Standing Committee
for Economic and Commercial Cooperation
of the Organization of Islamic Cooperation (COMCEC)

COMCEC

Improving Cooperation among Central Banks in terms of Digital Currencies: Challenges and Prospects for OIC Member Countries

COMCEC COORDINATION OFFICE

October 2023

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Ankara, Türkiye

October, 2023

This report has been commissioned by the COMCEC Coordination Office and prepared by an academic team coordinated by Prof. Dr. Mehmet Babacan. The academic team includes Prof. Dr. Ahmet Faruk Aysan, Assoc. Prof. Mustafa Disli, Dr. Umar A. Oseni, Dr. Adam (Ruslan) Nagayev, Prof. Dr. Serhat Yüksel, Prof. Dr. Hasan Dinçer, Dr. Irum Saba, Khalid A. Ansari (PhD candidate) as well as research assistants Hassnian Ali (technical director), M. Fazlur Syarif and Jamila Abubakar. The project team extends its gratitude to Mr. Adam Zaitov, IT Professional and expert for his invaluable contribution to the report. The team also thanks the Standing Committee for Economic and Commercial Cooperation (COMCEC) of the OIC for providing the necessary means for the research and Mr. Can Aygül, Mrs. Seyyide Ravza Çoksöyler from COMCEC Coordination Office in specific, for their kindness and support throughout the process.

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LIST OF ABBREVIATIONS

AML/CFT	:	Anti-Money Laundering/Combating the Financing of Terrorism
AMM	:	Automated Market Maker
ASEAN	:	Association of Southeast Asian Nations
BI	:	Bank Indonesia
BIS	:	Bank for International Settlements
BNM	:	Bank Negara Malaysia
BOK	:	Bank of Korea
BVN	:	Bank Verification Number
CBDC	:	Central Bank Digital Currency
CBN	:	Central Bank of Nigeria
DEA	:	Digital Economy Agreement
DeFi	:	Decentralized Finance
DCGI	:	Digital Currency Global Initiative
DLT	:	Distributed Ledger Technology
EMDE	:	Emerging Market and Developing Economy
FAST	:	Fast and Secure Transfers
FX	:	Foreign Exchange
GCC	:	Gulf Cooperation Council
IFDI	:	Islamic Finance Development Indicator
ILF	:	Intraday Liquidity Facility
MAS	:	Monetary Authority Singapore
NBS	:	Nigeria Bureau of Statistics
NIN	:	National Identification Number
OIFI	:	Other Islamic Financial Institutions

OIC	:	Organization for Islamic Cooperation
QAR	:	Qatari Riyal
QCB	:	Qatar Central Bank
QMP	:	Qatar Mobile Payment
QNV	:	Qatar National Vision
QPS	:	Qatar Payment System
PBM	:	Purpose Bound Money
PBOC	:	People's Bank of China
PoC	:	Proof of Concept
r-CBDC	:	Retail Central Bank Digital Currency
RTGS	:	Real Time Gross Settlement System
SANEF	:	Shared Agent Network Facility
SCS	:	Single-Currency Stablecoin
SGX	:	Singapore Stock Exchange
SGD	:	Singapore Dollar
SGQR	:	Singapore Quick Response Code
SFF	:	Singapore FinTech Festival
UNCITRAL	:	United Nations Commission on International Trade Law
USSD	:	Unstructured Supplementary Service Data
w-CBDC	:	Wholesale Central Bank Digital Currency

EXECUTIVE SUMMARY

As digitalization in financial services has gained a significant momentum in the aftermath of 2008 great financial crisis, several attempts are made to improve efficiency through lower transaction costs as well as granting secure and reliable infrastructure for introduction of new means of payment and even digital form of currencies. Several digital coins have been introduced since then as the central banks across the world struggled to cope with this new transformant process. Development of the central bank digital currencies (CBDCs), a virtual money backed and issued by a central bank, increased its pace and several countries issued theirs one by one. Along with a few advanced countries and international institutions such as the Bank for International Settlements (BIS), emerging markets such as China, Russia and Nigeria have become pioneers in the field. According to Atlantic Council's CBDC tracker, there are now 130 countries corresponding to 98% of the world's GDP that explore the CBDCs. Among the G20 countries, 19 of them are already engaged in developing and some even adopting digital currencies. So far, 11 countries have launched a digital currency while there are 12 ongoing cross-border wholesale CBDC projects. Among such initiatives, Organization of Islamic Cooperation (OIC) countries lack a cross-border project -other than United Arab Emirates (UAE) and Saudi Arabia's Project Aber and this study explores the chances of joint efforts among OIC countries. Also highlighted in the report are the individual country cases' strengths and weaknesses so that lessons to be derived for other OIC member countries at large.

RESEARCH OBJECTIVES: Main objectives of this study therefore are to provide an analysis and elaboration on (i) digital currencies, ii) the current initiatives in different jurisdictions on CBDCs, with a particular focus on the initiatives in OIC member countries, iii) the roles and responsibilities among government institutions for introducing and regulating digital currencies, iv) the challenges and prospects of digital currencies for OIC member countries. Based on the analysis of the framework, the study also provides concrete policy recommendations to the OIC Member countries, particularly considering the lessons learnt from the existing practices and the case studies within the framework of this report. This study is prepared for the members of the COMCEC Financial Working Group, and the findings and policy advice are presented for their consideration.

SCOPE OF THE STUDY: This study provides policy recommendations for improving cooperation among central banks of OIC member countries in terms of digital currencies and conducts an in-depth analysis of challenges and prospects brought by digital currencies. Based

on the findings, the study proposes concrete policy recommendations to OIC Member countries, particularly considering the lessons learnt from the best practices to be analyzed and the case studies to be conducted within the framework of this report. After drawing lessons from individual and cross-border CBDC projects, chances and factors needed to run cross-border CBDC projects among OIC member countries are shortly discussed.

METHODOLOGY: Addressing the research objectives, the study undertakes a comprehensive literature review (reports, books, articles, regulations, etc.) and gather primary data using a survey and expert interview. Descriptive and/or empirical analysis are applied to the data collected, and the findings are reported accordingly. The case study countries are selected based on the geographical distribution, legal origin and level of digital currency development.

KEY FINDINGS: The study has provided concise, systematic, and viable policy recommendations to the OIC Member countries for improving cooperation among central banks in terms of development and adoption of digital currencies. The findings and recommendations are considered to be beneficial to policymakers of the OIC and non-OIC member countries, the international community, as well as international organizations. Based on the findings, the key factors affecting the performance of digital currency development and implementation along with possible reasons of failure are identified. Hence, effective strategies are recommended to the policy makers of the selected countries as well as the OIC representatives at large. Additionally, the study refers to the most successful among the selected countries in developing and adapting digital currencies.

Overall Policy Recommendations for the OIC Countries on CBDCs

#1 Establishing a Project Management/Steering Committee and Identifying the Objectives and Use Cases for CBDCs in Consultation with a Wide Range of Relevant Stakeholders (government bodies, financial institutions, universities, think tanks, civil society organizations etc.) to Build a Digital Ecosystem that is interoperable with Existing Payment System(s), Increase Financial Inclusion and Improve Monetary Policy Transmission

#2 Developing Legal Framework and Regulatory Compliance / Regulatory Approval and Oversight for Ensuring Legal Clarity, Risk Management, Consumer Protection and Central Bank's Role

#3 Setting-up a Dedicated Task Force including Central Bank Specialists to Identify the Right Technology Stack for the CBDCs (i.e. for providing security, efficiency, scalability, interoperability etc.)

#4 Designing and Developing of CBDCs with Extensive Testing and Pilot Studies by Central Banks in Consultation with Technology Experts and Relevant Stakeholders

#5 Developing Policies/Strategies/Programs for Ensuring Security and Privacy in order to Protect User Data and Transactions, and to Balance Privacy and Legal Requirements

#6 Facilitating the Access of the Public to the CBDCs through User-Friendly Distribution Channels in Collaboration with Financial Institutions

#7 Enhancing monetary transmission mechanism, Improving Monetary Policy Effectiveness and Financial Stability through the CBDCs

#8 Developing a Comprehensive Public Relations and Communication Strategy (i.e. Mobile Applications) to Enhance User Capacities and Raise Awareness about CBDC Usage, Benefits, and Security

#9 Developing/Improving Sound Monitoring and Maintenance Mechanisms for Gathering Insights about the CBDC's Performance

#10 Promoting Cross-Border CBDC Utilization by Enhancing International Cooperation between Central Banks and International Organizations through Standards and Protocols

It is evident that there are recurring focuses on infrastructure, regulation, cross-border collaboration, fintech ecosystem development, and trade across the different sets of recommendations provided.

