolation method to estimate the rate of digital financial inclusion in the sampled countries for the year 2020.

The data collection timeline starting from the middle of 2021, asking individuals about using digital payments in the last year, in addition to the remarkable growth of fintech industry during 2020, make the data of 2020 very close to 2021. Thus, the linear interpolation would be a judicious choice to estimate digital financial inclusion level in 2020.

In this study, we will use multi-year panel data, we opted for triennial (3-years interval) data for the periods 2014, 2017, 2020 due to data collection constraint. This approach is consistent with data provided by World bank, which report digital financial inclusion data for these periods. In addition, the approach aligns with (Demir et al., 2022) and (Chinoda & Mashamba, 2021a) who used triennial (3-years interval) data for 3 periods 2011, 2014 and 2017, unlike (Thaddeus et al., 2020) who used the same years but converted triennial data to quarter.

Moreover, (Yoke Wang Tok & Dyna Heng, 2022) and (Khera et al., 2021a), both conducted studies for World Bank, they used two periods, 2014 and 2017 (digital financial inclusion is available for these two periods), to assess the impact of fintech on digital financial inclusion, and to investigate the determinants of digital financial inclusion, respectively. While (Khera et al., 2021a) used random effect method due to limited time dimension, (Yoke Wang Tok & Dyna Heng, 2022) used fixed effect method and this aligns with our approach.

To control the effect of covid on economic growth in 2020, a dummy variable named "Covid" was created. Covid takes the value 1 for the period during covid which is 2020 in this study, and it takes the value 0 for all periods before covid. Covid was added to all the models of the study.

Furthermore, to assess how covid pandemic affected digital financial inclusion and its relationship with economic growth, the interaction term between the dummy variable "Covid" and digital financial inclusion was added.

Moreover, although the primary focus of this thesis is on the MENA region, we have also included a group of developing and emerging countries from diverse regions to our study in this chapter. (see table 3.1). By incorporating these developing countries into our study, we sought to provide a broader perspective on the subject.

Table 3. 1: Sampled countries

MENA countries
Algeria
Egypt, Arab Rep.
Iran, Islamic Rep.
Iraq
Jordan
Lebanon
Pakistan
Saudi Arabia
Tunisia
Türkiye
Palestine

SSA countries
Benin
Burkina Faso
Cameroon
Cote d'Ivoire
Ghana
Kenya
Namibia
Senegal
South Africa
Uganda
Zambia
Zimbabwe

Developing countries
Bangladesh
Burkina Faso
Chile
Colombia
Honduras
Hungary
Kazakhstan
Mongolia
Peru
Philippines
Thailand
Uruguay
Uzbekistan

Emerging Markets
Brazil
Bulgaria
China
India
Indonesia
Malaysia
Russian Federation

To differentiate the MENA region from the other developing countries in our analysis, we introduced an interaction term involving a "MENA" dummy variable and digital financial inclusion.

The dummy variable "MENA" takes the value 1 for the countries that belong to the MENA region, while it takes value 0 for the countries that belongs to other regions.

This approach ensures that we can capture the unique effects of digital financial inclusion on economic growth in the MENA region within a global context. This approach was adopted by (Emara & El Said, 2021)

3.1.1. Definition of data

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

Table 3. 2: Definition of variables

Variable	*Definition*	*Source*	*Code*
Dependent Variable:			
GDP per capita growth	GDP per capita is the sum of gross value added by all resident of a given country divided by the total population.	World Bank development indicators	GDP.P.CAP
Control Variables:			
- *Inflation rate*	The annual percentage increase of the cost of living, measured by the consumer price index.		Inflation
- *Trade openness*	Ratio of the Total of Exports of goods and services and Imports of goods and services on GDP.		Trade
- *Population growth %*	The change in the population	World Bank development indicators	Population
- *Gross Capital formation % GDP*	Ration of Investment in fixed asset on GDP.		Capital
Independent Variable:			
Made or Received Digital Payment	The percentage of respondents who report using digital devices to receive or make a payment from an account--or using the internet to pay bills or to buy something online-in the past year.	Global Findex 2021	Digitalpay
Dummy variables:			
- *Covid*	It takes value 1 for period during covid and 0 for the period pre-covid		Covid
- *MENA*	It takes value 1 for MENA countries and 0 for other regions		MENA

Source: World bank development indicators and global financial inclusion database

3.1.2. Methodology

Static panel analysis with fixed effect, random effect and pooled OLS methods was applied.

Panel analysis was chosen due to the nature of the data of the study. Panel data (longitudinal data) is appropriate when we have data for the same sample of countries or individuals over a specific period of time. It takes into consideration both time series and cross-sectional dimensions, making it advantageous compared to cross-sectional models or time series models. (Ozturk & Ullah, 2022, p. 4)

Panel models are represented as follow:

$$Y_{it} = \alpha + \beta X_{it} + \mu_{it}$$

where y_{it} is the dependent variable, α is the intercept term, β represents the coefficients of parameters to be estimated, x explanatory variables; t = 1….. T; i = 1..., N, μ_{it} represent the error term of the model.

Panel analysis present several advantages; As it counts for both time series and cross-sectional dimensions, it provides more observations, thus more information and more degrees of freedom are available. It also control for heterogeneity by allowing for subject-specific variables. (Ozturk & Ullah, 2022, p. 4)

In addition, panel data helps to avoid omitted variables bias problem. (Hsiao et al., 2007, p. 11)

There are several methods to estimate static panel data, in this study we will focus on 3 of them, pooled OLS, Fixed effect and Random Effect.

Pooled Regression

Pooled OLS method is the simplest way to estimate a panel data using OLS. It combines the observations together as a single dataset. This methods assumes that there is no heterogeneity. (Wooldridge, 2002, p. 256)

Pooled OLS method is represented as follows:

$$Y_{it} = \alpha + \beta X_{it} + \mu_{it}$$

Fixed effect

Fixed effect models are represented as follow:

$$Y_{it} = \alpha_{it} + \beta X_{it} + \mu_i + \nu_{it}$$

μ represents the fixed effect for unit i , it accounts for individual specific characteristics that do not vary over time. Fixed effect method captures the heterogeneity between individuals, by allowing for different intercepts for each cross-sectional unit.

The advantages of fixed effect is that it can allow the individual- specific effects to be correlated with explanatory variables X_{it}. (Hsiao, 2007, p. 11)

The Random Effects Model

Random effect model is represented as:

$$Y_{it} = \alpha + \beta X_{it} + \omega_{it};\ \omega_{it} = \varepsilon_{it} + \mu_{it}$$

Random effect model assumes that each cross-section unit has a different intercept term that are constant over time. The intercepts assumed to come from the global intercept α, in addition to a random variable that varies between cross-section units but constant over time. ε_{it} in the model, takes into account the random deviation of each unit's intercept from α.

Unlike the fixed effect model, random effect assumes that ε_{it} are not correlated to independent variables X_{it}. (Wooldridge, 2002, p. 257)

3.1.3. Model specifications

In this study, 3 models were built

Model 1:

The first model is the basic one, and is represented as fellow:

$$\mathbf{GDPpcap_{i,t} = \alpha + \beta * DFI_{i,t} + \beta_1 X_{i,t} + \beta_2\ Covid + \varepsilon_{it}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where i represents the country ID and t the time period. i, = 1,… N; t = 1,…..T. $\boldsymbol{\varepsilon_{it}}$ represents the error term.

GDPpcap represent the GDP per capita growth in %, DFI is the digital financial inclusion, Covid is a dummy variable that takes value 1 for periods during covid and 0 for periods pre-covid19, and finally X represents a set of control variables including, trade openness, population growth, inflation rate and investment proxied by gross capital formation (percentage of GDP).

Second model:

To assess either the impact of digital financial inclusion on economic growth in the MENA region is different than in the other regions, a dummy variable named "MENA" and its interaction with DFI were added to the model, "MENA" takes the value 1 if the countries belong to MENA region and 0 if the countries is not a MENA country. This approach was adopted by (Emara & El Said, 2021).

$$\mathbf{GDPpcap_{i,t} = \alpha + \beta * DFI_{i,t} + \beta_1 X_{i,t} + \beta_2 * MENA + \beta_3\ Covid + \beta_4\ (MENA * DFI) + \varepsilon_{it}} \ldots (2)$$

Model 3:

To be able to verify if covid19 has an effect on how digital financial inclusion impacted economic growth, the interaction term of Covid dummy variable and digital financial inclusion was added to the 3rd model which is represented as follow:

$$\mathbf{GDPpcap_{i,t} = \alpha + \beta * DFI_{i,t} + \beta_1 X_{i,t} + \beta_2\ Covid + \beta_3\ (Covid * DFI) + \varepsilon_{it}} \ldots\ldots\ldots\ldots (3)$$

Finally, each model was estimated using pooled OLS, fixed effect and random effect. To check if the assumptions are not violated, various tests were conducted including, Durbin Watson for autocorrelation, Shapiro-Wilk for the normality, Pesaran CD test for cross-sectional dependance, Breusch-Pagan test homoscedasticity.

3.2. Result

All the three models were estimated using fixed effect, random effect and pooled OLS methods.

However, before starting the estimations, we will first analyse the descriptive statistics of the main independent variable (digital financial inclusion), and we will check for multicollinearity.

The following tables shows the descriptive statistics of digital payment in each region.

Table 3. 3: Descriptive statistics of digital financial inclusion variable

Region	N. obs	Mean	St dev	Max	Min.
MENA region	33	34.38	24.23185	89.77	4.17
SSA region	36	44.67	19.73188	78.96	7.74
Other regions	57	51.20	19.96835	94.375	7.68
The whole sample	126	45.31	22.4	94.375	4.17

Source: By the researcher base on RStudio (R 4.3.1) outputs

The results indicate that the Min of the sample is registered in the MENA region with 4.17% in Iraq in 2014, while the Max is registered in Mongolia (other regions) in 2020 with 94.4%. However, Iraq saw a noticeable growth with 19% in 2017. Moreover, the Min and Max of all regions are close to each other's.

While the mean of SSA region equals to the mean of the whole sample, the mean of the other regions is higher with 51.2%, and the mean of the MENA region is lower with only 34.38%, indicating that the MENA region has the lowest digital financial inclusion rates in the world.

The correlation matrix

Table 3. 4: Correlation Matrix

	GDPPCAP	INFLATION	GRCAPITAL	TRADE	PPGR	DIGITALPAY
GDPPCAP	1.000000					
INFLATION	- 0.20	1.000000				
GRCAPITAL	0.17	- 0.1	1.000000			
TRADE	- 0.057	-0.08	0.05	1.000000		
PPGR	-0.22	- 0.030	0.057	- 0.05	1.000000	
DIGITALPAY	- 0.013	0.07	0.115	0.23	-0.29	1.000000

Source: RStudio (R 4.3.1) outputs

The low correlation coefficients between independent variables suggest that multicollinearity is not an issue. However, to confirm about multicollinearity, we calculate the variance inflation factor (VIF) for each variable. VIF < 5 indicates that multicollinearity is not a problem. In R we use VIF function, and the result are summarized in the following table.

Table 3. 5: variance inflation factor

	INFLATION	GRCAPITAL	TRADE	PPGR	DIGITALPAY
VIF	1.025	1.034	1.068	1.1	1.18

Source: RStudio (R 4.3.1) outputs

The results show that VIF =1, confirming that independent variables are not correlated and multicollinearity is not an issue.

Model 1 estimation:

The first model is statistically significant for the three methods fixed effect, random effect and pooled OLS.

The following table illustrate the R outputs of fixed effect, random effect and pooled OLS method for model 1.

Table 3. 6: Model 1 estimation (fixed effect, random effect and pooled OLS)

Independent variable: GDP per capita

Unbalanced Panel: n = 42, T = 3, N = 123

Variable	Fixed effect	Random effect	Pooled OLS
Inflation	**-0.024613***	**-0.021833.**	**-0.0258630.**
	[0.0340245]	[0.0486809]	[0.0692803]
Capital	**0.232156****	**0.126275****	**0.0712244***
	[0.0023396]	[0.0023637]	[0.0331754]
Population	**-0.659913*****	**-0.563342*****	**-0.6365780*****
	[0.0004936]	[0.0001608]	[0.0001498]
Trade	**0.045509**	**-0.011132**	**-0.0145250.**
	[0.2578487]	[0.3316904]	[0.0791827]
Covid19	**-4.634562*****	**-4.263842*****	**-4.1351246*****
	[<2.277e-15]	[< 2.2e-16]	[1.717e-11]
Digitalpay	**0.059050***	**0.019349**	**0.0108388**
	[0.0166473]	[0.1795242]	[0.3825622]
Intercept		**-0.122308**	**1.9983080.**
		[0.9279906]	[0.0728711]
R-Squared	0.68007	0.56135	0.41327
Adj. R-Squared	0.47957	0.53866	0.38292
F-statistic	26.5704		13.6175
p-value	< 2.22e-16	< 2.22e-16	1.1772e-11

Signif. codes : 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: By the researcher base on RStudio (R 4.3.1) outputs

However, to choose the most appropriate method, different tests were conducted.

First, Hausman test is used to choose between random and fixed effect. In R studio phtest function was used.

The null hypothesis states that random effect is better. The result (see table 3-3) shows that the test is significant with p-value 0.02392 which is below 0.05, and this mean null hypothesis is rejected, indicating that the fixed effect model is more appropriate.
Furthermore, to confirm that fixed effect is the most appropriate among the 3 methods, another test "F test for individual effects" is used to choose between fixed effect and pooled OLS.

To perform F Test in R studio, pFtest function was used. The null hypothesis states that fixed effect is better.

The table shows the results of Hausman test and F test to select between fixed effect, random effect and pooled OLS.

Table 3. 7: Husman test and F test result for the first model

Test	Null hypothesis	P-value
Hausman	Fixed effect is the most appropriate between fixed effect and random effect	0.02392
F	Fixed effect is the most appropriate between fixed effect and pooled OLS	5.732e-09
Result	Fixed effect is the most appropriate method for model 1	

Source: By the researcher base on RStudio (R 4.3.1) outputs

The result with P-value 5.732e-09 which is much lower than 0.05, indicates that the null hypothesis is rejected, and this confirms that fixed affect is the more appropriate than pooled OLS.

Therefore, among the three methods, fixed effect is the most appropriate.
The first model after estimation and selecting fixed effect as the most appropriate is represented as fellow:

GDPPCAP = - **0.024613***INFLATION + **0.232156***CAPITAL - **0.659913***POPULATION + **0.045509***TRADE **- 4.634562***COVID19 **+ 0.059050***DIGITALPAY…… (1)

Second model estimation:

The following table illustrate the R outputs for fixed effect, random effect and pooled OLS methods, for the second model.

Table 3. 8: Model 2 estimation (fixed effect, random effect and pooled OLS)

Independent variable: GDP per capita

Unbalanced Panel: n = 42, T = 3, N = 123

Variable	Fixed effect	Random effect	Pooled OLS
Inflation	**-0.023110***	**-0.0219180***	**-0.0266047***
	[0.0469788]	[0.0466553]	[0.0421516]
Capital	**0.203122***	**0.1086791****	**0.0733246***
	[0.0106079]	[0.0052994]	[0.0184750]
Population	**-0.655113*****	**-0.4913656****	**-0.5089898****
	[0.0005271]	[0.0008223]	[0.0010338]
Trade	**0.056320**	**-0.0067142**	**-0.0070752**
	[0.1720638]	[0.5201961]	[0.3595443]
Covid19	**-4.599967*****	**-3.9740674*****	**-3.7615135*****
	[3.507e-15]	[<2.2e-16]	[3.807e-11]
Digitalpay	**0.053283***	**-0.0040295**	**-0.0172366**
	[0.0330699]	[0.7901942]	[0.1894555]
MENA		**-4.3357209****	**-4.2679954*****
		[0.0055886]	[0.0008377]
MENA*Digitalpay	**0.080062**	**0.0505508**	**0.0389019**
	[0.2402597]	[0.2461863]	[0.2809831]
Intercept		**1.4381574**	**2.9968104****
		[0.2706676]	[0.0052688]
R-Squared	0.68601	0.5835	0.51522
Adj. R-Squared	0.48234	0.55427	0.4812
F-statistic	23.0968		15.1446
p-value	2.7458e-16	< 2.22e-16	5.8583e-15

Signif. codes : 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: By the researcher base on RStudio (R 4.3.1) outputs

The interaction between dummy variable (MENA) and Digital financial inclusion was added to the second model, the main idea is to verify if the impact of digital financial inclusion on economic growth in the MENA region differs from other regions.

Same as for model 1, the second model was estimated using fixed effect, random effect and pooled OLS.

The second model is statistically significant for the three methods fixed effect, random effect and pooled OLS (see table 3.8). To select the most appropriate method; First, Hausman test is used to choose between random and fixed effect.

The result (see table 3.9) shows that Hausman test is significant with p-value (0.01252) less than 0.05, which means the fixed effect model is better.

Moreover, to confirm that fixed effect is the most appropriate among the 3 methods, another test "F test for individual effects" is used to choose between fixed effect and pooled OLS. The result with P-value (8.638e-07) below 0.05 confirms that fixed affect is the most appropriate.

The table below shows the results of Hausman and F test.

Table 3. 9: Husman test and F test result for the first model

Test	Null hypothesis	P-value
Hausman	Fixed effect is the most appropriate between fixed effect and random effect	0.01252
F	Fixed effect is the most appropriate between fixed effect and pooled OLS	8.638e-07
Result	Fixed effect is the most appropriate method for model 2	

Source: By the researcher base on RStudio (R 4.3.1) outputs

After selecting fixed effect method for the second model as the tests suggest, the model is represented as follow:

GDPPCAP = **- 0.023110***INFLATION + **0.203122***CAPITAL - **0.655113***POPULATION + **0.056320***TRADE - **4.599967***COVID19 + **0.053283***DIGITALPAY + **0.080062***(MENA*DIGITALPAY) …….. (2)

Model 3 estimation:

The table below illustrates the R outputs of fixed effect, random effect and pooled OLS for the 3rd model.

Table 3. 10: Model 3 estimation (fixed effect, random effect and pooled OLS)

Independent variable: GDP per capita

Unbalanced Panel: n = 42, T = 3, N = 123

Variable	Fixed effect	Random effect	Pooled OLS
Inflation	**-0.024634*** [0.0269486]	**-0.021244*** [0.0466353]	**-0.0245741.** [0.07939]
Capital	**0.253235***** [0.0006328]	**0.138987***** [0.0006934]	**0.0760716*** [0.02123]
Population	**0.716059***** [0.0001043]	**-0.610890***** [2.814e-05]	**-0.6753005***** [5.203e-05]
Trade	**0.041191** [0.2849932]	**-0.011527** [0.3109241]	**-0.0151652.** [0.06278]
Covid19	**-6.860941***** [1.047e-10]	**-6.565867***** [6.635e-13]	**-6.7947507***** [1.023e-06]
Digital pay	**0.040165.** [0.0991400]	**0.002993** [0.8456194]	**-0.0077139** [0.60209]
Covid19*Digitalpay	**0.045622*** [0.0065907]	**0.046436**** [0.0052078]	**0.0533876.** [0.02830]
Intercept		**0.343806** [0.7989625]	**2.7493968*** [0.01719]
R-Squared **Adj. R-Squared**	0.71063 0.52293	0.59393 0.56921	0.4374 0.40316
F-statistic **p-value**	25.9614 < 2.22e-16	< 2.22e-16	12.7726 4.7064e-12

Signif. codes : 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: By the researcher base on RStudio (R 4.3.1) outputs

To verify if covid 19 has an impact on the relationship between digital financial inclusion and economic growth, the interaction of the two variables (dummy covid19 and digital financial inclusion was added to the model 3) and was estimated using fixed effect, random effect and pooled OLS methods.

The model is statistically significant for the three methods fixed effect, random effect and pooled OLS. However, we need to select the most appropriate method. Hausman test and F test were used.

Hausman test helps to choose between random and fixed effect. The result (see table 3.11) shows that the Hausman test is significant with p-value (0.01723) less than 0.05, which means the fixed effect model is preferred.

To confirm that fixed effect is the most appropriate among the 3 methods, another test "F test for individual effects" is used to choose between fixed effect and pooled OLS. The result shows that P-value (1.529e-09) is below 0.05, and this suggests that fixed affect is the most appropriate.

Table 3. 11: Husman test and F test result for the third model

Test	Null hypothesis	P-value
Hausman	Fixed effect is the most appropriate between fixed effect and random effect	0.01723
F	Fixed effect is the most appropriate between fixed effect and pooled OLS	1.529e-09
Result	Fixed effect is the most appropriate method for model 3	

Source: By the researcher base on RStudio (R 4.3.1) outputs

As fixed effect is the most appropriate method for the third model, the model is represented as follows:

GDPPCAP = **-0.024634***INFLATION + **0.253235***CAPITAL **- 0.716059***POPULATION + **0.041191***TRADE **- 6.860941***COVID19 + **0.040165***DIGITALPAY + **0.045622***(COVID19*DIGITALPAY) … (3)

After running the 3 models using pooled OLS, fixed effect and random effect methods, and using **Hausman** test and F test, we confirm that the most appropriate method for the 3 models is Fixed effect.

The table below summarize the estimate of the 3 models under fixed effect method.

Table 3. 12: estimation of the three models using fixed effect technique

Variable	*Model 1. Coeff*	*Model 2*	*Model 3*
Inflation	**-0.024613***	**-0.023110***	**-0.024634***
	[0.0340245]	[0.0469788]	[0.0269486]
Capital	**0.232156****	**0.203122***	**0.253235*****
	[0.0023396]	[0.0106079]	[0.0006328]
Population	**-0.659913*****	**-0.655113*****	**0.716059*****
	[0.0004936]	[0.0005271]	[0.0001043]
Trade	**0.045509**	**0.056320**	**0.041191**
	[0.2578487]	[0.1720638]	[0.2849932]
Covid19	**-4.634562*****	**-4.599967*****	**-6.860941*****
	[<2.277e-15]	[3.507e-15]	[1.047e-10]
Digitalpay	**0.059050***	**0.053283***	**0.040165.**
	[0.0166473]	[0.0330699]	[0.0991400]
*MENA*Digitalpay*		**0.080062**	
		[0.2402597]	
*Covid19*Digitalpay*			**0.045622***
			[0.0065907]
R-Squared	0.68007	0.68601	0.71063
Adj. R-Squared	0.47957	0.48234	0.52293
F-statistic	26.5704	23.0968	25.9614
p-value	< 2.22e-16	2.7458e-16	< 2.22e-16

Signif. codes : 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: By the researcher base on RStudio (R 4.3.1) outputs

The interaction between **MENA** dummy variable and **Digitalpay** in the second model is not statistically significant, which means we can just neglect the second model and continue testing model 1 and 3.

To check that the assumptions are not violated for the model 1 and 3, we conducted different tests, including; Durbing Watson test for autocorrelation, Breusch-Pagan test for homoscedasticity, Shapiro test for normality and Pesaran CD test for cross-sectional dependence.

We will start with autocorrelation test, to test the existence of autocorrelation in the models, Durbing Watson test will be used.

For Durbing Watson test, we will use pdwtest function in R.

where null hypothesis = no autocorrelation.

The following table shows the result of Durbin Watson Test

Table 3. 13: Durbin Watson Test for Autocorrelation

Test	Null hypothesis	P-value model 1	P-value model 3
Durbin Watson	No autocorrelation	1	1
Result	Null hypothesis is accepted, no autocorrelation issue in the models 1 and 3		

Source: By the researcher base on RStudio (R 4.3.1) outputs

P-value (1) for model 1 and model 3, indicates that there's no autocorrelation for both models 1 and 3.

Moreover, to verify the homoscedasticity, Breusch-Pagan test was performed using bptest function in R. The null hypothesis says there is homoscedasticity.

Table 3. 14: Breusch-Pagan test for homoscedasticity

Test	Null hypothesis	P-value model 1	P-value model 3
Breusch-Pagan test	No heteroscedasticity problem	4.313e-05	1.063e-06
Result	Null hypothesis is rejected, there is heteroscedasticity issue in the models 1 and 3		

Source: By the researcher base on RStudio (R 4.3.1) outputs

The results (see table 3.14) show a very small p-value, (4.313e-05) for model 1 and (1.063e-06) for the third model, both are below 0.05. Thus, the null hypothesis is rejected, indicating that there's a heteroscedasticity issue for both model 1 and 3.

Furthermore**,** for normality test, Shapiro.test function was used to perform Shapiro-Wilk test, the null hypothesis indicates that residuals are normality distributed in the model. P-value for both models is greater than 0.05, (0.3125) for the first model and (0.4808) for the third model, thus, we assume that there is normality for the two models.

Table 3. 15: Shapiro-Wilk test for Normality

Test	Null hypothesis	P-value model 1	P-value model 3
Shapiro-Wilk	Normally distributed	0.3125	0.4808
Result	Null hypothesis is accepted, data are normally distributed in the models 1 and 3		

Source: By the researcher base on RStudio (R 4.3.1) outputs

Finally, for cross sectional dependence test, as the data is a short panel data, T<N, **Pesaran** CD test is preferred and this is according to (Hsiao et al., 2007, p. 13).

To conduct Pesaran CD test in R, the pcdtest function used for "CD" test.

Table 3. 16: Pesaran CD test for cross-sectional dependence

Test	Null hypothesis	P-value model 1	P-value model 3
Pesaran CD	No cross-sectional dependence problem	0.02001	0.6792
Result	Null hypothesis is accepted, there is no cross-sectional dependence problem in the models 1 and 3		

Source: By the researcher base on RStudio (R 4.3.1) outputs

The null hypothesis suggests that there is no cross-sectional dependence in the data. The P-value for model 1(0.02001) is smaller than 0.05 for the first model and (0.6792) for the third model. We accept the null hypothesis and assume that there's no cross-sectional dependence issue in the model 3, while the null hypothesis is rejected for model 1, indicting cross-sectional dependence. However, despite Pesaran CD test suggests a potential existence of cross-sectional dependence in the first model with P-value of 0.02, the Bias-corrected Scaled LM test with P-value 0.1 (see figure A.17 in the appendix, p.128), indicates that this potential cross-sectional dependence is not severe to affect the result.

After conducting assumptions diagnostics, the results indicate that all assumptions are respected, except homoscedasticity for both models.

For robust interpretation of results, the issue of heteroscedasticity should be corrected.

To control heteroscedasticity problem, Clustered robust standard error was applied. VCOVHC function in R was used to estimate the model 1 and 3.

After using Clustered Robust Standard Error to control the heteroscedasticity, all the variables are statistically significant except trade. Population and dummy (covid) are statistically significant at level 0.1% for model 1 and 3; Investment (Capital) is significant at 1% for the two models; Inflation is statistically significant at 1% for model 1 and 0.1% for model 3, and digital financial inclusion is statistically significant at level 5% for model 1, while it remained not significant at 5% but significant at 10% for model 3. However, after using robust standard error, the P-value of digital payment in model 3, decreased from 0.099 to 0.068.

In the second model, the interaction between covid19 and digital payment is statistically significant at 5%.

The table below summarizes the new estimation using Robust Standard Error to control heteroscedasticity.

Table 3. 17: Estimation with Robust Standard Error for model 1 and 3

Independent variable: GDP per capita growth

Unbalanced Panel: n = 42, T = 3, N = 123, fixed effect method

Variable	Model 1	Model 3
Inflation	**-0.024613**** [0.002374]	**-0.024634***** [0.0008237]
Capital	**0.232156**** [0.001689]	**0.253235**** [0.0010449]
Population	**-0.659913***** [2.883e-13]	**0.716059***** [1.570e-14]
Trade	**0.045509** [0.241750]	**0.041191** [0.3245764]
Covid19	-4.634562*** [4.528e-12]	**-6.860941***** [7.982e-07]
Digitalpay	**0.059050*** [0.030808]	**0.040165.** [0.0687944]
Covid19*Digitalpay		**0.045622*** [0.0252106]

Signif. codes : 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: By the researcher base on RStudio (R 4.3.1) outputs

To ensure the robustness of the results derived from the initial approach of averaging GDP, we opted to complement it with two additional distinct approaches applied on the first model.

Each approach has its own advantages and disadvantages, the second approach focuses on specific years but may miss continuous trends, while the third approach, interpolation, offers continuity but may provide artificial data. The purpose of adding these two additional approaches is that these different approaches collectively contribute to a robust analysis in the study.

The second approach adopted in this research focused exclusively on the discrete years 2014, 2017, and 2020, disregarding the years in between. This approach was chosen to capture specific economic conditions and events associated with those years, by using listwise deletion of missing values. The following table shows the results of fixed effect, random effect, and pooled OLS.

Table 3. 18: Estimation of the 1st model using listwise deletion approach

Independent variable: GDP per capita

Unbalanced Panel: n = 42, T = 3, N = 123

Variable	Fixed effect	Random effect	Pooled OLS
Inflation	**-0.0119517** *	**-0.0084893.**	**-0.0083472**
	[0.0198086]	[0.089597]	[0.18270]
Capital	**0.3291167****	**0.1853643** ***	**0.0938956***
	[0.0001025]	[0.000182]	[0.02178]
Population	**-0.8325552** ***	**-0.5682137****	**-0.4450691***
	[7.319e-05]	[0.001440]	[0.02847]
Trade	**0.0783491**.	**-0.0068915**	**-0.0161267**
	[0.0734338]	[0.631317]	[0.12330]
Covid	**-7.4828873*****	**-7.7552688*****	**-7.8767491*****
	[< 2.2e-16]	[< 2.2e-16]	[< 2.2e-16]
Digital pay	**0.0806105***	**0.0308858.**	**0.0307439.**
	[0.0101323]	[0.095815]	[0.05194]
Intercept		**0.0806105***	**0.3150200**
		[0.0101323]	[0.81541]
R-Squared	0.82248	0.71967	0.83343
Adj. R-Squared	0.71123	0.70517	0.72538
F-statistic	57.9137		52.8935
p-value	< 2.22e-16	< 2.22e-16	< 2.22e-16

Signif. codes : 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: By the researcher base on RStudio (R 4.3.1) outputs

To choose the most appropriate method, we first, used Hausman test to choose between random and fixed effect. As the results show that fixed effect is more appropriate, we used F test to compare between fixed effect and pooled OLS. The results in the following table indicate that fixed effect is preferred.

Table 3. 19: Husman test and F test result for the first model (second approach)

Test	Null hypothesis	P-value
Hausman	Fixed effect is the most appropriate between fixed effect and random effect	0.002796
F	Fixed effect is the most appropriate between fixed effect and pooled OLS	4.231 e – 09
Result	Fixed effect is the most appropriate method	

Source: By the researcher base on RStudio (R 4.3.1) outputs

The third approach employed linear interpolation to estimate GDP values for the years between 2014 and 2017, as well as between 2017 and 2020, creating a more continuous dataset.