CHAPTER I: INTRODUCTION

The given chapter provides an overview of the subject matter presented, including its aim, scope, and significance. The chapter outlines the methodology and conceptual framework employed and provides definitions of key terms. A concise summary of the remaining chapters included in the report is also presented.

1.1. Background of the Study

Economic change could be attributed to a wide array of developments in human life. A general review of the existing literature discusses the impact of geography (i.e. trade), culture, institutions and other factors that shape human behavior and incentives. The role of finance however has been one of the most profound among others while the creation of central banks paved the way to effectively conduct payment services, oversee the bank transfers of money, act as the lender of the last resort and facilitate other intermediary transactions. Yet the central banks have the upper hand as the sole authority to print the national currencies and regulate the monetary and financial markets. Rapid transformation in the type of financial transactions and complexity of today's needs have given birth to new forms of payment services and even monetary forms.

A taxonomy of money based on i) the technical form of money and ii) the issuer could be made in three folds. As Huber (2023) suggests, money still exists in the form of coins, notes and reserves circulated by the central bank could be referred as its base-level (i.e. the central bank money). This approach considers the central bank digital currencies (CBDCs) based on its issuer as the base level money as well. Among the second-tier based on central bank money are the liquid bank money as well as deactivated bank money. A third-tier based on bank money consists of money market fund shares (MMFs), e-money, stablecoins and other complementary currencies. The rise of new means of payment since early 1980s especially in the form of MMFs, e-monies and stablecoins have transformed the two-tier monetary system into a three-tier system which is widely based on bank money (Huber, 2023; pp. 19-20). A similar taxonomy by the Federal Reserve Bank of the US refers to central bank money, commercial bank money and nonbank money all having a digital form (FED, 2022; p. 5).

After the emergence of e-money in 1990s which became legally regulated by 2000s, the digitalization pace led the mobile applications or internet backed platforms other than conventional banks gain momentum. Companies such as PayPal or Amazon Payments were

among others that claimed considerable market share in digital payments. The e-money regulation requires 100% coverage for the banks or money institutions (a 1:1 basis against the bank money) while its widespread coverage through mobile communication technologies lowered down the transaction costs for many that live in Africa and other developing world that lags far behind their advanced peers in terms of financial inclusion. Conventional banks would not provide such a low-cost service for their customers in such countries given the limited access to finance on behalf of their potential customers due to high costs. E-money particularly has become the most common mode of payment system in Kenya, Zimbabwe, Zambia, Uganda and Rwanda in the African continent.

With the introduction of stablecoins, which are a form of cryptocurrencies, and issued against the bank money and exchange for the other digital tokens (i.e. Bitcoin), both on the technology and financial/social trust grounds the central banks and governments' authorities have become questioned. Therefore, it sparked a wide range of discussions among technocrats, policy makers and regulators as well as market players. The financial technologies associated with the coins such as blockchain also triggered a new race for digital innovation in finance and even other industries.

The CBDCs provide an alternative based on central bank money against the rising decentralized finance and its instruments especially after the great financial crisis of 2008. The modern monetary system evolves into its fourth transformation period suggested by many scholars such as Galbraith (1975), Aliber & Kindleberger (2015) and Skidelsky (2018). First period of change in monetary history took place between late 17th century and 1840s where the sovereign coin was in decline and unregulated paper money were on the rise. Within the second wave of change between 1840s until early 20th century, the central bank regulated monetary system emerged, which was followed by almost a century long period as the third wave of change where it was the bank money on the rise this time against the falling tide for central bank notes and reserves (Huber, 2023; p. 64). The most recent transformation which marks the fourth wave of change in finance came in the form of decentralized coins and altcoins as well as non-bank financial intermediaries' greater role within the first quarter of the 21st century.

Instead of issuing banknotes in their physical form, an increase in cashless transactions has been on the agenda of advanced countries for a long time. Aftermath of the 2008 financial crisis especially catalyzed by the 2019 Coronavirus pandemic witnessed the rise of digital money (i.e. tokens) as well the CBDCs. While the COVID-19 pandemic has accelerated this process of

digitalization, developments in cryptocurrencies in various forms of coins have made it more comprehensive and yet complex, opening new directions for central banks. Unlike cryptocurrencies, the existence of a central authority behind digital currencies allows them to move on more solid ground. In this period especially within the developing and emerging market economies, there has been a rapid pace of decentralized financialization of masses. Now the stablecoins and altcoins constitute a visible part of the total digital money where they stand as exchanges for traditional bank money in various forms.

The emergence of the cryptocurrencies as digital and virtual forms of money since the great financial crisis of 2008 and their widespread transaction across the world therefore occupies the agenda of an entire global financial system. Innovative features of cryptocurrencies, such as the blockchain system and its independence from a central authority caused not only investors but also government authorities to turn eye into such developments. Although the initial approach to cryptocurrencies was skeptical and more focusing on the risks that might arise, opportunities offered by such technological developments for the digitalization of money have come to the fore in recent years. The latest wave of bankruptcies in crypto exchange platforms and the significant price fluctuations in cryptocurrencies justified these concerns around security, operability, scalability and stability of the financial system; but opportunities are also taking shape in the digitalization of government-backed currencies. As a new form of fiat currencies, CBDCs are the outcome of the interest of the government authorities in these developments.

Currently, some 130 countries are exploring CBDCs, and 64 are in an advanced exploration phase (development, pilot, or launch).[1] Many governments have made progress, and some have fully introduced their own digital currencies, such as the Bahamas launched Sand Dollar in 2020, retail and token type CBDC issued by the Central Bank of Bahamas.[2] The steps in leading economies such as the US could become a turning point and make further steps towards this direction as the Federal Reserve Bank of New York launched a pilot program on the digital US dollar in November 2022.[3] However, since it is a new playing field, there are many aspects that countries could learn from each other. Apart from opportunities such as lowering costs in cross-border transactions and increasing financial inclusion that retail and wholesale CBDCs might

[1] https://www.atlanticcouncil.org/cbdctracker/
[2] https://cbdctracker.org/currency/bahamas-sand_dollar
[3] https://www.newyorkfed.org/newsevents/news/financial-services-and-infrastructure/2022/20221115

bring, various issues including stability of the financial system and cyber securities, need to be carefully addressed.

With their potential benefits and challenges, the newly rising CBDCs among the Organization of Islamic Countries (OIC) members are the focus of this study where they are discussed at a comprehensive perspective. From the technological breakthrough and potential driving force of financial innovation perspective to interoperability questions as well as regulatory and legal issues they may face, the CBDC experiences of the selected OIC countries are expected to provide an intuition for individuals, policy makers, academics, businesses and financial institutions.

Table 1 : Level of CBDC development in OIC region

CBDC Stage	**Country**
Launched	Nigeria (October 2021)
Pilot & Proof of Concept	Iran (September 2022), Kazakhstan (June 2021), Malaysia (2022), Saudi Arabia (January 2023), Tunisia (July 2021), Turkiye (December 2022), UAE (October 2022)
Development	Bahrain, Indonesia
Research	Algeria, Azerbaijan, Bangladesh, Cameroon, Chad, Egypt, Gabon, Jordan, Mauritania, Morocco, Oman, Pakistan, Qatar, Uganda
Inactive	Benin, Lebanon, Palestine, Kuwait

Source: Atlantic Council (n.d.)

Note: *Dates in parentheses for relevant countries mark the piloting stage accomplished.*

Some OIC member countries have already taken initiatives in CDBCs. However, it is seen that there is a significant difference between them in terms of progress and interest. In other words, while some countries take proactive steps by passing the pilot phase in digital currencies, such as Nigeria and the UAE, some are in the initial research phase or have not yet put it on their agenda. Therefore, there is a need to establish a knowledge of digital currencies within the OIC and to transfer the experience gained so far. Such an effort may also pave the way for increased commercial and economic cooperation between Islamic countries.

Currently the UAE, Malaysia and Saudi Arabia among the OIC members that are engaged in cross-border CBDC development projects. This study under given circumstances seeks to examine development stages of digital currencies and improve collaboration among central banks of OIC member countries. Also, the study aims to present challenges and prospects for

OIC countries in detail through an analytical and comprehensive approach. The research results provide an elaboration on and analysis of the recent global and local initiatives and issues on digital currencies. Furthermore, the study provides policy recommendations to OIC Member Countries to facilitate further cooperation among OIC member countries.

1.2. Aim and Scope of the Study

The main objectives of this study are to provide an analysis and elaboration on (i) digital currencies, ii) the current initiatives in different jurisdictions on CBDCs, with a particular focus on the initiatives in OIC member countries, iii) the roles and responsibilities among government institutions for introducing and regulating digital currencies, iv) the challenges and prospects of digital currencies for OIC member countries. This study is prepared for the members of the COMCEC Financial Working Group, and the findings and policy advice are presented for their consideration.

It provides policy recommendations for improving cooperation among central banks of OIC member countries in terms of digital currencies and conducts an in-depth analysis of challenges and prospects brought by digital currencies. Based on the findings, the study proposes concrete policy recommendations to OIC Member countries, particularly considering the lessons learnt from the best practices to be analyzed and the case studies to be conducted within the framework of this report.

Therefore, primary objectives of this study encompass a comprehensive analysis of digital currencies, an exploration of ongoing CBDC initiatives across different jurisdictions, with a specific emphasis on those within OIC member nations, an examination of the roles and responsibilities of government institutions regarding the introduction and regulation of digital currencies, and an evaluation of the challenges and opportunities posed by digital currencies for OIC member states. Additionally, this research aims to provide concrete policy recommendations to OIC member countries, drawing insights from the analyzed practices and case studies within this report. The ultimate recipients of these recommendations are the esteemed members of the COMCEC Financial Working Group, who will consider the findings and policy guidance presented herein.

This study offers a set of policy recommendations designed to enhance collaboration among the central banks of OIC member nations concerning digital currencies. It also conducts a detailed analysis of the complexities and potential benefits associated with digital currencies.

Drawing from these insights, the study proposes specific policy recommendations to OIC member countries, guided by lessons gleaned from the examination of best practices and case studies featured in this report.

1.3. Significance of the Study

The study aims to provide concise, systematic, and viable policy recommendations to the OIC Member countries for improving cooperation among central banks in terms of digital currencies. The findings and recommendations are expected to be beneficial to policymakers of the OIC and non-OIC member countries, the international community, as well as international organizations. Based on the findings, the key factors affecting the performance of digital currency development and possible cooperation among the OIC member countries are identified. Hence, effective strategies are recommended to the policy makers of the selected countries. Additionally, the study reflects on which of the selected countries have become more successful in developing digital currencies.

In sum, economic and financial ecosystem that is fostered by the central banks and changes in monetary systems are discussed to have a proper understanding of the rise of the CBDCs. Furthermore, the policy issues alongside the technical ones are important to address in order to learn about the potential benefits and challenges of the CBDCs. The social and economic implication of the CBDC implementation is important to underline. Finally, the lessons for the OIC member countries especially on the policy-making grounds would be drawn.

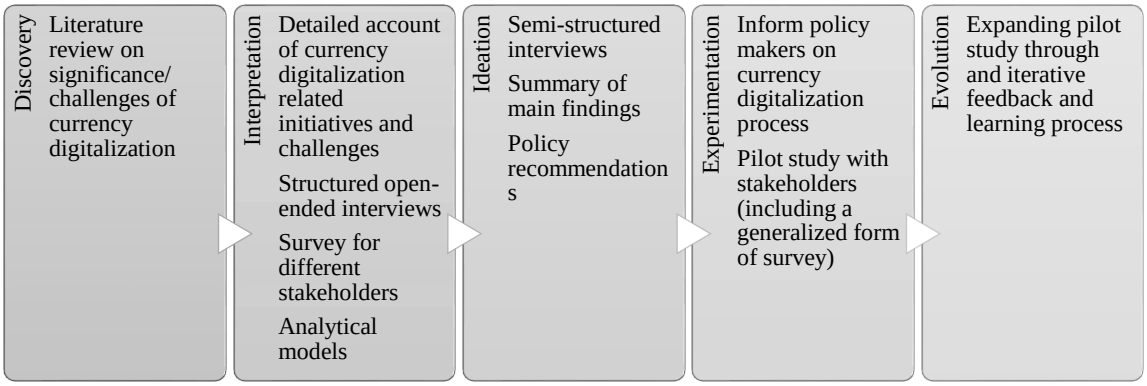
The overarching goal of this study is therefore to furnish concise, structured, and viable policy recommendations to OIC member countries for the enhancement of cooperation among their central banks regarding digital currencies. The findings and recommendations generated are expected to serve as valuable resources for policymakers within both OIC and non-OIC member countries, the international community, and international organizations. The study's insights are to facilitate the identification of key factors influencing digital currency performance and enable the formulation of effective strategies for policymakers in the selected countries.

1.4. Research Methodology

The study follows a design thinking approach. As an implicit activity to view, shape, and construct a better understanding of a problem throughout the process of solving it, the design thinking can assist in finding hidden issues and problems and finally assist in finding creative

and synthetic solutions to the problem. This is accomplished by following five defined phases of design thinking – *discovery, interpretation, ideation, experimentation,* and *evolution* – to translate observations into feasible and successful solutions (see *Figure 1* below).

Figure 1: Design thinking process



In the *discovery phase*, a comprehensive literature survey is conducted to provide a theoretical basis for currency digitalization and to explain its significance and challenges. *Next*, during the *interpretation phase*, the study identifies an original way through its employed research methodology to approach the digitalization-related issues and initiatives on local, regional, and global scales.

Findings from the literature complemented by data collected from stakeholders through structured closed-ended questions and open-ended expert interviews and this mainly via the internet to overcome the geographical barriers (see Appendix – Table 8 for survey questions).

The survey is prepared in accordance with the study's purpose to obtain fundamental information about the expertise, experience, attitudes, and opinions of researchers including academicians, regulators, private sector representatives and even students of this field. Based on the primary data collected through the survey process and semi-structured interviews, the most pressing issues and concerns that improve the cooperation among central banks in terms of digital currencies are spotted.

The output from the previous phases serve as the input for the *ideation phase*. In this phase, semi-structured interviews are conducted with experts from various segments, including financial institutions, regulators, and international bodies (see Appendix - Table 9 for the

interview protocol). The in-depth insights derived from these interviews also help relevant parties to have a better understanding of the coordination practices of selected case countries.

To address the research objectives, this study adopts a multifaceted approach. It involves an extensive literature review encompassing reports, publications, articles, and regulatory documents. Additionally, primary data have been collected through surveys and expert interviews. The data gathered is subject to a detailed descriptive and/or empirical analysis, and the resulting findings are meticulously reported in chapter 4. The selection of case study countries has been contingent upon various factors, including geographical diversity, legal framework, and the level of digital currency development.

Case Country Selection Criteria

The study applies three criteria in selection of case countries (see *Table 2: List of Selection Criteria2* below): *firstly*, four case countries must represent the OIC members, in addition to a non-OIC country; *secondly*, represent different geographic regions; and, *finally*, represent different levels of financial sector development.

The first and second criteria are applied based on the list of countries provided by COMCEC[4]. Furthermore, the third criterion is met by referring to Thomson Reuters' Islamic Finance Development Indicators (IFDI)[5] obtained from Refinitiv Eikon database.

Table 2: List of Selection Criteria

Criteria	Description	Approach
I	4 OIC member countries and 1 non-OIC country	COMCEC List
II	Geographic groups: African, Arab, and Asian	COMCEC List
III	Maturity of Islamic finance industry	IFDI

Note: *IFDI is the Islamic Finance Development Indicator provided by Thomson Reuters.*

[4] See "*Annex 1 of ToR: The Official 3 Regional Groups of the OIC Member States*"; as well as COMCEC website: https://www.comcec.org/member-states/

[5] Refinitiv Islamic finance development indicator (IFDI) is a composite weighted index that measures the overall development and health of the Islamic finance industry. It draws on five indicators that are the main drivers of development in the industry: Quantitative Development, Knowledge, Governance, Corporate Social Responsibility, and Awareness. By measuring changes in these indicators over time and across different countries, the IFDI provides a vital tool in guiding policy within the industry. The IFDI also gives an indication of the strength of the ecosystem behind the industry's overall development as well as the size and growth of the different Islamic finance sectors within the many countries where it has a presence.

Table 7 (Appendix) ranks 52 OIC Member countries based on their level of Islamic financial sector development.[6] We focus on the first 25 jurisdictions since they have significant contribution to the global Islamic finance industry. Based on this list, the pioneering five markets are Malaysia, Indonesia, Saudi Arabia, Bahrain, and the United Arab Emirates. The middle position is taken by Oman, Maldives, Qatar, Brunei, Nigeria, Bangladesh, and Türkiye, whereas the least development is seen in the following five economies: Egypt, Yemen, Gambia, Morocco, and Kazakhstan. Among the non-OIC countries, Singapore and the United Kingdom are the top performers. While selecting the case study countries, the following issues are mainly taken into consideration.

(i) geographical distributions of the selected countries,

(ii) legal systems of the countries,

(iii) level of development of the digital currencies.

While considering these issues, following countries are selected in this project for the evaluation.