The following table illustrate the result of the estimation using R studio.

Table 3. 20: Estimation of the 1st model using interpolation approach

Independent variable: GDP per capita

Unbalanced Panel: n = 42, T = 8, N = 329

Variable	Fixed effect	Random effect	Pooled OLS
Inflation	**-0.0142728***** [0.001846]	**-0.0133558**** [0.003012]	**-0.0158951**** [0.001326]
Capital	**0.1375739**** [0.004599]	**0.1120733***** [0.000536]	**0.0685572**** [0.002196]
Population	**-0.8109107***** [1.546e-06]	**-0.6722992***** [5.193e-06]	**- 0.5951670***** [8.564e-06]
Trade	**0.0585269*** [0.022811]	**-0.0061695** [0.531774]	**-0.0110171.** [0.057320]
Covid	**-7.6744668***** [< 2.2e-16]	**-7.7582935***** [< 2.2e-16]	**-7.6179781***** [< 2.2e-16]
Digital pay	**0.0726682***** [4.497e-05]	**0.0268532*** [0.026814]	**0.0098815** [0.246433]
Intercept		**-0.1456853** [0.895702]	**1.9451450*** [0.010905]
R-Squared	0.59191	0.53426	0.44578
Adj. R-Squared	0.52366	0.52558	0.43546
F-statistic	67.9302		43.1665
p-value	< 2.22e-16	< 2.22e-16	< 2.22e-16

Signif. codes : 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: By the researcher base on RStudio (R 4.3.1) outputs

to choose the most appropriate method, we first, used Hausman test to choose between random and fixed effect. As the results show that fixed effect is more appropriate, we used F

test to compare between fixed effect and pooled OLS. The results in the following table indicate that fixed effect is preferred.

Table 3. 21: Husman test and F test result for the first model (Third approach)

Test	Null hypothesis	P-value
Hausman	Fixed effect is the most appropriate between fixed effect and random effect	3.263e-09
F	Fixed effect is the most appropriate between fixed effect and pooled OLS	< 2.2e-16
Result	Fixed effect is the most appropriate method	

Source: By the researcher base on RStudio (R 4.3.1) outputs

Table 3. 22: Comparison of the results of fixed effect using the 3 approaches

Variable	Average approach	Listwise deletion approach	Interpolation approach
Inflation	**-0.024613*** [0.0340245]	**-0.0119517 *** [0.0198086]	**-0.0142728***** [0.001846]
Capital	**0.232156**** [0.0023396]	**0.3291167***** [0.0001025]	**0.1375739**** [0.004599]
Population	**-0.659913***** [0.0004936]	**-0.8325552 ***** [7.319e-05]	**-0.8109107***** [1.546e-06]
Trade	**0.045509** [0.2578487]	**0.0783491.** [0.0734338]	**0.0585269*** [0.022811]
Covid	**-4.634562***** [<2.277e-15]	**-7.4828873***** [< 2.2e-16]	**-7.6744668***** [< 2.2e-16]
Digital pay	**0.059050*** [0.0166473]	**0.0806105*** [0.0101323]	**0.0726682***** [4.497e-05]
R-Squared	0.68007	0.82248	0.59191
Adj. R-Squared	0.47957	0.71123	0.52366

Source: By the researcher base on RStudio (R 4.3.1) outputs

We can see a relatively smaller coefficient of covid in the first approach due to averaging GDP per Capita growth for 3 years, which caused the dilution of the impact of covid over 3 years instead of one year.

However, the outcomes across these approaches exhibited striking similarity in term of coefficients and significance for all the other variables including digital financial inclusion.

The convergence of results underscores the robustness of our analysis, bolstering our confidence in the reported findings.

3.3. Discussion

Inflation in the first model is statistically significant at 0.1%. The coefficient of (-0.024613) indicates that a rise in inflation rate by 1 point is associated with decrease of 0.025 point of the GDP per capita growth.

This negative relationship between inflation and GDP per capita is due to erosion of purchase power, as when prices rise permanently, the purchasing power of the country will decrease, which affects the consumer's behavior leading to less consumption and investment, and in the turn, it will lead to lower GDP per capita. This aligns with the findings of (Emara & El Said, 2021)

Trade openness is not statistically significant. However, the coefficient of 0.045509 indicates that an increase of 1 % in trade openness is associated with an increase in GDP per capita growth by 0.046 points.

Trade openness boosts GDP per capita by facilitating the transfer of advanced technologies and fostering healthy competition.

Investment proxied by gross capital formation % GDP, is statistically significant, the positive coefficient of 0.23 indicates that an improvement in fixed asset by 1% can lead to a higher GDP per capita growth with 0.23 point.

This can be explained by the importance of investment in infrastructure and technology in improving the productive capacity, which help to contribute in increasing the economic growth. The results related to trade openness and gross capital formation aligns with the new growth theory.

The negative coefficient and small P-value below 0.05 suggest that there is a negative significant relationship between population growth and GDP per capita, the negative coefficient of (- 0.66) indicates that a 1% increase in the population growth can lead to a decrease in GDP per capita by 0.66 points.

A population that grows faster than the economic growth leads to lower GDP per capita. If a county doesn't manage to create enough jobs, a rapid increase in population can lead to higher unemployment rates and lower living standards.

According to the results, covid19 has a large negative impact with an average decrease of 4% in all countries in the sample, the p-value below 0.05 suggest that it is statistically significant.

The negative impact of the Covid pandemic is attributed to the implications of travel restrictions, reduced consumer spending and lockdowns on economic activities, which led to reduction in productivity and disruption in supply chains.

Digital financial inclusion proxied by world Bank indicator "made or received digital payments in the past year" was found statistically significant with a p-value under 0.05, and has a positive relationship with GDP per capita, where an increase in digital financial inclusion by 1% can boost GDP per capita growth by 0.06 point.

This result aligns with the findings mentioned in the literature review, and it can be explained by the ability of digital financial inclusion by improving access to financial services, such as payments, credit, insurance etc.… to boost productivity, stimulate entrepreneurship, enhance investment in human capital, encourage innovation, and enable data-driven decision-making.

The main idea in the second model is to verify if the impact of digital financial inclusion in the MENA region is not similar to the other regions.

To do so, a dummy variable MENA was added, MENA takes value 1 if the country belongs to the MENA region and 0 for all countries outside the MENA region, then the interaction between dummy and digital payment was added to the second model.

The interaction term allows us to know if the impact of digital financial inclusion differs from region to region.

However, the P-value (0.24) greater than 0.05 suggest that null hypothesis cannot be rejected which means there is no evidence that the effect of digital financial inclusion in MENA is different compared to the other regions included in the sample of the study. Therefore, the impact of digital financial inclusion on economic growth in MENA countries is similar to the impact of digital financial inclusion on economic growth in the other regions. This suggests that all findings can be taken into consideration for all the regions in the same way.

In the third model, we wanted to verify if Covid has an impact on how digital financial inclusion affects economic growth in the countries included in the sample.

An interaction term between dummy variable of covid-19 and digital financial inclusion is added to the 3rd model. This interaction term allows to understand the join effect of covid_19 and digital financial inclusion on economic growth.

The significant positive coefficient of the interaction term suggests that although covid-19 has a negative effect on economic growth, it had a positive effect on digital financial inclusion.

Conclusion

Studies examining the nexus between digital financial inclusion and economic growth are limited, especially for MENA countries. Thus, this study contributes to existing literatures by investigates the relationship between digital financial inclusion on economic growth in the MENA region and a sample of developing and emerging markets from 2014 to 2021.

Digital financial inclusion is proxied by “Made or received digital payments" indicator, and economic growth is proxied by GDP per capita. By using fixed effect method on panel data, the findings show that high level of digital financial inclusion is associated with higher economic growth. This finding aligns with the theoretical framework and other researchers’ and scholars’ findings that were used as a foundation of this research.

The results provide evidence that digital financial inclusion is an important channel through which MENA countries and emerging markets can achieve sustainable development by boosting economic growth and GDP perc capita. This finding reinforces the theoretical framework of the study.

Moreover, the interaction term between covid_19 and digital financial inclusion has a positive impact on GDP per capita, suggesting that impact of digital financial inclusion on GDP per capita is higher during the period of covid and this is attributed to the rise of digital methods adoption by individuals to make financial transactions such as payments, loans, insurance. etc.., that contributed to economic growth.

Furthermore, the findings show that the relationship between digital financial inclusion and economic growth is similar in the MENA region and the other developing countries.

Policy makers in MENA countries should focus on promoting digital financial inclusion by improving the digital infrastructure and literacy, in addition to strong regulatory framework specifically designed to digital financial services.

Conclusion

By overcoming the obstacles to financial access and facilitating the access to financial services for unbanked individuals, fintech has the potential to promote the economic development through financial inclusion channel.

However, the nascent financial technologies present high level of risks related to data protection, financial fraud, credit repayment risk, problem of regulation etc. In addition, the adoption of fintech require advanced digital infrastructure and certain level of digital financial literacy among individuals. These issues can be resolved by policies that protect both investors and customers. On one hand, a strong regulatory framework can attract fintech companies and users. On the other hand, government support through digital infrastructures and training programs to improve financial literacy can boost the adoption of digital financial services while protecting the consumers from fraud and potential mistakes that can occur due to lack of knowledge.

In the MENA region, despite the improvements made in financial inclusion, the region remains the last region in term of account penetration. 50% of adult population doesn't have a formal account. The main causes are lack of trust, lack of documentation, geographical distance, lack of money, in addition to religious concerns. To promote financial inclusion in the MENA region, the governments launched initiatives like FIARI and FITF to support financial inclusion through financial literacy and financial technology.

To achieve their financial inclusion objectives, MENA countries put intensive efforts in fintech industry. However, the FinTech industry in the MENA region, despite its constant growth, its share remains too small with approximately only 1.2% of the global fintech funding in 2022. Investment in fintech is driven by many factors like national income, population and investment climate, making the fintech industry in the MENA concentrated in a few richer countries like Saudi Arabia and UAE and those with large population like Egypt. These 3 countries secured 86% of the total funding of the MENA region for 2022. If we count Bahrain and Jordan with 12% and 1% respectively, the rest of countries together secured only 1% of the total funding.

On one hand, there is a high positive correlation between FinTech ecosystem and digital financial inclusion in the MENA region. On the other hand, digital financial inclusion has a potential to boost economic growth of developing countries including MENA countries. Thus, building a robust fintech ecosystem is crucial for achieving sustainable development in the MENA region.

The culmination of the research reveals several key findings that can be summarized in the following points:

- Financial inclusion contributes positively to poverty alleviation, reduction of inequality, and promotion of inclusive economic growth.

- Fintech has the potential to overcome the obstacles to financial access for businesses and individuals, thus promoting financial inclusion.

- Besides the benefits of Fintech, it also has risks related to data, fraud, regulation and repayment risks, in addition to challenges related to its acceptance and adoption by the individuals and firms.

- Despite the noticeable improvement in account penetration rate since 2011, The MENA region has the lowest level in the world.

- MENA countries are making hard efforts to build strong fintech ecosystems, but the region's share in term of funding remains insignificant compared to the global market with only 1.2% of the total funding, in addition there is a large disparity between countries with dominance of UAE and Saudi Arabia.

- Financial literacy, talents, political stability, large population, government support are the main driver of fintech.

- In MENA countries the strength of fintech ecosystem is highly correlated with digital financial inclusion.

- Digital financial inclusion has a strong positive relationship with GDP per capita in MENA countries and emerging markets.

- Covid 19 has boosted the positive effect of digital financial inclusion on economic growth in MENA countries.

The findings above indicate that the first and third hypothesis of the study suggesting that a responsible adoption of fintech can promote economic development through financial inclusion, and digital financial inclusion has a positive impact on economic growth in the MENA region, both are approved.

However, the second hypothesis stating that the MENA region has a strong fintech ecosystem and high level of financial inclusion is partially rejected, as the results show that despite the improvement in financial inclusion and fintech industry in the region, their levels

are still very low. Fintech investment in the MENA regions represents only 1.2% of the global investment, and in term of financial inclusion the MENA region is ranked the last among all the other regions with 50% of unbanked population.

Based on the insights gained from this study, the following recommendations are suggested for policy makers in MENA countries:

- Creating a favorable investment environment to attract talents and investments to fintech industry in MENA.

- Providing a strong digital infrastructure that facilitates the adoption of financial technology.

- Developing a fintech-friendly regulatory framework that allow fintech companies to grow, while ensuring customer protection.

- Developing cross-border collaboration in term of regulation and knowledge exchange.

- Creating sandboxes to test new digital financial services in a controlled environment.

- Establishing academies and developing collaboration between various educational institutions to form talents and skilled professionals in the field of digital finance and fintech.

- Implementing educational programs to enhance financial literacy and digital knowledge, which contributes in promoting financial inclusion and digital financial inclusion by allowing individuals and businesses to integrate the formal financial system and make informed financial decisions.

Future research opportunities:

While this study has provided valuable insights into the relationship between fintech, financial inclusion, and economic development in MENA countries, there remain several promising areas for future research.

Firstly, delving deeper into the financial inclusion of SMEs can provide valuable recommendations for policymakers and businesses. Additionally, exploring the role of financial literacy in fostering fintech adoption in the MENA region would provide critical insights for policymakers. Finally, conducting an in-depth examination of fintech's impact on financial stability stands as a pivotal area for further investigation.

These directions for further research will contribute significantly to a more comprehensive understanding of the interaction between fintech, financial inclusion, and economic development in the MENA context.

Bibliography

Bibliography

Ahmed Mansour, Houssem eddine Bedoui, Ishan Pandey, Nouran Youssef, & Ratul Roshan. (2021). Strategies for adopting DLT/ Blockchain Technologies in Arab Countries (167). Arab Monetary Fund. https://www.amf.org.ae/sites/default/files/publications/2021-12/strategies-adopting-dlt-blockchain-technologies-arab-countries.pdf

Al Tilooby. (2018). The Impact of Blockchain Technology on Financial Transactions [Georgia State University]. https://doi.org/10.57709/12552634

Ali, A. E. S. (2022). Empowering the poor through financial and social inclusion in Africa: An Islamic perspective. Palgrave Macmillan.

Amidžić, G., Massara, A., & Mialou, A. (2014). Assessing Countries' Financial Inclusion Standing—A New Composite Index.

Andrew Weir & Lee George Lam. (2018). Fintech: A game changer (HK-FS18-0001). KPMG. https://assets.kpmg.com/content/dam/kpmg/cn/pdf/en/2018/04/fintech-a-game-changer.pdf

Arab Monetary Fund. (n.d.-a). Arab Financial Inclusion Task Force | Arab Monetary Fund. Retrieved 28 June 2023, from https://www.amf.org.ae/en/financial-sector/financial-inclusion-arab-region/task-force

Arab Monetary Fund. (n.d.-b). Financial Inclusion for the Arab Region Initiative (FIARI) | Arab Monetary Fund. Retrieved 23 June 2023, from https://www.amf.org.ae/en/fiari

Arab Monetary Fund. (n.d.-c). Introduction to Financial Inclusion for the Arab Region Initiative (FIARI). Arab Monetory Fund. https://www.amf.org.ae/modules/fiari/assets/brochures/fiari-brochure.pdf

Arner, D. W., Barberis, J. N., & Buckley, R. P. (2015). The Evolution of Fintech: A New Post-Crisis Paradigm? SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2676553

Aron, J. (2015). 'Leapfrogging': A Survey of the Nature and Economic Implications of Mobile Money. Centre for the Study of African Economies.

ASF. (n.d.). ASF – Algerian Startup Fund. Retrieved 27 June 2023, from https://asf.dz/

Atlam, H. F., Alenezi, A., Alassafi, M. O., & Wills, G. B. (2018). Blockchain with Internet of Things: Benefits, Challenges, and Future Directions. International Journal of Intelligent Systems and Applications, 10(6), 40–48. https://doi.org/10.5815/ijisa.2018.06.05

Bank Al-Maghrib. (2019). Stratégie Nationale d'Inclusion financière (01). Bank Al-Maghrib.

Bank Of Algeria. (n.d.). Brochure sur l'inclusion financière. https://www.bank-of-algeria.dz/wp-content/uploads/2022/10/inclusion7.pdf

Bank Of England. (2023, February 7). What is CBDC? https://www.bankofengland.co.uk/explainers/what-is-a-central-bank-digital-currency

BCT fintech. (n.d.). Lancement du site 'BCT-Fintech' et ouverture des inscriptions en ligne de la Sandbox réglementaire | BCT. Retrieved 28 June 2023, from

https://fintech.bct.gov.tn/fr/evenement/lancement-du-site-bct-fintech-et-ouverture-des-inscriptions-en-ligne-de-la-sandbox

Beehive. (2018, August 7). Borrow Fast, Low Cost Finance. Beehive. https://www.beehive.ae/borrow/

Belk, R., Humayun, M., & Brouard, M. (2022). Money, possessions, and ownership in the Metaverse: NFTs, cryptocurrencies, Web3 and Wild Markets. Journal of Business Research, 153, 198–205. https://doi.org/10.1016/j.jbusres.2022.08.031

C2FO. (2023, January 31). The History of Fintech: How Has the Industry Evolved? C2FO. https://c2fo.com/resources/finance-and-lending/the-history-of-fintech-how-has-the-industry-evolved/

Central Bank of Egypt. (n.d.). Main Highlights of the Financial Inclusion Strategy (2022-2025). Central Bank of Egypt. https://www.cbe.org.eg/-/media/project/cbe/page-content/rich-text/financial-inclusion/the-central-bank-of-egypt-launches-the-financial-inclusion-strategy-(2022-2025).pdf

Ceyla Pazarbasioglu, Alfonso Garcia Mora, Mahesh Uttamchandani, Harish Natarajan, Erik Feyen, & Mathew Saal. (2020). Digital Financial Services. World Bank. https://pubdocs.worldbank.org/en/230281588169110691/Digital-Financial-Services.pdf

CGAP. (n.d.). Financial Inclusion | CGAP. Retrieved 15 July 2023, from https://www.cgap.org/financial-inclusion

Charles Gallo, Anna Jumamil, & Pak Aranyawat. (2017). Blockchain and financial inclusion: The role of blockchain technology can play in accelerating financial inclusion. Georgetown University. https://d3h0qzni6h08fz.cloudfront.net/reports/blockchain-and-financial-inclusion.pdf

Chinoda, T., & Mashamba, T. (2021a). Financial inclusion, bank competition and economic growth in Africa. Journal of Economic and Financial Sciences, 14(1). https://doi.org/10.4102/jef.v14i1.649

Chinoda, T., & Mashamba, T. (2021b). Fintech, financial inclusion and income inequality nexus in Africa. Cogent Economics & Finance, 9(1), 1986926. https://doi.org/10.1080/23322039.2021.1986926

Chloe Orji. (2022, August 25). Bitcoin ban: These are the countries where crypto is restricted or illegal | Euronews. https://www.euronews.com/next/2022/08/25/bitcoin-ban-these-are-the-countries-where-crypto-is-restricted-or-illegal2

Coindesk. (2023). Bitcoin Price | BTC Price Index and Live Chart—CoinDesk. Coindesk. https://www.coindesk.com/price/bitcoin/

CoinMarketCap. (2023a). All Cryptocurrencies. CoinMarketCap. https://coinmarketcap.com/all/views/all/

CoinMarketCap. (2023b, July 10). Ethereum price today, ETH to USD live price, marketcap and chart. CoinMarketCap. https://coinmarketcap.com/currencies/ethereum/

CPA Canada & AICPA. (2017). Blockchain Technology and Its Potential Impact on the Audit and Assurance Profession. Deloitte Development LLC.

CVJ.CH, E. O. (2023, January 19). Cryptocurrencies in Morocco: Regulating instead of banning. Crypto Valley Journal. https://cvj.ch/en/focus/legal-and-compliance/cryptocurrencies-in-morocco-regulation-instead-of-a-ban/

Daniel Liberto. (2020, December 30). Endogenous Growth Theory: Definition, History, and Criticism. Investopedia. https://www.investopedia.com/terms/e/endogenousgrowththeory.asp

Daud, S. N. M., & Ahmad, A. H. (2023). Financial inclusion, economic growth and the role of digital technology. Finance Research Letters, 53, 103602. https://doi.org/10.1016/j.frl.2022.103602

Demir, A., Pesqué-Cela, V., Altunbas, Y., & Murinde, V. (2022). Fintech, financial inclusion and income inequality: A quantile regression approach. The European Journal of Finance, 28(1), 86–107. https://doi.org/10.1080/1351847X.2020.1772335

Demirgüç-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2022). The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19. The World Bank. https://doi.org/10.1596/978-1-4648-1897-4

Deng, Huang, & Cheng. (2019). FinTech and Sustainable Development: Evidence from China based on P2P Data. Sustainability, 11(22), 6434. https://doi.org/10.3390/su11226434

Emara, N., & El Said, A. (2021). Financial inclusion and economic growth: The role of governance in selected MENA countries. International Review of Economics & Finance, 75, 34–54. https://doi.org/10.1016/j.iref.2021.03.014

Emara, N., & Mohieldin, M. (2021). Beyond the Digital Dividends: Fintech and Extreme Poverty in the Middle East and Africa. 23(2).

Fawry. (n.d.). About Fawry. Fawry. Retrieved 29 June 2023, from https://www.fawry.com/about/

Fazle Kabir & Nor Shamsiah Mohd Yunus. (2019). Technical Note on Financial Inclusion and Islamic Finance. IFSB. file:///C:/Users/Massi-Nissa/Downloads/TN-3_%20Technical%20Note%20on%20Financial%20Inclusion%20and%20Islamic%20Finance_En.pdf

Financial Inclusion for the Arab Region Initiative. (2021). Annual Report of the Financial Inclusion for the Arab Region Initiative 2020. Financial Inclusion for the Arab Region Initiative. https://www.amf.org.ae/sites/default/files/publications/2021-12/financial-inclusion-arab-region-initiative-fiari-annual-report-2020.pdf

Fintech Egypt. (2021). Egypt FinTech Landscape Report 2021. Fintech Egypt.

Fintech Middle East. (n.d.). Fintech News Middle East: UAE Fintech Report 2021. Fintech Middle East. https://fintechnews.ae/wp-content/uploads/2021/07/UAE-Fintech-Report-2021.pdf

Fintech Saudi. (2022). Fintech Saudi Annual Report 2021/2022. Fintech Saudi.

Girasa, R. (2018). Regulation of cryptocurrencies and blockchain technologies (1st edition). Springer Science+Business Media.

GPFI. (n.d.-a). Data | GPFI. Retrieved 15 July 2023, from https://www.gpfi.org/data

GPFI. (n.d.-b). G20 Financial Inclusion Indicators Glossary. GPFI. https://thedocs.worldbank.org/en/doc/e3a48de5eddfc200c994727ebd33ee20-0050062023/original/Glossary-010823.pdf

Habib Attia & Carol Coye Benson. (2018). Digital Financial Services: Payment Aspects for Financial Inclusion in the Arab Region. Arab Monetary Fund. https://www.amf.org.ae/sites/default/files/publications/2022-01/dfs-payment-aspects-for-financial-inclusion-in-the-arab-region.pdf

Hsiao, C. (2007). Panel data analysis—Advantages and challenges. TEST, 16(1), 1–22. https://doi.org/10.1007/s11749-007-0046-x

Hsiao, C., Pesaran, M. H., & Pick, A. (2007). Diagnostic Tests of Cross Section Independence for Nonlinear Panel Data Models. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.982629

IISD. (n.d.). Sustainable Development. International Institute for Sustainable Development. Retrieved 15 July 2023, from https://www.iisd.org/mission-and-goals/sustainable-development

IOSCO. (2017). IOSCO Research Report on Financial Technology (fintech). IOSCO. https://www.iosco.org/library/pubdocs/pdf/IOSCOPD554.pdf

Jake Frankenfield. (2023, April 21). Cryptocurrency Explained With Pros and Cons for Investment. Investopedia. https://www.investopedia.com/terms/c/cryptocurrency.asp

James Manyika, Susan Lund, Marc Singer, Olivia White, & Chris Berry. (2016). Digital Finance For All: Powering Inclusive Growth In Emerging Economies. McKinsey Global Institute.

Johnen, C., Parlasca, M., & Mußhoff, O. (2023). Mobile money adoption in Kenya: The role of mobile money agents. Technological Forecasting and Social Change, 191, 122503. https://doi.org/10.1016/j.techfore.2023.122503

Jon Frost, Leonardo Gambacorta, & Hyun Song Shin. (2021). From Financial Innovation to Inclusion. IMF.

Josh Howarth. (2023, January 26). Fintech Market Size & Future Growth (2023-2027). Exploding Topics. https://explodingtopics.com/blog/fintech-market

Julia Kagan. (2023, April 27). Financial Technology (Fintech): Its Uses and Impact on Our Lives. Investopedia. https://www.investopedia.com/terms/f/fintech.asp

Kaji, S., Nakatsuma, T., & Fukuhara, M. (Eds.). (2021). The Economics of Fintech. Springer Singapore. https://doi.org/10.1007/978-981-33-4913-1

Khera, P., Ng, S., Ogawa, S., & Sahay, R. (2021a). Is Digital Financial Inclusion Unlocking Growth? (167). International Monetary Fund.

Khera, P., Ng, S., Ogawa, S., & Sahay, R. (2021b). Measuring Digital Financial Inclusion in Emerging Market and Developing Economies: A New Index (90). International Monetary Fund.

King, R. G., & Levine, R. (1993). Finance and Growth: Schumpeter Might Be Right. The Quarterly Journal of Economics, 108(3), 717–737. https://doi.org/10.2307/2118406

Kumar, A. S., & Padakandla, S. R. (2023). Do NFTs act as a good hedge and safe haven against Cryptocurrency fluctuations? Finance Research Letters, 56, 104131. https://doi.org/10.1016/j.frl.2023.104131

Le, T.-H., Chuc, A. T., & Taghizadeh-Hesary, F. (2019). Financial inclusion and its impact on financial efficiency and sustainability: Empirical evidence from Asia. Borsa Istanbul Review, 19(4), 310–322. https://doi.org/10.1016/j.bir.2019.07.002

Leora Klapper, Mayada El-Zoghbi, & Jake Hess. (2016). Achieving the Sustainable Development Goals The Role of Financial Inclusion. Consultative Group to Assist the Poor. https://www.cgap.org/sites/default/files/Working-Paper-Achieving-Sustainable-Development-Goals-Apr-2016_0.pdf

Liu, Y., Luan, L., Wu, W., Zhang, Z., & Hsu, Y. (2021). Can digital financial inclusion promote China's economic growth? International Review of Financial Analysis, 78, 101889. https://doi.org/10.1016/j.irfa.2021.101889

Magnitt. (2023a). 2022 MENA Venture Debt Investment Report. Magnitt. https://magnitt.com/research/2022-mena-venture-debt-investment-report-50855

Magnitt. (2023b). FY2022 MENA FinTech Venture Investment Report. Magnitt. https://magnitt.com/research/2022-mena-fintech-venture-investment-report-50856

Martino, P. (2021). Blockchain and banking: How technological innovations are shaping the banking industry. Palgrave Macmillan. https://doi.org/10.1007/978-3-030-70970-9

McKinsey. (2023, March 31). What is central bank digital currency (CBDC)? https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-central-bank-digital-currency-cbdc

Mercy Corps. (n.d.). Financial Inclusion Approach and Principles Markets, Economic Recovery and Growth Technical Unit. Mercy Corps. https://europe.mercycorps.org/sites/default/files/2019-11/TSU%20Financial%20Inclusion%20Approach%20and%20Principles-%20January%202017.pdf

Mhlanga, D. (2020). Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion. International Journal of Financial Studies, 8(3), 45. https://doi.org/10.3390/ijfs8030045

Mhlanga, D. (2022). Digital Financial Inclusion: Revisiting Poverty Theories in the Context of the Fourth Industrial Revolution. Springer International Publishing. https://doi.org/10.1007/978-3-031-16687-7

Michael Magrath & Gabrielle Inhofe. (2022). 2022 Global Financial Regulations Report—Executive Summary. OneSpan.

Michelle Black & Jordan Tarver. (2022, March 31). Equity Crowdfunding: What Is It & How Does It Work? – Forbes Advisor. https://www.forbes.com/advisor/business-loans/equity-crowdfunding/

Mohamed, H., & Ali, H. (2019). Blockchain, fintech, and Islamic finance: Building the future in the new Islamic digital economy. Walter de Gruyter Inc.

Mohammed Laksaci. (2014). Rôle des banques centrales dans la promotion de l'inclusion financière: Référence au cas de l'Algérie. Bank Of Algeria. https://www.bank-of-algeria.dz/wp-content/uploads/2021/02/interventiongouverneur_dakar14et15052014.pdf

Moloi, T., & Marwala, T. (2020). Artificial Intelligence in Economics and Finance Theories. Springer International Publishing. https://doi.org/10.1007/978-3-030-42962-1

Mueller Jackson & S. Piwowar Michael. (2019). The rise of fintech in the middle east: An analysis of the emergence in Bahrain and United Arab Emirates. Milken Institute.

Musleh Al-Sartawi, A. M. A. (Ed.). (2022). Artificial intelligence for sustainable finance and sustainable technology: Proceedings of ICGER 2021. Springer.

Nafis Alam, Gupta, L., & Zameni Abdolhossein. (2019). Fintech and Islamic finance: Digitalization, development and disruption. Palgrave Macmillan. https://doi.org/10.1007/978-3-030-24666-2

Nishith Pathak & Anurag Bhandari. (2018). IoT, AI, and blockchain for .net: Building a next-generation application from the ground up. Springer Science+Business Media.

Nkwede, F. (2015). Financial Inclusion and Economic Growth in Africa: Insight from Nigeria. European Journal of Business and Management.

Nouran Yousef. (2021). Fintech Index in the Arab Countries "FinxAr" (Methodology and Results). Arab Monetary Fund.

Okine, A. N. D., Li, Y., Djimesah, I. E., Zhao, H., Adjei Budu, K. W., Duah, E., & Kissi Mireku, K. (2023). Analyzing crowdfunding adoption from a technology acceptance perspective. Technological Forecasting and Social Change, 192, 122582. https://doi.org/10.1016/j.techfore.2023.122582

Ozturk, I., & Ullah, S. (2022). Does digital financial inclusion matter for economic growth and environmental sustainability in OBRI economies? An empirical analysis. Resources, Conservation and Recycling, 185, 106489. https://doi.org/10.1016/j.resconrec.2022.106489

Paracha, Z. N. (2021, February 1). Fawry's market cap swells to over $2 billion. MENAbytes. https://www.menabytes.com/fawry-2-billion/

Reuters. (2023, June 29). FWRY.CA - | Stock Price & Latest News | Reuters. https://www.reuters.com/markets/companies/FWRY.CA/

Richie Santosdiaz. (2021). Fintech: Middle east and Africa 2021 The fintech lanscape report. The Fintech Times.