1) Indonesia: Asia
2) Nigeria: Africa
3) Pakistan: Asia
4) Qatar: Arab
5) Singapore: Non-OIC

The selected five case study countries have different geographical distributions (Far East, Middle East, Africa etc.). This situation could be regarded as one of the main contributions of this project to provide suggestions in a comparative manner over the use of a digital currency system. Similarly, these countries have also different legal origins, such as Civil Law, Sharia Law, Common Law. The diversity of the legal systems for these selected countries also gives information about the quality of the sample country selection.

Finally, the field studies pose additional challenges other than geographical differences, legal and regulatory environment or technical infrastructure differences. For many of the case studies, particularly in Nigeria and Singapore, the central banking authorities have been either reluctant or they have withdrawn from their initial commitments to conduct in-depth interviews. The study however utilized the most available sources to conduct the research, including central bank experts, other regulatory officials as well as academicians and industry

[6] Note that non-OIC countries have been removed from the list.

professionals. Meantime, our study has considered the sensitivities of the respondents and related institutions to remain anonymous.

1.5. Overview of the Study

As a general overview, the report is organized as follows:

i. **Introduction**: This chapter provides an overview of the subject matter presented, including its aim, scope, and significance. The chapter outlines the methodology and conceptual framework employed and provides a background discussion of the issue. A concise summary of the remaining chapters included in the report is also presented.

ii. **Digitalization of Currencies**: This chapter covers the concise description of the nature of digital currencies, their principles, and historical evolution, highlighting the importance of digitalization for economic development. It also distinguishes between cryptocurrencies and CBDCs and explains the roles and responsibilities of government institutions in introducing and regulating digital currencies.

iii. **Global, Regional, and Local Trends**: This chapter presents a comprehensive and detailed analysis of the needs, challenges, and trends for digitalization of currencies at the global, regional, and country levels. It highlights the best digital currency initiatives and discusses the structural, regulatory, and technical challenges that hinder effective digital currencies. The chapter also provides information about the attitudes and initiatives of global institutions towards digital and cryptocurrencies and briefly touches upon pioneering countries with a supportive regulatory framework for digital currencies. Moreover, the chapter evaluates the current state of OIC member countries towards CBDCs and initiatives taken by some member countries. It explains in detail how the level of the financial sector development in a country, particularly in OIC member countries, impacts the digitalization of currencies. In addition, this section examines the Shari'ah and accounting issues related to CBDCs. It analyzes the various government approaches and compares them, considering industry experiences, feedback, and criticisms.

iv. **Case Studies:** This chapter presents case studies on five countries, one of which is a non-OIC country, based on geography and economic size, the level of financial sector development and digitalization. The selected countries are examined in detail, focusing on their efforts in CBDCs, considering their legal and regulatory framework, as well as

current initiatives, coverage, challenges, and issues. It explains the case countries selection criteria, reviews their legal regimes and systems, and assesses their current state of digitalization efforts towards digital and cryptocurrencies. It also evaluates the needs, challenges, and trends in each case country on the subject matter, including legal, regulatory, and technical challenges. The lessons learnt from each case country are examined, and good practices of leading countries for knowledge and experience sharing are analyzed to identify ways and means for transferring knowledge and increasing cooperation between OIC member countries. Specific recommendations and needs are given for each case study, and these recommendations as well as identified needs are used to derive general advice for all the OIC member countries.

v. **Policy Recommendations**: This chapter provides practical policy recommendations for enhancing collaboration and cooperation among OIC member countries in developing CBDCs. They are presented in a step-by-step approach and designed as a roadmap, considering short-, medium-, and long-term structures. The recommendations are tailored to the level of financial sector development and digitalization in each OIC member country, and the rationale behind each of them is clearly explained to encourage the transfer of knowledge and experience among OIC member countries.

Hence, the policy recommendations are formulated based on the findings and insights from the following sources:

1) **Literature Review.** In-depth review of written and visual literature is conducted while analyzing information from related documentation to comprehend the experiences of relevant countries (the OIC member countries as well as countries from the rest of the world) and international institutions, and using the resources of relevant national institutions.
2) **Surveys and interviews.** The online structured survey has been administered to collect data from the stakeholders, such as academicians, government authorities and the private sector representatives of the OIC member countries. Moreover, to support and improve surveys and to get deeper insights, online and face-to-face expert and expert interviews with related industry leaders and influencers are conducted to identify the needs and best practices.

3) **Case Studies.** The study applied the case country selection criteria and selected five countries, including one non-OIC country, as case studies on desk research and/or field visits. The cases studies specifically focus on the subject matter considering the findings of the previous chapters and considering the legal and regulatory framework as well as current trends and sizes. The structural, regulatory, and technical challenges that hinder currency digitalization and cooperation among central banks on local, OIC, and global levels are discussed.
4) **Data Analysis.** A descriptive/empirical analysis on collected survey data has been carried out to derive insightful conclusions and formulate policy recommendations.

CHAPTER II: DIGITALIZATION OF CURRENCIES

This chapter covers the concise description of the nature of digital currencies, their principles, and historical evolution, highlighting the importance of digitalization for economic development. It also distinguishes between cryptocurrencies and CBDCs and explains the roles and responsibilities of government institutions in introducing and regulating digital currencies. Additionally, it discusses the role of international institutions such as the BIS in creating and regulating cross-border platforms for joint projects on digital currencies.

2.1. The Nature and Historical Background of Digital Currencies

The advent of the digital age has ushered in a transformative era in finance and economics, prominently marked by the rise of digital assets, including cryptocurrencies, stablecoins, and CBDCs. Cryptocurrencies, epitomized by Bitcoin's introduction in 2009 by Satoshi Nakamoto, represent decentralized digital tokens secured by cryptography. Their success is underpinned by decentralization, security, transparency, and global accessibility (Nakamoto, 2008). Bitcoin, in particular, has evolved into a digital store of value and has attracted institutional investors. Nevertheless, cryptocurrencies face criticism for their environmental impact and potential use in illicit activities (Golumbia, 2016). Stablecoins address cryptocurrency volatility by pegging their value to fiat currencies or assets. Their success lies in providing stability, efficiency, smart contract capabilities, and global acceptance (Garrat and Shin, 2023). However, regulatory concerns about centralization and maintaining value pegs pose challenges (Arner et al. 2020). CBDCs, issued and regulated by central banks, represent digital transformations of fiat currencies. Their success hinges on government backing, potential financial inclusion, efficient monetary policy implementation, and reduced transaction costs (Bech and Garrat, 2017). CBDCs, though, raise concerns regarding privacy, surveillance, and their impact on commercial banks (WEF, 2021).

As the history of digital currencies dates back to the 1990s, when various attempts were made to create digital money and online payment systems, it wasn't until the creation of Bitcoin in 2009 however that a decentralized digital currency with a secure and transparent underlying technology, known as blockchain, gained significant attention. Since then, the concept of digital currencies has evolved and expanded, with numerous cryptocurrencies being created and central banks around the world exploring the potential of issuing their own digital currencies -

CBDCs. Despite challenges such as regulatory and security issues, digital currencies have continued to gain popularity and recognition as a legitimate form of currency.

Digital currency, a form of money existing purely in electronic or digital format, has become a prominent facet of modern finance. This chapter aims to comprehensively examine digital currency, its characteristics, functions, and implications, while also delving into the emerging phenomenon of digital fiat currencies – electronic representations of government-issued money.

Digital currency, often referred to as cryptocurrencies or stablecoins, represents a paradigm shift in the way we perceive and transact with money. Unlike physical currencies, such as coins or banknotes, digital currencies have no tangible presence; they exist solely within digital accounts or wallets. Their operation hinges on intricate computer networks and cryptographic algorithms, which underpin secure transactions in the digital domain.

Notably, digital currencies are characterized by decentralization, signifying their independence from any central authority like governments or financial institutions. Bitcoin, introduced in 2009, stands as a pioneering example of digital currency. Bitcoin operates on a foundational technology known as blockchain—a decentralized ledger that meticulously records all transactions. Beyond Bitcoin, a plethora of digital currencies such as Ethereum, Litecoin, and Ripple have gained prominence, each with its unique features and applications.

The inception of digital currencies involves a complex process called "mining." In this process, formidable computational systems undertake the arduous task of solving intricate mathematical problems to validate and record transactions on the blockchain. This mechanism ensures the integrity and security of digital currency transactions.

Digital currencies serve a multitude of purposes, ranging from facilitating online purchases and serving as investment assets to enabling efficient remittances and acting as a store of value. The advantages of digital currency are multifaceted. They offer faster and cost-effective transactional capabilities, heightened security through cryptographic protocols, and the potential for financial inclusion, particularly in regions where traditional banking services are limited. However, it is crucial to acknowledge that digital currencies are not without challenges, including regulatory concerns, price volatility, and susceptibility to illicit activities.