Richie Santosdiaz. (2022). FINTECH: Middle East &Africa 2022 Economic Development Through Prosperity With Fintech. The Fintech Times.

Riley, Pamela, Sarah Romorini, Emma Golub, & Maggie Stokes. (2020). Digital Financial Services in the MENA Region. Abt Associates.

Roman Beck, Michael Kubach, Kim Peiter Jørgensen, Rachelle Sellung, Christian Schunck, & Lorenzo Gentile. (2019). Study on the Economic Impact of Blockchain on the Danish Industry and Labor Market. European Blockchain Center, IT University of Copenhagen, Fraunhofer IAO. https://pure.itu.dk/ws/portalfiles/portal/84414484/Economics_of_Blockchain_Study_Denmark.pdf

Sabir, A. A., Ahmad, I., Ahmad, H., Rafiq, M., Khan, M. A., & Noreen, N. (2023). Consumer Acceptance and Adoption of AI Robo-Advisors in Fintech Industry. Mathematics, 11(6), 1311. https://doi.org/10.3390/math11061311

Saed Khalil, Jamel Jouini, & Anwar Othman. (2023). Impacts of Financial Inclusion on Human Capital Development in the Arab Region (No.115-2023). Arab Monetary Fund.

Savvas Papagiannidis & Davit Marikyan. (2022). Unified Theory of Acceptance and Use of Technology. In TheoryHub Book. Newcastle Universirty. https://open.ncl.ac.uk/theory-library/unified-theory-of-acceptance-and-use-of-technology.pdf

Schueffel, P. M. (2016). Taming the Beast: A Scientific Definition of Fintech. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3097312

Selim Yuksel. (2022). CB Insights 2022 State of Fintech Report. CB Insights. https://www.cbinsights.com/reports/CB-Insights_Fintech-Report-2022.xlsx

Shaikh, A. A., Glavee-Geo, R., Karjaluoto, H., & Hinson, R. E. (2023). Mobile money as a driver of digital financial inclusion. Technological Forecasting and Social Change, 186, 122158. https://doi.org/10.1016/j.techfore.2022.122158

Sharma, U., & Changkakati, B. (2022). Dimensions of global financial inclusion and their impact on the achievement of the United Nations Development Goals. Borsa Istanbul Review, 22(6), 1238–1250. https://doi.org/10.1016/j.bir.2022.08.010

Shen, Y., Hu, W., & Hueng, C. J. (2021). Digital Financial Inclusion and Economic Growth: A Cross-country Study. Procedia Computer Science, 187, 218–223. https://doi.org/10.1016/j.procs.2021.04.054

Shobhit Seth. (2023, April 18). What Is a Central Bank Digital Currency (CBDC)? Investopedia. https://www.investopedia.com/terms/c/central-bank-digital-currency-cbdc.asp

Tamara. (n.d.). Tamara raises $100m in Series B equity round led by Sanabil Investments after 10x YoY increase in revenue. Retrieved 29 June 2023, from https://tamara.co/en/tamara-series-b.html

Thaddeus, K. J., Ngong, C. A., & Manasseh, C. O. (2020). Digital Financial Inclusion and Economic Growth: Evidence from Sub-Saharan Africa (2011-2017). The International Journal of Business & Management, 8(4). https://doi.org/10.24940/theijbm/2020/v8/i4/BM2004-051

The Economist Intelligence Unit Limited. (2020). Islamic fintech: Reaching the next generation of Muslims. Economist Intelligence Unit Limited.

The Global Findex Database 2021. (2022). [dataset]. World Bank. https://www.worldbank.org/en/publication/globalfindex

Tian, Y., & Zhang, Y. (2023). The impact of the reward scheme design on crowdfunding performance. Technological Forecasting and Social Change, 194, 122730. https://doi.org/10.1016/j.techfore.2023.122730

Timothy Lyman & Kate Lauer. (2015, March 10). What is Digital Financial Inclusion and Why Does it Matter? | Blog | CGAP. Cgap. https://www.cgap.org/blog/what-is-digital-financial-inclusion-and-why-does-it-matter

True Tamplin. (2023, May 23). Debt Crowdfunding | Definition, Types, Benefits, and Risks. Finance Strategist. https://www.financestrategists.com/financial-advisor/startup-funding-strategies/debt-crowdfunding/

UN Innovation Network. (n.d.). Practical Guide to Using Blockchain within the United Nations. UN Innovation Network. https://atrium.network/guide

UNCDF. (n.d.). UNCDF and the 2030 Agenda for Sustainable Development. Retrieved 15 July 2023, from https://www.uncdf.org/sdgs

Union of Arab Banks. (2017). Financial Literacy in the Arab Region: A Prerequisite for Financial Inclusion. Union of Arab Banks.

United Nations. (n.d.). Sustainable Development Goals. United Nations; United Nations. Retrieved 15 July 2023, from https://www.un.org/en/sustainable-development-goals

United Nations- Department of Economic and Social Affairs & Poverty. (n.d.). Financial Inclusion | Poverty Eradication. UN. Retrieved 15 July 2023, from https://www.un.org/development/desa/socialperspectiveondevelopment/issues/financial-inclusion.html

unsgsa.org. (2023, April 12). Morocco has Opportunity to Harness Digital Payments, Fintech, and Green Finance to Expand Financial Inclusion | United Nations | UNSGSA Queen Máxima. https://www.unsgsa.org/country-visits/morocco-has-opportunity-harness-digital-payments-fintech-and-green-finance-expand-financial-inclusion

Wangchuk, P. (2021). Common types of Crowdfunding Models, Related Concepts and Its Impact on Business: A Brief Literature Review. Asian Journal of Economics, Business and Accounting, 56–63. https://doi.org/10.9734/ajeba/2021/v21i1430471

Will Kenton. (2023, January 31). Donation-Based Crowdfunding: What it is, How it Works, Uses. Investopedia. https://www.investopedia.com/terms/d/donationbased-crowd-funding.asp

Wooldridge, J. M. (2002). Econometric analysis of cross section and panel data. MIT Press.

World Bank. (n.d.). Digital Financial Inclusion [Text/HTML]. World Bank. Retrieved 15 July 2023, from https://www.worldbank.org/en/topic/financialinclusion/publication/digital-financial-inclusion

World Bank. (2015). How to Measure Financial Inclusion [Text/HTML]. World Bank. https://www.worldbank.org/en/topic/financialinclusion/brief/how-to-measure-financial-inclusion

World Bank. (2022, March 29). Financial Inclusion [Text/HTML]. World Bank. https://www.worldbank.org/en/topic/financialinclusion/overview

Yilmaz, T., Sagfossen, S., & Velasco, C. (2023). What makes NFTs valuable to consumers? Perceived value drivers associated with NFTs liking, purchasing, and holding. Journal of Business Research, 165, 114056. https://doi.org/10.1016/j.jbusres.2023.114056

Yoke Wang Tok & Dyna Heng. (2022). Fintech: Financial Inclusion or Exclusion? (WP/22/80). International Monetary Fund.

Zhu, H., & Zhou, Z. Z. (2016). Analysis and outlook of applications of blockchain technology to equity crowdfunding in China. Financial Innovation, 2(1), 29. https://doi.org/10.1186/s40854-016-0044-7

Zimmerman, E. (2016, April 6). The Evolution of Fintech. The New York Times. https://www.nytimes.com/2016/04/07/business/dealbook/the-evolution-of-fintech.html

Appendix

Figure A. 1: Variance Inflation Factor

```
> Multic <- lm(GDP.P.CAP ~ Inflation+ Trade+Capital+Population+Digitalpay)
> vif(Multic)
 Inflation      Trade    Capital Population Digitalpay
  1.024997   1.068451   1.034764   1.104621   1.181918
```

Source: RStudio (R 4.3.1) outputs

Figure A. 2: Pooled OLS estimation 1st Model

```
Call:
plm(formula = y ~ x, data = pnldf, model = "pooling")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-11.72114  -1.80437   0.36952   1.89636   5.21410

Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
(Intercept)  1.9983080  1.1039842  1.8101 0.0728711 .
xInflation  -0.0258630  0.0141052 -1.8336 0.0692803 .
xTrade      -0.0145250  0.0082015 -1.7710 0.0791827 .
xCapital     0.0712244  0.0330406  2.1557 0.0331754 *
xPopulation -0.6365780  0.1623547 -3.9209 0.0001498 ***
xDigitalpay  0.0108388  0.0123658  0.8765 0.3825622
xCovid      -4.1351246  0.5543002 -7.4601 1.717e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    1460.9
Residual Sum of Squares: 857.14
R-Squared:      0.41327
Adj. R-Squared: 0.38292
F-statistic: 13.6175 on 6 and 116 DF, p-value: 1.1772e-11
```

Source: RStudio (R 4.3.1) outputs

Figure A. 3: Random effect estimation 1st Model

```
Call:
plm(formula = y ~ x, data = pnldf, model = "random")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Effects:
                 var std.dev share
idiosyncratic 3.257   1.805 0.437
individual    4.202   2.050 0.563
theta:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 0.4715  0.5469  0.5469  0.5432  0.5469  0.5469

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-7.6057 -1.3583  0.2481  0.0053  1.2040  4.4209

Coefficients:
             Estimate Std. Error  z-value  Pr(>|z|)
(Intercept) -0.122308   1.353366  -0.0904 0.9279906
xInflation  -0.021833   0.011075  -1.9714 0.0486809 *
xTrade      -0.011132   0.011467  -0.9707 0.3316904
xCapital     0.126275   0.041534   3.0403 0.0023637 **
xPopulation -0.563342   0.149280  -3.7737 0.0001608 ***
xDigitalpay  0.019349   0.014416   1.3422 0.1795242
xCovid      -4.263842   0.413794 -10.3043 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    912.73
Residual Sum of Squares: 400.37
R-Squared:      0.56135
Adj. R-Squared: 0.53866
Chisq: 148.57 on 6 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 4: Fixed effect estimation 1st Model

```
Call:
plm(formula = y ~ x, data = pnldf, model = "within")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Residuals:
    Min.  1st Qu.   Median  3rd Qu.     Max.
-3.75691 -0.88133 -0.12715  0.81667  3.50935

Coefficients:
             Estimate Std. Error t-value  Pr(>|t|)
xInflation  -0.024613   0.011399 -2.1593 0.0340245 *
xTrade       0.045509   0.039915  1.1402 0.2578487
xCapital     0.232156   0.073682  3.1508 0.0023396 **
xPopulation -0.659913   0.181145 -3.6430 0.0004936 ***
xDigitalpay  0.059050   0.024109  2.4493 0.0166473 *
xCovid      -4.634562   0.465342 -9.9595 2.277e-15 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    763.48
Residual Sum of Squares: 244.27
R-Squared:      0.68007
Adj. R-Squared: 0.47957
F-statistic: 26.5704 on 6 and 75 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 5: Hausman and F test 1st Model

```
> phtest(random, fixed)

        Hausman Test

data:  y ~ x
chisq = 14.565, df = 6, p-value = 0.02392
alternative hypothesis: one model is inconsistent

>
> pFtest(fixed, pooled)

        F test for individual effects

data:  y ~ x
F = 4.5897, df1 = 41, df2 = 75, p-value = 5.732e-09
alternative hypothesis: significant effects

>
```

Source: RStudio (R 4.3.1) outputs

Figure A. 6 :Pooled OLS estimation 2nd Model

```
Call:
plm(formula = y ~ x1, data = pnldf, model = "pooling")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Residuals:
    Min.  1st Qu.   Median  3rd Qu.     Max.
-9.16677 -1.60652  0.20301  1.61131  7.32618

Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
(Intercept)  2.9968104  1.0534148  2.8449 0.0052688 **
x1Inflation -0.0266047  0.0129455 -2.0551 0.0421516 *
x1Trade     -0.0070752  0.0076909 -0.9199 0.3595443
x1Capital    0.0733246  0.0306763  2.3903 0.0184750 *
x1Population -0.5089898  0.1511322 -3.3678 0.0010338 **
x1Digitalpay -0.0172366  0.0130573 -1.3201 0.1894555
x1Covid     -3.7615135  0.5140429 -7.3175 3.807e-11 ***
x1MENA      -4.2679954  1.2438624 -3.4312 0.0008377 ***
x1           0.0389019  0.0359122  1.0833 0.2809831
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    1460.9
Residual Sum of Squares: 708.2
R-Squared:      0.51522
Adj. R-Squared: 0.4812
F-statistic: 15.1446 on 8 and 114 DF, p-value: 5.8583e-15
```

Source: RStudio (R 4.3.1) outputs

Figure A. 7: Random effect estimation 2nd Model

```
Call:
plm(formula = y ~ x1, data = pnldf, model = "random")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Effects:
                 var std.dev share
idiosyncratic 3.240   1.800  0.52
individual    2.986   1.728  0.48
theta:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 0.4070  0.4846  0.4846  0.4808  0.4846  0.4846

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.6718 -1.2245  0.0744  0.0037  1.1508  5.4801

Coefficients:
               Estimate Std. Error z-value  Pr(>|z|)
(Intercept)   1.4381574  1.3056041  1.1015 0.2706676
x1Inflation  -0.0219180  0.0110173 -1.9894 0.0466553 *
x1Trade      -0.0067142  0.0104413 -0.6430 0.5201961
x1Capital     0.1086791  0.0389775  2.7883 0.0052994 **
x1Population -0.4913656  0.1468882 -3.3452 0.0008223 ***
x1Digitalpay -0.0040295  0.0151450 -0.2661 0.7901942
x1Covid      -3.9740674  0.4171607 -9.5265 < 2.2e-16 ***
x1MENA       -4.3357209  1.5646831 -2.7710 0.0055886 **
x1            0.0505508  0.0435909  1.1597 0.2461863
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    955.79
Residual Sum of Squares: 398.09
R-Squared:      0.5835
Adj. R-Squared: 0.55427
Chisq: 159.851 on 8 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 8:Fixed effect estimation 2nd Model

```
Call:
plm(formula = y ~ x1, data = pnldf, model = "within")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Residuals:
    Min.  1st Qu.   Median  3rd Qu.     Max.
-3.71583 -0.89226 -0.18064  0.76128  3.49590

Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
x1Inflation  -0.023110   0.011439 -2.0202 0.0469788 *
x1Trade       0.056320   0.040842  1.3790 0.1720638
x1Capital     0.203122   0.077470  2.6219 0.0106079 *
x1Population -0.655113   0.180707 -3.6253 0.0005271 ***
x1Digitalpay  0.053283   0.024533  2.1719 0.0330699 *
x1Covid      -4.599967   0.465021 -9.8920 3.507e-15 ***
x1            0.080062   0.067629  1.1839 0.2402597
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    763.48
Residual Sum of Squares: 239.72
R-Squared:      0.68601
Adj. R-Squared: 0.48234
F-statistic: 23.0968 on 7 and 74 DF, p-value: 2.7458e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 9 Hausman and F test 2nd Model

```
> phtest(random1, fixed1)

        Hausman Test

data:  y ~ x1
chisq = 17.881, df = 7, p-value = 0.01252
alternative hypothesis: one model is inconsistent

> pFtest(fixed1, pooled1)

        F test for individual effects

data:  y ~ x1
F = 3.6153, df1 = 40, df2 = 74, p-value = 8.638e-07
alternative hypothesis: significant effects
```

Source: RStudio (R 4.3.1) outputs

Figure A. 10: Pooled OLS estimation 3rd Model

```
Call:
plm(formula = y ~ x2, data = pnldf, model = "pooling")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-10.62967  -1.71935   0.15454   1.58951   6.39086

Coefficients:
               Estimate Std. Error t-value  Pr(>|t|)
(Intercept)   2.7493968  1.1371751  2.4177   0.01719 *
x2Inflation  -0.0245741  0.0138841 -1.7699   0.07939 .
x2Trade      -0.0151652  0.0080710 -1.8790   0.06278 .
x2Capital     0.0760716  0.0325675  2.3358   0.02123 *
x2Population -0.6753005  0.1606193 -4.2044 5.203e-05 ***
x2Digitalpay -0.0077139  0.0147537 -0.5228   0.60209
x2Covid      -6.7947507  1.3156984 -5.1644 1.023e-06 ***
x2            0.0533876  0.0240369  2.2211   0.02830 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    1460.9
Residual Sum of Squares: 821.88
R-Squared:      0.4374
Adj. R-Squared: 0.40316
F-statistic: 12.7726 on 7 and 115 DF, p-value: 4.7064e-12
```

Source: RStudio (R 4.3.1) outputs

Figure A. 11: Random effect estimation 3rd Model

```
Call:
plm(formula = y ~ x2, data = pnldf, model = "random")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Effects:
                 var std.dev share
idiosyncratic 2.986   1.728 0.414
individual    4.220   2.054 0.586
theta:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 0.4888  0.5632  0.5632  0.5596  0.5632  0.5632

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.7315 -1.1981  0.1241  0.0045  1.0957  5.3534

Coefficients:
              Estimate Std. Error z-value  Pr(>|z|)
(Intercept)   0.343806   1.349901  0.2547 0.7989625
x2Inflation  -0.021244   0.010678 -1.9896 0.0466353 *
x2Trade      -0.011527   0.011376 -1.0133 0.3109241
x2Capital     0.138987   0.040973  3.3922 0.0006934 ***
x2Population -0.610890   0.145866 -4.1880 2.814e-05 ***
x2Digitalpay  0.002993   0.015371  0.1947 0.8456194
x2Covid      -6.565867   0.913607 -7.1868 6.635e-13 ***
x2            0.046436   0.016621  2.7939 0.0052078 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    902.34
Residual Sum of Squares: 366.42
R-Squared:      0.59393
Adj. R-Squared: 0.56921
Chisq: 168.325 on 7 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 12: Fixed effect estimation 3nd Model

```
Call:
plm(formula = y ~ x2, data = pnldf, model = "within")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-3.234355 -0.967773  0.031206  0.829893  3.679105

Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
x2Inflation  -0.024634   0.010914 -2.2572 0.0269486 *
x2Trade       0.041191   0.038247  1.0770 0.2849932
x2Capital     0.253235   0.070947  3.5694 0.0006328 ***
x2Population -0.716059   0.174593 -4.1013 0.0001043 ***
x2Digitalpay  0.040165   0.024051  1.6700 0.0991400 .
x2Covid      -6.860941   0.912480 -7.5190 1.047e-10 ***
x2            0.045622   0.016318  2.7959 0.0065907 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    763.48
Residual Sum of Squares: 220.93
R-Squared:      0.71063
Adj. R-Squared: 0.52293
F-statistic: 25.9614 on 7 and 74 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 13 Hausman and F test 3rd Model

```
> phtest(random2, fixed2)

        Hausman Test

data:  y ~ x2
chisq = 17.026, df = 7, p-value = 0.01723
alternative hypothesis: one model is inconsistent

> pFtest(fixed2, pooled2)

        F test for individual effects

data:  y ~ x2
F = 4.9095, df1 = 41, df2 = 74, p-value = 1.529e-09
alternative hypothesis: significant effects
```

Source: RStudio (R 4.3.1) outputs

Figure A. 14: Durbin-Watson test, 1st and 3rd model

```
> pdwtest(fixed)

        Durbin-Watson test for serial correlation in panel models

data:  y ~ x
DW = 2.755, p-value = 1
alternative hypothesis: serial correlation in idiosyncratic errors

> pdwtest(fixed2)

        Durbin-Watson test for serial correlation in panel models

data:  y ~ x2
DW = 2.7829, p-value = 1
alternative hypothesis: serial correlation in idiosyncratic errors
```

Source: RStudio (R 4.3.1) outputs

Figure A. 15: Shapiro-Wilk normality test, 1st and 3rd model

```
> residuals <- residuals(fixed)
> shapiro.test(residuals)

        Shapiro-Wilk normality test

data:  residuals
W = 0.98734, p-value = 0.3125

> residuals1 <- residuals(fixed2)
> shapiro.test(residuals1)

        Shapiro-Wilk normality test

data:  residuals1
W = 0.9896, p-value = 0.4808
```

Source: RStudio (R 4.3.1) outputs

Figure A. 16: Pesaran CD test, 1st and 3rd model

```
> pcdtest(fixed, c("cd"))

        Pesaran CD test for cross-sectional dependence in panels

data:  y ~ x
z = 2.3262, p-value = 0.02001
alternative hypothesis: cross-sectional dependence

> pcdtest(fixed2, c("cd"))

        Pesaran CD test for cross-sectional dependence in panels

data:  y ~ x2
z = 0.41361, p-value = 0.6792
alternative hypothesis: cross-sectional dependence
```

Source: RStudio (R 4.3.1) outputs

Figure A. 17: Bias-corrected Scaled LM test

```
> pcdtest(fixed, c("bcsclm"))

        Bias-corrected Scaled LM test for cross-sectional dependence in panels

data:  y ~ x
z = 1.6285, p-value = 0.1034
alternative hypothesis: cross-sectional dependence
```

Source: RStudio (R 4.3.1) outputs

Figure A. 18 Breusch-Pagan test, 1st and 3rd model

```
> bptest(y ~ x, data = pnldf, studentize = FALSE)

        Breusch-Pagan test

data:  y ~ x
BP = 29.788, df = 6, p-value = 4.313e-05

> bptest(y ~ x2, data = pnldf, studentize = FALSE)

        Breusch-Pagan test

data:  y ~ x2
BP = 40.384, df = 7, p-value = 1.063e-06
```

Source: RStudio (R 4.3.1) outputs

Figure A. 19: Robust standard error estimation 1st and 3rd model

```
> coeftest(fixed, vcovHC)

t test of coefficients:

             Estimate Std. Error t value  Pr(>|t|)
xInflation  -0.024613   0.007824 -3.1459  0.002374 **
xTrade       0.045509   0.038569  1.1799  0.241750
xCapital     0.232156   0.071264  3.2577  0.001689 **
xPopulation -0.659913   0.074574 -8.8491 2.883e-13 ***
xDigitalpay  0.059050   0.026828  2.2011  0.030808 *
xCovid      -4.634562   0.563741 -8.2211 4.528e-12 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(fixed2, vcovHC)

t test of coefficients:

               Estimate Std. Error t value  Pr(>|t|)
x2Inflation  -0.0246339  0.0070631 -3.4877 0.0008237 ***
x2Trade       0.0411909  0.0415357  0.9917 0.3245764
x2Capital     0.2532351  0.0741960  3.4131 0.0010449 **
x2Population -0.7160587  0.0750247 -9.5443 1.570e-14 ***
x2Digitalpay  0.0401654  0.0217502  1.8467 0.0687944 .
x2Covid      -6.8609413  1.2724081 -5.3921 7.982e-07 ***
x2            0.0456220  0.0199702  2.2845 0.0252106 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Source: RStudio (R 4.3.1) outputs

Figure A. 20: Pooled OLS estimation 1st Model with listwise deletion approach

```
Call:
plm(formula = y ~ x, data = plnDF, model = "pooling")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-12.93332  -2.05668   0.24238   2.36501   8.52117

Coefficients:
              Estimate Std. Error  t-value Pr(>|t|)
(Intercept)  0.3150200  1.3463045   0.2340  0.81541
xInflation  -0.0083472  0.0062270  -1.3405  0.18270
xGrcapital   0.0938956  0.0403759   2.3255  0.02178 *
xPPgr       -0.4450691  0.2006249  -2.2184  0.02847 *
xTrade      -0.0161267  0.0103885  -1.5524  0.12330
xCovid19    -7.8767491  0.7026485 -11.2101  < 2e-16 ***
xDigitalpay  0.0307439  0.0156549   1.9638  0.05194 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    3086.5
Residual Sum of Squares: 1341.6
R-Squared:      0.56532
Adj. R-Squared: 0.54284
F-statistic: 25.1438 on 6 and 116 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 21: Random effect estimation 1st Model with listwise deletion approach

```
plm(formula = y ~ x, data = plnDF, model = "random")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Effects:
                 var std.dev share
idiosyncratic 5.047   2.246 0.451
individual    6.139   2.478 0.549
theta:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 0.4603  0.5362  0.5362  0.5325  0.5362  0.5362

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-8.9074 -1.3348  0.0486  0.0049  1.4493  7.1014

Coefficients:
              Estimate Std. Error  z-value  Pr(>|z|)
(Intercept) -2.3700571  1.6490094  -1.4373  0.150644
xInflation  -0.0084893  0.0050010  -1.6975  0.089597 .
xGrcapital   0.1853643  0.0495268   3.7427  0.000182 ***
xPPgr       -0.5682137  0.1783224  -3.1864  0.001440 **
xTrade      -0.0068915  0.0143612  -0.4799  0.631317
xCovid19    -7.7552688  0.5421471 -14.3047 < 2.2e-16 ***
xDigitalpay  0.0308858  0.0185446   1.6655  0.095815 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    2341.4
Residual Sum of Squares: 656.38
R-Squared:      0.71967
Adj. R-Squared: 0.70517
Chisq: 297.808 on 6 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 22: Fixed effect estimation 1st Model with listwise deletion approach

```
Call:
plm(formula = y ~ x, data = plnDF, model = "within")

Unbalanced Panel: n = 42, T = 2-3, N = 123

Residuals:
    Min.  1st Qu.   Median  3rd Qu.     Max.
-5.65819 -1.07354  0.16313  1.06809  4.90793

Coefficients:
             Estimate Std. Error  t-value  Pr(>|t|)
xInflation  -0.0119517  0.0050198  -2.3809 0.0198086 *
xGrcapital   0.3291167  0.0802071   4.1033 0.0001025 ***
xPPgr       -0.8325552  0.1983144  -4.1982 7.319e-05 ***
xTrade       0.0783491  0.0431541   1.8156 0.0734338 .
xCovid19    -7.4828873  0.5862323 -12.7644 < 2.2e-16 ***
xDigitalpay  0.0806105  0.0305562   2.6381 0.0101323 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    2132.2
Residual Sum of Squares: 378.5
R-Squared:      0.82248
Adj. R-Squared: 0.71123
F-statistic: 57.9137 on 6 and 75 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 23: Hausman and F test (Listwise deletion approach)

```
        Hausman Test

data:  y ~ x
chisq = 19.976, df = 6, p-value = 0.002797
alternative hypothesis: one model is inconsistent

> pFtest(fixed, pooling)

        F test for individual effects

data:  y ~ x
F = 4.6547, df1 = 41, df2 = 75, p-value = 4.231e-09
alternative hypothesis: significant effects
```

Source: RStudio (R 4.3.1) outputs

Figure A. 24: Pooled OLS estimation 1st Model with interpolation approach

```
Call:
plm(formula = y ~ x, data = pnldf, model = "pooling")

Unbalanced Panel: n = 42, T = 5-8, N = 329

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-14.15277  -1.97247   0.19142   1.96854   9.78697

Coefficients:
                                    Estimate Std. Error  t-value  Pr(>|t|)
(Intercept)                        1.9451450  0.7596408   2.5606  0.010905 *
xInflation                        -0.0158951  0.0049079  -3.2387  0.001326 **
xTrade                            -0.0110171  0.0057751  -1.9077  0.057320 .
xPopulation.growth                -0.5951670  0.1315721  -4.5235 8.564e-06 ***
xGross.capital.formation....of.GDP.  0.0685572  0.0222068   3.0872  0.002196 **
xDigitalpayInter                   0.0098815  0.0085099   1.1612  0.246433
xcovid                            -7.6179781  0.5376133 -14.1700 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    5514.2
Residual Sum of Squares: 3056.1
R-Squared:      0.44578
Adj. R-Squared: 0.43546
F-statistic: 43.1665 on 6 and 322 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 25: Random effect estimation 1st Model with interpolation approach

```
Call:
plm(formula = y ~ x, data = pnldf, model = "random")

Unbalanced Panel: n = 42, T = 5-8, N = 329

Effects:
                var std.dev share
idiosyncratic 6.081   2.466 0.654
individual    3.215   1.793 0.346
theta:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 0.4761  0.5627  0.5627  0.5595  0.5627  0.5627

Residuals:
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-10.5723  -1.3119   0.0722   0.0057   1.1943  10.8224

Coefficients:
                                    Estimate Std. Error  z-value  Pr(>|z|)
(Intercept)                       -0.1456853  1.1113149  -0.1311  0.895702
xInflation                        -0.0133558  0.0045021  -2.9665  0.003012 **
xTrade                            -0.0061695  0.0098665  -0.6253  0.531774
xPopulation.growth                -0.6722992  0.1475367  -4.5568 5.193e-06 ***
xGross.capital.formation....of.GDP.  0.1120733  0.0323718   3.4621  0.000536 ***
xDigitalpayInter                   0.0268532  0.0121277   2.2142  0.026814 *
xcovid                            -7.7582935  0.4583099 -16.9281 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    4445.4
Residual Sum of Squares: 2070.4
R-Squared:      0.53426
Adj. R-Squared: 0.52558
Chisq: 369.637 on 6 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 26: Fixed effect estimation 1st Model with interpolation approach

```
Oneway (individual) effect Within Model

Call:
plm(formula = y ~ x, data = pnldf, model = "within")

Unbalanced Panel: n = 42, T = 5-8, N = 329

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-6.995165 -1.182437 -0.056634  1.102921 11.452329

Coefficients:
                                  Estimate Std. Error  t-value  Pr(>|t|)
xInflation                      -0.0142728  0.0045399  -3.1439  0.001846 **
xTrade                           0.0585269  0.0255668   2.2892  0.022811 *
xPopulation.growth              -0.8109107  0.1651521  -4.9101 1.546e-06 ***
xGross.capital.formation....of.GDP.  0.1375739  0.0481568   2.8568  0.004599 **
xDigitalpayInter                 0.0726682  0.0175302   4.1453 4.497e-05 ***
xcovid                          -7.6744668  0.4730270 -16.2242 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    4187.1
Residual Sum of Squares: 1708.7
R-Squared:      0.59191
Adj. R-Squared: 0.52366
F-statistic: 67.9302 on 6 and 281 DF, p-value: < 2.22e-16
```