In addition to digital currencies like Bitcoin, there is another transformative phenomenon on the horizon—the digitalization of fiat currencies. These digital fiat currencies represent

electronic counterparts of traditional government-issued currencies such as the United States dollar (USD), Euro (EUR), or British pound (GBP). Importantly, they retain the essential characteristics and value of their physical counterparts but exist exclusively in electronic form.

The digitalization of fiat currencies entails the conversion of physical cash into digital records, which are stored and transacted through electronic systems. This transformation can be facilitated through various means, including online banking platforms, mobile payment applications, or electronic payment systems offered by financial institutions.

Unlike digital currencies, digital fiat currencies maintain the backing and authority of the respective government or central bank responsible for their issuance. This central authority plays a pivotal role in ensuring the stability, value, and regulatory compliance of the currency. They wield monetary policies to govern factors such as inflation, interest rates, and money supply. The utilization of digital fiat currencies offers a plethora of benefits, with convenience being paramount. Users can seamlessly engage in electronic transactions, eliminating the need for physical cash handling.

In the digital age, the financial landscape continues to undergo profound changes, with digital currencies and digital fiat currencies at the forefront of this transformation. Digital currencies offer a glimpse into the future of money, enabling secure and efficient transactions in the digital realm. Simultaneously, the emergence of digital fiat currencies showcases the adaptability of traditional financial systems to the digital age.

2.2. The Importance and Role of Digital Currencies

In recent years, digitalization has emerged as a pivotal force reshaping various industries across the globe. This phenomenon, characterized by the conversion of analog information into digital format, has fundamentally altered the way businesses operate and societies function.

The advent of digitalization represents a paradigm shift in contemporary society, revolutionizing traditional processes and methodologies. Its significance lies not only in its transformative potential but also in its capacity to enhance efficiency, productivity, and customer service across diverse sectors.

One of the paramount advantages of digitalization is the exponential increase in efficiency it affords. By leveraging automation and advanced technologies, tasks that were once manual and time-consuming are now executed seamlessly, liberating human resources for higher-value

endeavors. This heightened efficiency translates into improved overall productivity, a critical factor in the competitive landscape of modern industries.

Furthermore, the integration of digital technologies has enabled businesses to refine their operational processes. Through data-driven decision-making and process optimization, companies can achieve greater output with fewer resources, thereby driving profitability. The ability to swiftly engage with customers through digital channels has revolutionized customer service, providing real-time communication, order tracking, and issue resolution. This heightened level of customer-centricity not only fosters loyalty but also expands market reach.

Cost reduction constitutes another pivotal advantage. Digitalization has the potential to automate tasks, minimize paper consumption, and enhance energy efficiency, resulting in significant cost savings. Additionally, digital technologies serve as catalysts for innovation. Through research and development driven by data analytics and digital platforms, businesses can pioneer new products and services, securing a competitive edge in the market.

Despite its transformative potential, digitalization is not without its challenges. Security risks loom large in the digital landscape, with data breaches and cyber-attacks posing significant threats. Protecting sensitive information and ensuring secure transactions remains a paramount concern.

Data privacy concerns have also emerged as a critical issue. The extensive collection of big data, albeit for legitimate purposes, has raised questions regarding its usage, storage, and protection. Striking a balance between data-driven insights and privacy rights remains a complex undertaking.

A shortage of skilled digital technology labor force constitutes a considerable obstacle to the full realization of digitalization's potential. The demand for specialized talent far outstrips the current supply, necessitating a concerted effort to bridge this skills gap.

The role of digital currencies under such a framework can vary, but generally they serve as a medium of exchange, a unit of account, and a store of value. Digital currencies can be decentralized or centralized, with cryptocurrencies like Bitcoin being decentralized, and CBDCs being issued and backed by a government. In either form, digital currencies aim to provide a more efficient, secure, and accessible alternative to traditional fiat currencies. Additionally, digital currencies can have potential implications for financial inclusion, privacy, and monetary policy.

Digital currencies play several roles in the financial and monetary systems, some of which include:

- Providing an alternative to traditional fiat currencies: Digital currencies offer a decentralized and digital alternative to traditional government-issued currencies.
- Facilitating cross-border transactions: Digital currencies can be used for cross-border transactions, allowing for faster and more efficient transfer of funds.
- Improving financial accessibility: Digital currencies have the potential to provide financial services to individuals and businesses that have limited access to traditional banking systems.
- Increasing financial privacy: Digital currencies can offer increased privacy for users as transactions can be conducted without revealing personal information.
- Enabling decentralized applications: Digital currencies form the backbone of decentralized applications and platforms, enabling new forms of online interactions and transactions.

These are some of the key roles of digital currencies, however, their actual use and adoption may vary depending on various factors such as government regulations, technological infrastructure, and public perception. Resistance to change persists as a hurdle for organizations seeking to embark on digitalization initiatives and creating digital currencies. Overcoming entrenched practices and fostering a culture of digital innovation demands strategic planning and change management.

In conclusion, the benefits of digitalization of currencies far outweigh the challenges it presents. It has become imperative for industries to wholeheartedly embrace this paradigm shift as the future of business. With evolving digital technologies promising even greater opportunities for optimization and innovation, the transformative potential of digitalization on a global scale is boundless. As we navigate this digital era, businesses and societies alike must adapt, innovate, and harness the full potential of digitalization for a prosperous future.

2.3. Types of Digital Currencies: Cryptocurrencies vs. CBDCs

There are three main types of digital currencies: cryptocurrencies, CBDCs, and hybrid digital currencies.

Cryptocurrencies are decentralized digital currencies that use cryptography to secure transactions and control the creation of new units. They are not issued or backed by a government or central authority and are typically designed to be borderless and censorship-resistant. Examples of cryptocurrencies include Bitcoin, Ethereum, and Litecoin.

CBDCs, on the other hand, are digital currencies issued and backed by a central bank or government. They aim to provide a digital version of a country's fiat currency and can offer greater financial inclusion, faster and cheaper payment systems, and enhanced monetary policy tools. CBDCs can be either retail, meaning they can be used by the general public, or wholesale, meaning they can only be used by financial institutions.

So, the main difference between cryptocurrencies and CBDCs lies in their decentralization and the backing of a central authority.

In addition to these two main types, there are also hybrid digital currencies, which combine elements of both cryptocurrencies and CBDCs. These digital currencies can have both decentralized and centralized components and are designed to offer the benefits of both types of currencies.

2.4. Regulating the CBDCs: Pros and Cons of Digital Currencies

Issuance of the CBDCs might come with a price, i.e. social cost which leads to a certain regulatory framework by the central banks even though they first sound like a great innovation which is expectedly create a fair playing ground for all segments in a society. Private households might get a chance to have greater access a full range of money options found in a modern monetary system through the introduction of digital currencies, in particular the CBDCs (Hofmann, 2023). However, the social cost embedded in such a development is the commercial banks' competition with the CBDC issuer central banks for deposits which in turn increase the costs of finance while lowering the amount of loans (Hofmann, 2023).

Digital currencies are coming, not least, some would say, especially in Asia (Eichengreen and Viswanath-Natraj, 2022). The question is how quickly and in what form because digital coins and currencies come in three basic flavors: plain-vanilla cryptocurrencies such as Bitcoin; stablecoins such as Tether and USD Coin; and CBDCs (Eichengreen and Viswanath-Natraj, 2022).

The Bank for International Settlements (BIS) defines a CBDC as a digital payment instrument denominated in the national unit of account that is a direct liability of the central bank (ADB, 2023). A CBDC would be a digital banknote. It could be used by individuals to pay businesses, shops, or each other -a "retail CBDC"- or between financial institutions to settle trades in financial markets -a "wholesale CBDC"- (ADB, 2023). The FED considers CBDCs as similar to the cryptocurrencies, except that their value is fixed by the central bank and equivalent to a country's fiat currency (FED, 2022).

The central banking community is actively considering the merits of issuing CBDCs, and many central banks have started in-depth discussions on the appropriateness and feasibility of issuing such currency (Wouter et al., 2020). IMF staff concluded that "CBDC could be the next milestone in the evolution of money," while at the same time cautioning that staff finds "no universal case for CBDC adoption yet." (Wouter et al., 2020).

The economics literature has emphasized that institutions in general, and the legal system in particular, represent a fundamental determinant of economic growth, especially in connection to financial development (ECB, 2007). The "legal system" is not only legislation and rule books but also the infrastructure of the civil courts and the market regulators (ECB, 2007). It would be inconceivable to think of a financial system of any financial instrument without a legal system to support it (ECB, 2007). Therefore, the legal system's importance in the context of any currency is multifaceted, and it will be equally crucial for CBDC.