Source: RStudio (R 4.3.1) outputs

Figure A. 27: Hausman and F test (Listwise deletion approach)

```
> phtest(random, fixed)

        Hausman Test

data:  y ~ x
chisq = 50.79, df = 6, p-value = 3.263e-09
alternative hypothesis: one model is inconsistent

> pFtest(fixed, pooled)

        F test for individual effects

data:  y ~ x
F = 5.4045, df1 = 41, df2 = 281, p-value < 2.2e-16
alternative hypothesis: significant effects
```

Source: RStudio (R 4.3.1) output

Figure A. 28: Dataset used for MENA countries

Year	Country	GDP.P.Cap	DigitalPay	Inflation	Capital	Population	Trade
2014	Algeria	1,76594123	27,82	2,91692692	45,62657391	1,97904881	62,414316
2015	Algeria	1,64665726		4,78444701	50,78068839	1,99994605	59,6951286
2016	Algeria	1,16314758		6,3976948	50,77772389	1,99343169	55,9256679
2017	Algeria	-0,66317119	25,98	5,59111591	48,54374106	1,95700247	55,321403
2018	Algeria	-0,70795048		4,26999021	47,07082503	1,90332543	58,0654918
2019	Algeria	-0,84085666		1,95176821	44,68980398	1,83944489	51,8095837
2020	Algeria	-6,72994165		2,41513094	43,81898484	1,73245673	45,3305109
2021	Algeria	1,70006377	33,74	7,22606307	37,92786876	1,6577032	53,1952522
2014	Egypt, Arab F	0,53182407	8,12	10,0702155	13,64319249	2,34379305	36,9201878
2015	Egypt, Arab F	2,09553831		10,3704903	14,28863701	2,20525981	34,845943
2016	Egypt, Arab F	2,19220863		13,8136062	15,04023031	2,08630285	30,2465491
2017	Egypt, Arab F	2,12874338	22,83	29,5066084	17,14488908	1,9897685	42,8321344
2018	Egypt, Arab F	3,34981502		14,4014658	18,70901376	1,89893077	45,9110197
2019	Egypt, Arab F	3,67537083		9,15279959	20,05360972	1,79400213	41,1240172
2020	Egypt, Arab F	1,77096873		5,04493289	15,99486396	1,73312957	32,1262556
2021	Egypt, Arab F	1,59181629	20,2	5,21404941	15,17161681	1,65838368	29,8569735
2014	Iraq	-3,25142072	4,17	2,23597408	18,21597494	3,50227675	68,9824869
2015	Iraq	1,91791209		1,39333029	20,35965171	2,71497647	69,5917686
2016	Iraq	11,0230162		0,5565214	17,87720479	2,4594025	54,5883202
2017	Iraq	-4,10746397	19,06	0,1840589	17,852477	2,35769233	59,7809124
2018	Iraq	0,1823678		0,36744149	17,58547078	2,41756069	65,8017918
2019	Iraq	3,04417477		-0,19896538	22,74072459	2,36838831	68,9899384
2020	Iraq	-14,0902347		0,57416268	22,34685894	2,36211184	57,7423162
2021	Iraq	-0,69547107	14,24	6,04186489	19,58500545	2,26888921	62,0956266
2014	Jordan	-8,11747949	13,32	2,89947905	25,80859519	11,7940157	109,938806
2015	Jordan	-6,53100718		-0,87685136	24,83503291	9,21991789	95,3579122
2016	Jordan	-2,82074529		-0,77843046	23,40441876	4,83585014	88,7207179
2017	Jordan	-0,04150069	32,53	3,32389448	24,71736035	2,48500934	90,0684092
2018	Jordan	-0,46313617		4,46231109	24,3624337	2,36510266	87,9639085
2019	Jordan	-0,52007044		0,76151405	21,41333445	2,25750975	85,8210745
2020	Jordan	-3,67771235		0,33329435		2,12736282	
2021	Jordan	0,20979374	36,37	1,34609377		1,98907686	
2014	Lebanon	-7,24259098	33,08	1,85460421	24,96719514	9,97196954	79,8171566
2015	Lebanon	-1,49384761		-3,74914525	22,22277926	1,96637327	71,8390426
2016	Lebanon	3,83144723		-0,78335962	23,14257137	-2,21727979	67,7236178
2017	Lebanon	3,37003795	33,09	4,32135218	21,78793523	-2,41552103	68,4554293
2018	Lebanon	0,72715084		6,07698908	22,4871034	-2,62721254	68,2573073
2019	Lebanon	-4,19522551		3,00538949	12,32247426	-2,8798659	62,980916
2020	Lebanon	-19,7484285		84,8643331	8,098177366	-2,07933691	50,1298043
2021	Lebanon	-5,83236678	14,02	154,756096	5,359484343	-1,24903517	78,8286204
2014	Tunisia	1,92976505	17,4	4,625551	21,95359751	1,13215769	95,5338405
2015	Tunisia	-0,15775276		4,43737127	21,73899971	1,12092817	87,2485307
2016	Tunisia	0,01079632		3,62939937	20,47500758	1,10043313	87,0926644
2017	Tunisia	1,14914305	29,41	5,3088484	21,29455993	1,07057592	95,809198
2018	Tunisia	1,57907863		7,30759176	22,96356612	1,02422999	103,871824
2019	Tunisia	0,60771277		6,72007533	19,80339808	0,96966216	102,332615
2020	Tunisia	-9,66066158		5,63415116	12,73064211	0,92858317	84,2407722
2021	Tunisia	3,54356061	27,69	5,70635021	15,26396512	0,82886347	94,3521727

Source: World bank development and global financial inclusion database

Figure A. 29: Dataset used for MENA countries

Year	Country	GDP.P.Cap	DigitalPay	Inflation	Capital	Population	Trade
2014	Iran, Islamic	3,01176429	86,73	16,6065532	36,93965714	1,89721422	45,3514201
2015	Iran, Islamic	-3,62941716		12,4846816	31,98240852	2,26178493	39,4225887
2016	Iran, Islamic	6,83567535		7,24542549	29,10919934	1,83580792	40,3878469
2017	Iran, Islamic	1,300705	89,77	8,04492438	31,79653682	1,42882553	44,7448708
2018	Iran, Islamic	-3,52394425		18,0141183	31,53686656	1,30788221	58,3849004
2019	Iran, Islamic	-3,72270715		39,9073456		1,09959326	50,7543342
2020	Iran, Islamic	2,47089227		30,594139		0,83517615	43,8101646
2021	Iran, Islamic	3,96556869	84,49	43,3890163		0,72282251	44,3738341
2014	Pakistan	3,20999431	9,45	7,18938403	14,63527172	1,40918297	30,9012446
2015	Pakistan	3,38201895		2,52932817	15,70703082	1,29655172	27,6546725
2016	Pakistan	4,26375396		3,76511916	15,93574696	1,20405567	24,7015795
2017	Pakistan	3,05478922	17,69	4,08537368	16,33289051	1,32813543	25,4720364
2018	Pakistan	4,53244521		5,07805726	17,06829148	1,5371724	27,6260564
2019	Pakistan	0,86267422		10,5783618	15,49964347	1,60798135	28,9055758
2020	Pakistan	-2,97029465		9,73999314	14,81553934	1,73302782	26,7162805
2021	Pakistan	4,55184848	17,62	9,49621056	14,64489216	1,83406208	27,0501437
2014	Saudi Arabia	1,94530192	51,12	2,23629032	25,88078677	2,02203271	79,5616686
2015	Saudi Arabia	2,69452108		1,20607322	25,83330875	1,92462214	69,5038839
2016	Saudi Arabia	0,32164372		2,06884036	25,36167303	2,01445863	59,9054606
2017	Saudi Arabia	-2,3400685	61,17	-0,83819458	29,81557434	2,29816056	61,8143106
2018	Saudi Arabia	0,34121285		2,45814158	32,64794094	2,38415003	61,9555896
2019	Saudi Arabia	-1,44520819		-2,09333333	31,96566034	2,28458901	60,1981894
2020	Saudi Arabia	-4,79246757		3,44545826	35,63296509	0,4726671	49,7134711
2021	Saudi Arabia	4,0567515	73,45	3,06328989	38,60573163	-0,12984747	57,5092764
2014	Turkiye	2,87623408	49,55	8,85457271	28,96746336	1,98593892	53,7663012
2015	Turkiye	4,04114037		7,67085365	28,19920217	1,94494215	51,0885436
2016	Turkiye	1,57183793		7,77513415	28,01960361	1,70945078	48,3281862
2017	Turkiye	6,10019676	63,76	11,1443111	30,6942181	1,31255286	55,7621688
2018	Turkiye	2,08515775		16,3324639	29,37704929	0,87263355	62,5543695
2019	Turkiye	-0,02812335		15,1768216	25,232545	0,80868323	62,688729
2020	Turkiye	1,14794399		12,2789575	31,54844136	0,78004842	60,955931
2021	Turkiye	10,5128804	67,63	19,5964927	31,87707675	0,75777149	70,8349232
2014	Palestine	-2,47102631	14,06	1,7329851	22,52871756	2,34407721	67,7398372
2015	Palestine	1,37258509		1,43161146	25,08803069	2,29048006	70,7809682
2016	Palestine	6,44666146		-0,21910661	25,25283342	2,24610528	65,4225142
2017	Palestine	-0,5776228	14,2	0,21257093	27,57254464	1,98868635	68,4486607
2018	Palestine	-1,30481419		-0,19510777	28,32655469	2,53301148	71,4012755
2019	Palestine	-1,15161367		1,58018334	26,80129571	2,51178246	68,9934923
2020	Palestine	-13,496387		-0,735332	24,30384311	2,48654994	67,2881913
2021	Palestine	4,41469535	20,99	1,23748103	25,45143299	2,45703865	73,0835496

Source: World bank development and global financial inclusion database

Figure A. 30: Dataset used for Sub Saharan Africa countries

Year	Country	GDP.P.Cap	DigitalPay	Inflation	Capital	Population	Trade
2014	Benin	3,290505	8,2	-0,54875755	19,25758563	2,92622898	65,2682749
2015	Benin	-1,18168484		0,21878592	20,73186635	2,95124912	56,7563132
2016	Benin	0,33585225		-0,79405017	20,2720396	2,94982814	58,9869283
2017	Benin	2,60355023	28,48	1,76941247	23,96042223	2,94632156	61,476597
2018	Benin	3,62426822		0,64480362	26,38651302	2,92239219	61,7951945
2019	Benin	3,82450757		-0,70502664	25,62980058	2,88707409	63,6813323
2020	Benin	0,95193786		3,0227212	25,63384351	2,82913811	44,8332334
2021	Benin	4,23870896	43,69	1,73353963	28,85061832	2,75970518	48,0548608
2014	Burkina Faso	1,26399639	8,49	-0,25808952	19,26224919	2,9797785	58,8235625
2015	Burkina Faso	0,87778561		0,72483898	19,40669972	2,97234561	59,0891813
2016	Burkina Faso	2,89349833		0,44104145	20,79554795	2,93481129	57,8931728
2017	Burkina Faso	3,20325684	38,92	1,48299897	22,06183659	2,86565542	59,2687802
2018	Burkina Faso	3,69351333		1,95594303	21,73910482	2,76868116	60,5956256
2019	Burkina Faso	2,86872815		-3,23338934	22,20834483	2,70387557	58,6641672
2020	Burkina Faso	-0,77384747		1,88443994		2,68878767	
2021	Burkina Faso	4,11014035	33,29	3,65353287		2,65037592	
2014	Cameroon	2,55890269	7,74	1,8548985	19,72783434	3,03550757	50,8323893
2015	Cameroon	2,39279742		2,67623531	18,24985549	3,14758225	45,5401468
2016	Cameroon	1,45423267		0,87419038	19,81805484	2,99217542	40,6386315
2017	Cameroon	0,64821263	28,58	0,64040915	19,4451374	2,8337981	39,1990216
2018	Cameroon	1,12179522		1,06885811	19,53802964	2,76373764	40,5876029
2019	Cameroon	0,6432232		2,45280214	18,9346455	2,77487978	43,3785133
2020	Cameroon	-2,42243442		2,43760882	17,66054398	2,71185366	33,7389805
2021	Cameroon	0,95358361	49,85	2,27185763	18,87378503	2,63581941	37,069877
2014	Cote d'Ivoire	6,86886133	29,76	0,44868208	22,62045583	2,31524275	53,6804176
2015	Cote d'Ivoire	4,46388996		1,25149955	23,38986251	2,58076729	52,7128647
2016	Cote d'Ivoire	4,44236106		0,72317846	23,19440176	2,58067581	47,5655784
2017	Cote d'Ivoire	4,66846126	38,32	0,68588107	20,81765869	2,5862543	48,6625075
2018	Cote d'Ivoire	2,1866085		0,35940903	22,2527905	2,56647493	46,0375087
2019	Cote d'Ivoire	3,85584194		-1,10686344	21,83370827	2,53128745	44,5274919
2020	Cote d'Ivoire	-0,78284147		2,42500657	19,76993931	2,5086182	41,1094568
2021	Cote d'Ivoire	4,40481596	47,66	4,0919519	21,36791897	2,45530301	45,1243456
2014	Ghana	0,40940095	25,6	15,489616	27,19768456	2,40764489	63,8365616
2015	Ghana	-0,26533292		17,1499695	27,83589299	2,36426976	76,5212713
2016	Ghana	0,98323158		17,4546347	25,71257535	2,33938326	67,8770002
2017	Ghana	5,73907811	49,47	12,3719216	20,59381644	2,23494543	70,5483646
2018	Ghana	3,96954738		7,80876517	22,64933551	2,12267977	67,9585184
2019	Ghana	4,30597775		7,14364003	19,66442168	2,08893118	76,8248018
2020	Ghana	-1,54163653		9,88728956	19,07206589	2,0662688	38,5168617
2021	Ghana	3,262282	65,57	9,97108868	18,55262436	2,00774487	58,4300136
2014	Kenya	2,63818993	69,44	6,87815499	24,950719	2,29417802	46,1704894
2015	Kenya	2,68331743		6,5821744	22,1033982	2,20032212	40,3273847
2016	Kenya	1,94366814		6,29715753	19,34843583	2,20214556	34,8650196
2017	Kenya	1,60314662	78,96	8,00572279	20,6634949	2,17570843	35,9950579
2018	Kenya	3,52208444		4,68981976	19,37598625	2,03273401	34,4147532
2019	Kenya	3,05495785		5,23585999	19,34183437	1,97845695	31,7594667
2020	Kenya	-2,2569795		5,40481467	19,65158977	2,00970011	27,2363494
2021	Kenya	5,5204363	77,56	6,11090916	20,39123813	1,94276128	30,6892819