The legal system establishes regulatory compliance, including anti-money laundering and know-your-customer rules, ensuring the security of CBDC transactions and preventing illicit activities. Moreover, it provides consumer protection, defining dispute resolution mechanisms, fraud prevention measures, and data privacy regulations. Additionally, the legal system governs cross-border transactions, supports monetary policy frameworks, oversees digital identity management, sets cybersecurity and fraud prevention standards, and maintains financial stability by granting central banks the authority to intervene in times of crisis, collectively forming a critical foundation for the development and operation of CBDCs.

The importance of the legal environment was recognized most notably in the January 2007 Bloomberg-Schumer report, "Sustaining New York's and the US's global financial leadership," which reported that "a firm and predictable legal environment was the second most important criterion determining a financial center's competitiveness" (ECB, 2007).

2.4.1. Advantages of Cryptocurrencies and CBDCs

Digital currencies offer several potential advantages over traditional fiat currencies, including:

1. Efficiency: Digital currencies allow for faster and cheaper transactions, as they eliminate the need for intermediaries such as banks.
2. Accessibility: Digital currencies can help increase financial inclusion, as they can be used by individuals without access to traditional banking services.
3. Security: Digital currencies use cryptography to secure transactions and protect against fraud and hacking.
4. Decentralization: Cryptocurrencies are decentralized, meaning that they are not controlled by a single entity or government, providing users with more control over their funds.
5. Transparency: Digital currencies often use a public ledger, allowing for increased transparency and traceability in transactions.
6. Global reach: Digital currencies can be used for cross-border transactions without the need for currency exchange.
7. Programmability: Digital currencies, particularly cryptocurrencies, have programmable features that allow for the development of new financial products and services.

It is important to note that while these advantages are promising, digital currencies also face challenges and limitations, including price volatility, regulatory uncertainty, and cybersecurity risks.

On the other hand, CBDCs offer several potential advantages, including:

1. Increased financial inclusion: CBDCs can help increase access to financial services for individuals and businesses who do not have access to traditional banking services.
2. Improved payment efficiency: CBDCs can provide faster and cheaper payment services, as they eliminate the need for intermediaries such as banks.
3. Enhanced monetary policy tools: CBDCs can provide central banks with new tools to implement monetary policy, such as the ability to implement negative interest rates and to directly target certain groups of individuals or businesses.
4. Increased financial stability: CBDCs can help to reduce the risk of bank runs and other forms of financial instability by providing a secure and stable means of payment.

5. Improved security: CBDCs can use advanced technology and cryptography to enhance security and reduce the risk of fraud and hacking.
6. Better data collection: CBDCs can provide central banks with better information on the flow of funds and economic activity, allowing for improved economic analysis and decision-making.

It is important to note that these advantages are theoretical and still need to be proven in practice. Additionally, CBDCs also face several challenges, including implementation difficulties, regulatory hurdles, and potential risks to privacy and financial stability.

2.4.2. Disadvantages of Cryptocurrencies and CBDCs

As the recent attempts to create CBDCs loom over the future of payment systems and even a whole monetary system, arguments over the risks posed by such an innovative nature are also on the rise. Prasad (2023) for instance underline the risks on central bank independence and credibility with the possibility of central banks to be viewed as political agents if their role in payment transactions is used for law enforcement or surveillance purposes.

Cryptocurrencies, face several potential disadvantages and challenges, including:

1. Volatility: Digital currencies, particularly cryptocurrencies, are subject to high price volatility, making them unreliable as a store of value.
2. Regulation: The lack of clear regulatory frameworks for digital currencies can create uncertainty and limit their adoption.
3. Cybersecurity Risks: Digital currencies are vulnerable to hacking and other types of cyber-attacks, putting user funds at risk.
4. Limited Acceptance: Digital currencies, particularly cryptocurrencies, are not widely accepted as a means of payment, limiting their usefulness.
5. Complexity: Digital currencies can be difficult for the average person to understand and use, especially for those who are not familiar with technology.
6. Energy consumption: The production and maintenance of digital currencies, particularly cryptocurrencies, requires a large amount of energy, leading to environmental concerns.

7. Lack of Consumer Protection: Digital currencies are not backed by government guarantees or insurance programs, leaving users responsible for protecting their own funds.
8. Price manipulation: Some digital currencies, particularly smaller cryptocurrencies, may be vulnerable to price manipulation by large market participants.

Here are some potential disadvantages of CBDCs:

1. Privacy concerns: The central bank will have access to a lot of financial data and transactions, raising concerns about privacy and security.
2. Risk of cyber-attacks: CBDCs, being digital in nature, can be vulnerable to cyberattacks, which can result in theft or loss of funds.
3. Complex implementation: Introducing a CBDC can be complex and requires significant technical infrastructure and resources to be implemented effectively.
4. Legal and regulatory challenges: The legal and regulatory framework for CBDCs is still being developed, and there are potential challenges in terms of their impact on monetary policy and financial stability.
5. Technical difficulties: CBDCs may require significant upgrades to existing payment systems, and there may be technical difficulties in integrating them with existing financial infrastructure.
6. Resistance from the public: The public may be resistant to adopting a CBDC if they are not familiar with digital currencies or have concerns about security and privacy.

2.4.3. Challenges Faced by Digital Currencies

The structural, regulatory, and technical challenges that prevent an effective digital currency are as follows:

(i) Structural Challenges:

- Lack of clear and consistent regulations and standards: Different countries have different regulations and standards for digital currencies, making it difficult to create a globally accepted digital currency.

- Complex monetary systems: Digital currencies have to be integrated into existing monetary systems, which can be complex and difficult to navigate.

(ii) Regulatory Challenges:

- Money laundering and terrorist financing: Digital currencies can be used for illegal activities, and regulators need to find ways to prevent and detect such activities.
- Consumer protection: Digital currencies can be vulnerable to scams and fraud, and regulators need to ensure that consumers are protected.
- Privacy concerns: Regulators have to balance privacy concerns with the need for financial surveillance to prevent illegal activities.

(iii) Technical Challenges:

- Scalability: Digital currencies need to be able to handle large amounts of transactions, and scalability is a major challenge.
- Security: Digital currencies need to be secure to prevent hacking and theft, and this requires significant investment in cybersecurity.
- Interoperability: Digital currencies need to be able to work seamlessly with existing payment systems, and this requires technical integration and compatibility.
- User experience: Digital currencies need to be user-friendly, and this requires significant investment in user experience design and testing.

2.4.4. Pioneering Countries in Regulation

There are several countries that have taken steps to create a supportive regulatory framework for digital currencies as some are listed with their core features:

1. Switzerland: Switzerland has a favorable environment for digital currencies and has implemented regulations that allow for the growth of the blockchain and cryptocurrency industries.
2. Malta: Malta is known as the "Blockchain Island" due to its supportive regulatory framework and has attracted numerous blockchain and cryptocurrency companies.
3. Singapore: Singapore has a well-established financial sector and has taken a proactive approach to the regulation of digital currencies. It has implemented a licensing framework for cryptocurrency exchanges and payment services providers.
4. Japan: Japan has been a leader in the regulation of digital currencies and has recognized Bitcoin as a currency. It has implemented a licensing framework for cryptocurrency exchanges and has taken steps to prevent money laundering and terrorist financing.

5. Estonia: Estonia has implemented a comprehensive regulatory framework for digital currencies and has a highly developed digital infrastructure.

These countries have taken a proactive approach to the regulation of digital currencies, and their supportive regulatory frameworks have helped to create a favorable environment for the growth of the industry.

CHAPTER III: GLOBAL, REGIONAL, AND LOCAL TRENDS

This chapter presents a comprehensive and detailed analysis of the needs, challenges, and trends for digitalization of currencies at the global, regional, and country levels. It highlights the best digital currency initiatives and discusses the structural, regulatory, and technical challenges that hinder effective digital currencies. The chapter also provides information about the attitudes and initiatives of global institutions towards digital and cryptocurrencies and briefly touches upon pioneering countries with a supportive regulatory framework for digital currencies. Moreover, the chapter evaluates the current state of OIC member countries towards CBDCs and initiatives taken by some member countries. It explains in detail how the level of the financial sector development in a country, particularly in OIC member countries, impacts the digitalization of currencies. In addition, this section examines the Shari'ah and accounting issues related to CBDCs. It analyzes the various government approaches and compares them, considering industry experiences, feedback, and criticisms.