Source: World bank development and global financial inclusion database

Figure A. 31: Dataset used for Sub Saharan Africa countries

Year	Country	GDP.P.Cap	DigitalPay	Inflation	Capital	Population	Trade
2014	Namibia	4,27191937	45	5,35016967	34,77655215	1,73094394	103,080137
2015	Namibia	2,45071098		3,39401538	30,5564401	1,75460038	97,2390318
2016	Namibia	-1,71633798		6,72858235	22,02994359	1,76502653	93,966188
2017	Namibia	-2,75101363	71,42	6,14579981	17,76649567	1,75699919	81,2196674
2018	Namibia	-0,66855427		4,29159105	14,91634798	1,72516455	81,7138668
2019	Namibia	-2,49939822		3,72239414	15,32911345	1,68846817	82,9011521
2020	Namibia	-9,66882124		2,20938237	13,92920268	1,72031062	76,9252424
2021	Namibia	1,84491722	66,37	3,6169053	17,44639967	1,63585889	82,0036034
2014	Senegal	3,37470117	11,92	-1,09025507	25,88078677	2,71905101	58,442529
2015	Senegal	3,50805419		0,13521193	25,83330875	2,72463609	58,1103377
2016	Senegal	3,50688919		0,83728494	25,36167303	2,71544296	54,1081692
2017	Senegal	4,52749063	39,52	1,31815315	29,81557434	2,71797784	57,7052799
2018	Senegal	3,3648216		0,46098564	32,64794094	2,71464328	61,7898395
2019	Senegal	1,82926307		1,76011151	31,96566034	2,69763116	64,2362506
2020	Senegal	-1,34214593		2,54314686	35,63296509	2,68438185	60,0468716
2021	Senegal	3,7582458	53,02	2,18032278	38,60573163	2,64538055	69,12483
2014	South Africa	-0,17222061	65,99	6,1298377	18,48796382	1,57629422	59,4995741
2015	South Africa	-0,75792811		4,54064228	18,63320666	2,07401686	56,7266761
2016	South Africa	-0,30917117		6,57139642	16,96045229	0,97200398	55,8612575
2017	South Africa	0,76694161	60,11	5,18424665	16,61073406	0,38727849	53,5359318
2018	South Africa	0,28573563		4,51716523	16,18844358	1,22553004	54,6277116
2019	South Africa	-0,98717524		4,12024587	15,85328499	1,29507386	54,0547664
2020	South Africa	-7,48109276		3,21003598	12,40005296	1,2231793	50,8009815
2021	South Africa	3,87031529	80,81	4,61167218	12,79752987	0,99892042	56,2179797
2014	Uganda	2,03158559	40,47	3,07570669	26,85345466	2,96898607	36,0144011
2015	Uganda	1,98592377		5,58968606	23,85979445	3,09130916	37,6892983
2016	Uganda	1,34418675		5,70637505	25,41528826	3,33499475	31,209362
2017	Uganda	-0,41223933	54,69	5,20971706	24,61404269	3,49646847	36,8370529
2018	Uganda	2,74903046		2,61601191	24,32859898	3,40127796	36,6384056
2019	Uganda	2,88570892		2,86758803	25,52946078	3,39509056	39,361054
2020	Uganda	-0,4233165		3,3133229	24,21595056	3,33280875	37,0006924
2021	Uganda	0,26440077	62,58	2,20457205	24,08636835	3,2114279	41,7136307

Source: World bank development and global financial inclusion database

Figure A. 32: Dataset used for emerging economies

Year	Country	GDP.P.Cap	DigitalPay	Inflation	Capital	Population	Trade
2014	Brazil	-0,3545148	58,99	6,32904016	20,54841077	0,85783483	24,6854058
2015	Brazil	-4,35831718		9,02990102	17,41162587	0,8459926	26,9536259
2016	Brazil	-4,057423		8,73914352	14,96954697	0,81125648	24,5336821
2017	Brazil	0,52329659	57,86	3,44637335	14,6255876	0,7922634	24,3197344
2018	Brazil	0,97893849		3,66485028	15,09504163	0,79376815	28,8762034
2019	Brazil	0,44828041		3,73297621	15,51679083	0,7661078	28,8902579
2020	Brazil	-3,91800417		3,21176804	16,11582061	0,66517668	32,3020785
2021	Brazil	4,43535282	76,52	8,30165976	19,42521195	0,52859045	38,1814267
2014	China	6,75076032	49,28	1,92164163	25,15809342	0,63032639	44,905216
2015	China	6,42073648		1,43702381	25,59943795	0,58145615	39,4641693
2016	China	6,23821545		2,00000182	23,70879029	0,57305091	36,894415
2017	China	6,3018631	66,59	1,593136	22,63666996	0,60524501	37,6324132
2018	China	6,25170056		2,0747904	24,20307842	0,46767205	37,5657841
2019	China	5,57531686		2,89923416	25,0235627	0,35474089	35,890096
2020	China	1,99555804		2,4194219	21,12528198	0,23804087	34,7542958
2021	China	8,35072972	86,19	0,98101514	24,44728162	0,0892522	37,3019902
2014	India	6,08618023	22,24	6,66565672	34,26780562	1,24036218	48,9221858
2015	India	6,72106763		4,90697344	32,11673014	1,18779532	41,9229139
2016	India	6,9809897		4,94821634	30,17269167	1,18504623	40,0824857
2017	India	5,56833351	28,69	3,32817338	30,98217576	1,15562449	40,742497
2018	India	5,30240868		3,93882647	32,34321821	1,08752772	43,6169693
2019	India	2,8118731		3,72950574	30,09619757	1,02531077	39,9054035
2020	India	-6,72629208		6,62343678	28,75229851	0,95522086	37,8041254
2021	India	8,18436772	34,93	5,13140747	31,22549825	0,79721609	45,6676832
2014	Indonesia	3,79614077	23,31	6,39492541	34,60034391	1,15950664	48,0801756
2015	Indonesia	3,71774547		6,36312113	34,06279218	1,11085493	41,9376402
2016	Indonesia	3,92669809		3,52580516	33,8587393	1,05894206	37,4213418
2017	Indonesia	4,01762561	34,61	3,80879807	33,7105948	1,00643952	39,3554971
2018	Indonesia	4,16298429		3,19834642	34,57058583	0,96620644	43,074309
2019	Indonesia	4,03913566		3,03058665	33,78014238	0,93768927	37,6277775
2020	Indonesia	-2,88509409		1,92096801	32,34341205	0,84038927	32,9721754
2021	Indonesia	2,98510863	37,19	1,56012991	31,44898475	0,69471769	40,1977513
2014	Malaysia	4,37313596	62,6	3,14299051	24,97760843	1,55301827	138,312231
2015	Malaysia	3,52753444		2,1043898	25,42426328	1,49940972	131,370072
2016	Malaysia	2,93376225		2,0905666	25,995512	1,46206987	126,89901
2017	Malaysia	4,32563034	70,42	3,87120116	25,54734345	1,41536933	133,155173
2018	Malaysia	3,47276671		0,88470916	23,89741996	1,31563682	130,402626
2019	Malaysia	3,12489613		0,66289187	21,04824039	1,24151463	123,028562
2020	Malaysia	-6,66111665		-1,13870215	19,69906116	1,19985962	116,828586
2021	Malaysia	1,94412111	79,3	2,47710242	22,27126592	1,11985399	130,569851
2014	Russian Fede	-1,04526204	57,72	7,82341184	29,01799576	0,21764226	47,8013413
2015	Russian Fede	-2,18388547		15,5344051	34,22350468	0,19255795	49,3593493
2016	Russian Fede	0,01024792		7,04244763	30,89756125	0,17024524	46,5181198
2017	Russian Fede	1,70938569	70,52	3,68332944	28,79613112	0,10687057	46,8765243
2018	Russian Fede	2,81552411		2,87829724	26,12305754	-0,01306689	51,5809004
2019	Russian Fede	2,24397952		4,47036661	28,2955639	-0,04956867	49,2287537
2020	Russian Fede	-2,46115142		3,38165937	27,69150098	-0,23095039	45,9669082
2021	Russian Fede	5,17723487	87,42	6,69445892	25,12810288	-0,43395153	50,5577442

Source: World bank development and global financial inclusion database

Figure A. 33: Dataset used for South America and Eastern Europe countries

Year	Country	GDP.P.Cap	DigitalPay	Inflation	Capital	Population	Trade
2014	Bulgaria	1,54238792	51,76	-1,4181838	21,50716609	-0,56838926	130,28729
2015	Bulgaria	4,09010769		-0,10463326	20,99328062	-0,63806947	126,700942
2016	Bulgaria	3,76506856		-0,79864989	18,95427187	-0,7013821	122,833824
2017	Bulgaria	3,51553834	64,92	2,06159619	19,80587409	-0,73044318	129,676597
2018	Bulgaria	3,42891057		2,81454474	21,21425937	-0,72208041	128,851659
2019	Bulgaria	4,77305607		3,10372945	20,99774981	-0,70390564	124,6396
2020	Bulgaria	-3,38040072		1,67244097	20,33566723	-0,60024152	110,28183
2021	Bulgaria	8,51524959	75,23	3,29774435	21,07423708	-0,81484647	120,974081
2014	Chile	0,77292782	54,65	4,71867528	45,82395276	1,00681496	65,6346281
2015	Chile	1,10575838		4,34877353	43,23480666	1,02942555	59,3491105
2016	Chile	0,55029786		3,78619356	42,63137693	1,18906103	56,0578611
2017	Chile	-0,21326645	65,38	2,18271847	43,01329739	1,56205546	56,026159
2018	Chile	2,13907818		2,43488981	43,79347517	1,7959628	58,1770506
2019	Chile	-1,04550574		2,55754476	43,25110564	1,79139197	57,5468575
2020	Chile	-7,41362695		3,04549085	43,36667433	1,36064363	58,133427
2021	Chile	10,6318812	84,29	4,52456838	43,14029827	0,9943449	64,7216247
2014	Colombia	3,51395348	32,64	2,89883788	24,00331366	0,94713692	37,4874656
2015	Colombia	1,99061649		4,98983116	23,77369229	0,94199407	38,3607641
2016	Colombia	1,00227273		7,51346025	23,16741956	1,06861189	36,202653
2017	Colombia	-0,16195388	37,33	4,31431326	21,59937684	1,51228961	35,2829149
2018	Colombia	0,63843962		3,24056933	21,19547556	1,89558675	36,5347528
2019	Colombia	1,31495238		3,52301933	21,38060955	1,83074694	37,558534
2020	Colombia	-8,60581153		2,526635	19,07366834	1,47010203	34,1314689
2021	Colombia	9,75360149	52,11	3,49505757	18,96936573	1,14382092	40,2455672
2014	Honduras	1,17043068	23,1	6,1292493	22,18383223	1,84861911	112,975097
2015	Honduras	1,97813209		3,15783118	25,11800475	1,80936241	107,264405
2016	Honduras	2,06683935		2,72461223	23,37712854	1,77333694	99,815717
2017	Honduras	3,03458084	37,2	3,93436084	24,82071317	1,73985038	101,813111
2018	Honduras	2,08461859		4,34734938	26,57208628	1,70972891	103,551162
2019	Honduras	0,94219711		4,3658716	22,73109068	1,68069669	98,0275897
2020	Honduras	-10,4301902		3,46841178	18,83460331	1,62283638	85,6194181
2021	Honduras	10,8197331	31,64	4,48087963	23,99475127	1,53513967	100,380676
2014	Hungary	4,51336777	66,87	-0,22756627	24,05550825	-0,26937877	168,394597
2015	Hungary	3,95428261		-0,06164468	23,51230922	-0,237855	167,320445
2016	Hungary	2,50305336		0,39476931	21,54856236	-0,29511061	164,403928
2017	Hungary	4,5495633	71,46	2,34824281	23,10324924	-0,26586093	165,228516
2018	Hungary	5,49601879		2,85024793	26,80919572	-0,12678695	163,260512
2019	Hungary	4,91169353		3,33858635	28,39293725	-0,04525571	160,751343
2020	Hungary	-4,33001657		3,32674386	27,25039396	-0,21506784	155,483815
2021	Hungary	7,64446029	86,37	5,11096534	30,60990717	-0,41375102	160,199677
2014	Peru	1,31920126	22,63	3,4119458	24,66612051	1,04365113	46,8531211
2015	Peru	2,04895673		3,39809195	24,30511436	1,17223066	45,1627687
2016	Peru	2,54786708		3,55717664	22,02131339	1,36122544	45,3888412
2017	Peru	0,98551394	33,9	2,99490046	20,71181371	1,50694619	47,5135504
2018	Peru	2,03724979		1,50915423	21,31117514	1,87582164	48,6314702
2019	Peru	0,30664197		2,25212191	20,83363955	1,90972561	46,9435054
2020	Peru	-12,1539383		2,00241206	18,37842433	1,4514024	43,8346829
2021	Peru	12,035901	49,14	4,27166382	21,88011505	1,22566025	55,9695398

Source: World bank development and global financial inclusion database

Figure A. 34: Dataset used for Central and East Asian countries

Year	Country	GDP.P.Cap	DigitalPay	Inflation	Capital	Population	Trade
2014	Bangladesh	4,74777923	7,68	6,99163889	28,57787571	1,24596021	44,5140802
2015	Bangladesh	5,29106081		6,19428023	28,88668925	1,19106113	42,0859963
2016	Bangladesh	5,8032104		5,51352573	30,23976392	1,23079535	31,3341501
2017	Bangladesh	5,26645511	34,11	5,70207016	30,94687312	1,24972407	29,9997307
2018	Bangladesh	6,08023777		5,5436214	31,82257477	1,16137846	32,5146317
2019	Bangladesh	6,6876544		5,5919964	32,21372984	1,11317249	31,5780513
2020	Bangladesh	2,27110928		5,69107475	31,30794134	1,14420974	26,2714474
2021	Bangladesh	5,71664909	45,26	5,54565431	31,01873874	1,14931848	27,7240047
2014	Kazakhstan	2,67672093	46,74	6,70657829	25,79024724	1,47267087	64,9720347
2015	Kazakhstan	-0,26826712		6,66577612	27,9079156	1,46148469	53,0497288
2016	Kazakhstan	-0,32751463		14,5460238	27,82758289	1,42204614	60,3115966
2017	Kazakhstan	2,69343213	53,87	7,44000437	26,35248253	1,36038127	56,8253879
2018	Kazakhstan	2,74053638		6,01913097	25,25821271	1,31452299	63,5279565
2019	Kazakhstan	3,16101154		5,2454768	27,62757495	1,28960849	64,8586166
2020	Kazakhstan	-3,75798345		6,77154583	28,80691536	1,29863533	57,0264424
2021	Kazakhstan	2,95338136	77,93	8,04232063	26,1780161	1,29950844	57,5439013
2014	Mongolia	5,741884	72,27	12,2539808	35,17529764	2,00668671	109,322312
2015	Mongolia	0,24138371		5,73568282	24,51384852	2,11086628	89,6536635
2016	Mongolia	-0,68120993		0,73327223	22,62940994	2,16233695	101,055237
2017	Mongolia	3,36874224	85,27	4,30143105	27,4062543	2,17049016	115,932902
2018	Mongolia	5,43057257		6,8242479	39,37792751	2,17135598	126,355873
2019	Mongolia	3,36636843		7,30106954	35,59184516	2,1399971	124,396515
2020	Mongolia	-6,3512406		3,79604026	22,38359767	1,89701503	112,838648
2021	Mongolia	0,01414886	97,41	7,35281243	36,71902957	1,60937104	119,098078
2014	Philippines	4,64233603	21,36	3,59782344	20,92397044	1,6168406	57,4681721
2015	Philippines	4,58721825		0,67419254	21,34094787	1,66983002	59,1415921
2016	Philippines	5,26557127		1,2536988	24,6185031	1,77382447	61,7760658
2017	Philippines	5,06439325	25,09	2,85318773	25,55877386	1,76102262	68,1683697
2018	Philippines	4,54870092		5,30934662	27,15058204	1,70024777	72,1633983
2019	Philippines	4,37652555		2,39206534	26,40180846	1,65518369	68,8418423
2020	Philippines	-10,9781941		2,39316239	17,43337903	1,62663291	58,1695603
2021	Philippines	4,14651417	43,45	3,92718022	21,14073715	1,49455717	63,4846105

Source: World bank development and global financial inclusion database