3.1. Central Banks' Currency Digitalization Initiatives

CBDC refers to a digital form of a country's official currency that is issued and regulated by its central bank. CBDCs are a digital representation of a nation's fiat currency and are designed to serve as a secure and efficient medium of exchange for digital transactions (Bech and Garratt, 2017). CBDCs are transforming the worldwide financial arena. The growing interest in CBDCs can be attributed to two key factors (Williamson, 2022): the emergence of privately issued cryptocurrencies and the declining use of physical currency. The surge in such cryptocurrencies, as Bitcoin and Ethereum, has spurred greater curiosity about CBDCs. Unlike these private digital currencies, which lack central bank backing and can be volatile, CBDCs are perceived as a more stable form of digital currency as they are supported by a central authority. Furthermore, the reduced reliance on physical currency has fueled interest in CBDCs. Advancements in electronic payment technologies and the migration of retail activities to online platforms have also contributed to the decline of physical currency. Electronic payment methods offer convenience and enhanced security compared to cash transactions. Presently, central banks are actively developing two categories of CBDCs. A retail CBDC stands apart from conventional cashless payment options as it represents a direct claim on a central bank, exempt from any private financial institution's liability. In sharp contrast, wholesale CBDCs are tailored for a distinct audience, comprising banks, central banks, and financial institutions. These CBDCs operate in a

manner analogous to today's central bank reserves and settlement balances but offer innovative functionalities facilitated by tokenization, including composability and programmability (BIS, 2023).

Emerging Market and Developing Economies (EMDEs) have made more significant strides in their CBDC initiatives compared to Advanced Economies (AEs). Notably, all currently active CBDCs are operational in EMDE jurisdictions. Moreover, as per the Atlantic Council's CBDC tracker, central banks in EMDEs demonstrate significantly greater participation in both retail (29%) and wholesale (16%) CBDC pilot initiatives, nearly doubling the engagement observed in AEs at 18% and 10%, respectively.[7] According to Kosse and Mattei's (2023) survey of 86 central banks conducted in 2022 under the auspices of BIS, these disparities are accompanied by unique motivations. EMDEs emphasize financial inclusion-related drivers more prominently in their retail CBDC initiatives and place a greater emphasis on monetary policy implementation compared to AEs. However, there is also a convergence between AE and EMDE central banks, as both groups increasingly prioritize domestic payment efficiency, payment safety, financial stability, and cross-border payment efficiency as their key motivations for CBDC exploration, signifying a shared focus on these aspects.

Within the OIC member states, according to data from the Atlantic Council's CBDC tracker, Nigeria stands out as the only country to have successfully launched a CBDC. Meanwhile, seven other nations, including significant players like Iran, Malaysia, Saudi Arabia, and Türkiye, are currently in the pilot stage. Two additional countries are in the development phase, while 14 are actively engaged in research on CBDCs. The remaining countries within the OIC have yet to take any active steps toward CBDC development (see *Table 1*).

In the realm of cryptocurrency adoption, alongside CBDCs, the 2022 Global Crypto Adoption Index (GCAI) compiled by Chainalysis (2022) provides valuable insights into the global landscape of cryptocurrency adoption and usage. This comprehensive index is categorized into six segments, each delving into distinct aspects of cryptocurrency adoption. Below, in *Table 3*, you will find the top 20 jurisdictions that lead in terms of cryptocurrency adoption. The 2022 GCAI by Chainalysis provides insights into cryptocurrency adoption worldwide. Vietnam leads, excelling in P2P trading and DeFi. The Philippines ranks 2nd, strong in centralized services. Ukraine is 3rd, with broad adoption in various categories. India leads in centralized services but

[7] The classification of countries as AEs and EMDEs relies on the World Economic Outlook (WEO) categorization established by the International Monetary Fund (IMF).

lags in P2P trading. The USA ranks 5th. Pakistan ranks 6th, balancing various categories. Brazil, Thailand, Russia, and China follow. Nigeria excels in P2P trading at 11th. Turkey, Argentina, and Morocco have mixed rankings at 12-14. Colombia, Nepal, UK, Ecuador, Kenya, and Indonesia complete the list at 16-20.

Table 3: Crypto Adoption Index 2022

Country	**Overall index ranking**	**Centralized service value received ranking**	**Retail centralized service value received ranking**	**P2P exchange trade volume ranking**	**DeFi value received ranking**	**Retail DeFi value received ranking**
Vietnam	1	5	5	2	7	6
Philippines	2	4	4	66	13	5
Ukraine	3	6	6	39	10	14
India	4	1	1	82	1	1
USA	5	3	3	111	3	2
Pakistan	6	10	10	50	22	16
Brazil	7	7	7	113	8	7
Thailand	8	12	12	61	5	3
Russia	9	8	8	109	11	12
China	10	2	2	144	6	4
Nigeria	11	18	18	17	20	17
Türkiye	12	9	9	121	19	15
Argentina	13	13	13	26	21	25
Morocco	14	19	19	21	33	18
Colombia	15	23	23	10	27	29
Nepal	16	17	17	19	34	41
UK	17	14	14	71	12	11
Ecuador	18	37	37	6	45	56
Kenya	19	43	43	5	9	34
Indonesia	20	16	16	129	18	13

Source: Chainalysis (2022)

3.1.1. Leading Digital Currency Initiatives

In recent years, the digital asset landscape has witnessed a proliferation of successful initiatives, each offering unique features and value propositions to the burgeoning cryptocurrency and blockchain ecosystem. Bitcoin (BTC), recognized as the pioneer of cryptocurrencies, stands as a testament to the transformative potential of blockchain technology. Operating as a decentralized, peer-to-peer electronic cash system, BTC has emerged as both a store of value and a medium of exchange. Its foundational principles of security, scarcity, and portability have made it an attractive option for individuals seeking to preserve their wealth outside the purview of governmental control. The enduring prominence of Bitcoin underscores its enduring significance in the crypto space. Ethereum (ETH) has carved its niche

as a leading blockchain platform renowned for its support of smart contracts. These self-executing contracts, stored immutably on the Ethereum blockchain, empower a myriad of applications spanning decentralized finance (DeFi), decentralized applications (DApps), and tokenized assets. Ethereum's versatility and programmability have catalyzed an ecosystem of innovation, driving its adoption and utility across various sectors. Binance Coin (BNB), the native cryptocurrency of the Binance exchange, has established itself as a dynamic digital asset. BNB serves a multifaceted role, enabling users to pay trading fees on the exchange and participate in token sales via the Binance Launchpad. Furthermore, BNB fuels the Binance Smart Chain, a blockchain platform engineered for scalability and efficiency, positioning it as a contender in the race for blockchain superiority. Cardano (ADA) has emerged with a distinct focus on scalability, sustainability, and interoperability. Employing a proof-of-stake consensus mechanism, ADA offers an energy-efficient alternative to the energy-intensive proof-of-work models of Bitcoin and Ethereum. Its design emphasizes interoperability with other blockchain platforms, rendering it a valuable choice for cross-chain applications and fostering collaborative developments within the crypto ecosystem. Solana (SOL) distinguishes itself for its high throughput and minimal latency, setting new benchmarks for blockchain scalability. Capable of processing up to 50,000 transactions per second, SOL boasts exceptional transactional efficiency. The adoption of a proof-of-history consensus mechanism enhances its energy efficiency, further cementing its appeal in an era where sustainability is paramount. Stablecoins, such as Tether (USDT), TerraUSD (UST), and USD Coin (USDC), have garnered prominence as reliable assets within the crypto market. Tether, the foremost stablecoin by market capitalization, is pegged to the US dollar, providing traders with a means to navigate the volatile cryptocurrency landscape while maintaining price stability. TerraUSD, the second-largest stablecoin, offers a similar proposition, contributing to market stability. USD Coin, backed by a reserve of US dollars held by Circle, offers an additional layer of trust, reinforcing its standing as a dependable stablecoin within the digital asset sphere.

The advent of cryptocurrencies has ushered in a new era of inclusivity in financial transactions, eliminating the need for intermediaries and thereby facilitating easier access to financial services. However, it is important to acknowledge that cryptocurrencies have exhibited substantial price volatility, as highlighted by Demertzis and Martins (2023). Likewise, CBDCs have not gained the widespread adoption initially anticipated by regulatory authorities. This phenomenon is evident in countries such as Nigeria, the Bahamas, and China, where CBDCs

constitute a minuscule fraction of the total currency in circulation, barely exceeding 0.17 percent (Demertzis and Martins, 2023). Several significant challenges must be surmounted for CBDCs to achieve broader adoption. Take, for instance, the case of the Sand Dollar, the CBDC introduced by the Bahamas in October 2020. Its relatively limited uptake can be attributed to at least two key factors, as elucidated by Blustein (2022). Firstly, there exists a pervasive misconception among the public, who often confound the Sand Dollar with privately issued cryptocurrencies that lack immediate trustworthiness. This confusion stems from previous incidents, such as the FTX scandal, which had ties to the Bahamas, and has instilled a sense of skepticism regarding digital currencies. Secondly, the Sand Dollar faces acceptance challenges, as not all merchants possess the requisite infrastructure to transact using this CBDC, a concern similarly expressed in the context of the eNaira. Emphasizing that the nascent stages of CBDC development are ongoing, it remains premature to draw definitive conclusions about the viability of CBDCs. However, an assessment of their potential clearly reveals that CBDCs have not yet fully realized their promise, and they await further exploration and utilization.

3.2. Structural, Regulatory, and Technical Issues and Challenges

CBDCs have gained prominence in the realm of digital finance and central banking, with the potential to revolutionize the financial landscape. This section explores the multifaceted challenges associated with the implementation of CBDCs, encompassing structural, regulatory, and technical dimension

3.2.1. Structural Challenges

The implementation of CBDCs carries a myriad of structural challenges that must be addressed diligently to unlock their potential benefits. These challenges encompass infrastructure development, access and inclusion, and integration with existing financial systems. Overcoming these hurdles requires a concerted effort from central banks, governments, and private sector stakeholders to ensure the successful evolution of the financial landscape into the digital era.

i. **Infrastructure Development:** A fundamental structural challenge confronting the deployment of CBDCs revolves around the need for robust and secure infrastructure (BIS, 2020). The existing financial ecosystem may require substantial upgrades to seamlessly accommodate CBDC transactions, necessitating the reinforcement of payment systems, cybersecurity measures, and the establishment of reliable digital

identity verification mechanisms (WEF, 2023). Central banks, entrusted with the responsibility of issuing and managing CBDCs, must ensure the resilience and integrity of these infrastructures, as any delays or instability in CBDC deployment could erode public trust.

ii. **Access and Inclusion:** The introduction of a retail CBDC has the potential to exert a profound influence on payment system functionality (BIS, 2019). Consequently, its design must prioritize enhancing, rather than hindering, the smooth operation of the payment system, preserving confidence in the national currency, and promoting economic efficiency. A critical structural challenge is to ensure that all citizens, including those residing in remote or underserved areas, have access to CBDCs (WEF, 2023). However, this imperative must be carefully balanced with the protection of user privacy and security, adding to the complexity of CBDC development. Furthermore, offline capabilities and user-friendly interfaces are essential features to foster widespread adoption (Narula et al., 2023).

iii. **Integration with Existing Systems:** Achieving interoperability between CBDCs and the current financial ecosystem, which includes commercial banks and payment service providers, poses a formidable challenge (WEF, 2023). A harmonious transition is essential to prevent disruptions to the stability of the financial system. Collaboration between the public sector, central banks, and established private sector entities is paramount to shape the successful integration of CBDCs into the existing financial landscape (FATF, 2021). This cooperative effort is vital for addressing technical and operational complexities and ensuring that CBDCs seamlessly coexist with conventional financial instruments.

3.2.2. Regulatory Challenges

The regulatory challenges associated with CBDCs encompass a spectrum of considerations, including the establishment of comprehensive legal frameworks, the complexities of cross-border transactions, and the balance between privacy rights and regulatory oversight. Addressing these challenges is crucial to ensure the responsible and effective implementation of CBDCs on a global scale.

i. **Establishing a Comprehensive Legal Framework:** The creation of a robust legal framework for CBDCs is indispensable to ensure their responsible deployment. Central banks embarking on CBDC projects face intricate regulatory issues that span various

domains, including money laundering, consumer protection, and monetary policy transmission (FATF, 2021). The concern for regulatory compliance and the preservation of financial integrity are shared on a global scale. This necessitates the careful design of CBDCs to facilitate adherence to regulatory frameworks, notably those concerning anti-money laundering (AML) and the combating of the financing of terrorism (CFT) (ECB, 2020).

ii. **Cross-Border Transactions and International Regulatory Cooperation**: CBDCs possess the potential to facilitate cross-border transactions, offering benefits but also engendering regulatory complexities. This presents challenges associated with international regulatory cooperation, foreign exchange controls, and the synchronization of monetary policies. The circulation of a CBDC beyond a country's borders can influence capital flows and exchange rates, potentially impacting the monetary policy stance and transmission of the Central Bank. From the European Central Bank (ECB) perspective, precise effects depend on various factors, including the CBDC's interaction with international payment systems, its remuneration mechanisms, and limits on holdings, particularly concerning transactions by non-euro area residents (ECB, 2020). Consequently, the establishment of interoperability between CBDC systems and the formulation of global standards emerge as critical priorities (BIS, 2020). Collaborative efforts among different regions to develop common protocols and frameworks can facilitate the integration of CBDCs (WEF, 2023).

iii. **Balancing Privacy Rights and Regulatory Oversight:** A regulatory challenge that necessitates careful consideration pertains to the balance between safeguarding individual privacy rights and ensuring regulatory oversight in CBDC operations. Achieving this equilibrium becomes especially intricate in the context of anti-money laundering (AML) and know-your-customer (KYC) regulations (BIS, 2020). The design of CBDCs should enable users to enjoy a level of anonymity while still complying with these essential regulatory measures. Striking this balance is pivotal for the successful and responsible deployment of CBDCs.

3.2.3. Technical Challenges

The technical challenges in CBDC implementation encompass scalability, demanding an infrastructure capable of accommodating extensive transaction volumes, and cybersecurity,

requiring robust measures to counter the various threats that could undermine the integrity and functionality of digital currencies.

i. **Scalability:** A critical technical challenge for CBDCs is scalability, necessitating an infrastructure capable of accommodating a potentially immense volume of transactions. Ensuring scalability is pivotal for upholding the system's efficiency and reliability, particularly during periods of peak usage. The development of CBDCs requires a meticulous consideration of the underlying technology, encompassing choices between centralized or decentralized architectures, permissioned or permissionless networks, and the utilization of Distributed Ledger Technology (DLT) or alternative solutions. These choices must align with the specific objectives of the CBDC project, with a paramount focus on integrating CBDCs seamlessly into existing payment systems. Compatibility with the established financial infrastructure, comprising banks and payment service providers, is indispensable to guarantee smooth and efficient interoperability.

ii. **Cybersecurity:** The realm of cybersecurity presents formidable challenges in the context of CBDCs, given their susceptibility to cyberattacks, which could have far-reaching financial and operational implications (ECB, 2020). These cyberattacks may target various dimensions, encompassing monetary policy, financial stability, financial risk, and the overall safety and efficiency of the payment system. Malicious actors may exploit vulnerabilities to perpetrate fraud, extortion, or data exfiltration, potentially hindering or even preventing the utilization of the digital currency. Such attacks could also compromise the integrity of data and the value of the currency itself, eroding citizens' trust and violating the confidentiality of user information and underlying financial transactions. Addressing these multifaceted risks necessitates the creation of a resilient digital currency ecosystem that remains available under a broad spectrum of circumstances while adequately safeguarding the integrity and confidentiality of processed information. Given their appeal as prime targets for cyberattacks, central banks must implement cutting-edge cybersecurity measures to mitigate threats, encompassing hacking, data breaches, and other security vulnerabilities.

3.3. Attitudes and Initiatives of Global Institutions

3.3.1. Pioneering countries

Several countries have emerged as pioneers in adopting supportive regulatory frameworks for digital currencies and blockchain technology. These countries recognize the potential benefits of these technologies while aiming to balance innovation with consumer protection and financial stability. Here are some examples:

- **Switzerland:** The Swiss government has been supportive of the development of digital currencies and CBDCs. In 2019, the Swiss Federal Council published a report on the potential benefits and risks of CBDCs. The report concluded that CBDCs could have a number of benefits, such as improving financial inclusion and reducing the costs of cross-border payments. The Swiss government has also been supportive of the development of a regulatory framework for digital currencies (The Federal Council, 2019). In 2020, the Swiss Financial Market Supervisory Authority (FINMA) published guidance on the regulatory treatment of virtual currencies. The guidance clarifies the regulatory requirements for businesses that offer services related to virtual currencies. Switzerland implemented alterations to its taxation and regulatory framework concerning cryptocurrency assets in 2022. Specifically, investment tokens possessing participation rights are now classified as shares or participation certificates for tax-related considerations. The dividends derived from the aforementioned tokens are regarded as meaning distributions and are hence subjected to a withholding tax rate of 35% (Kamsky, 2023). During a conference held in Zurich on June 26, 2023, the chairman of the Swiss National Bank (SNB) announced the intention to launch a wholesale CBDC on Switzerland's SIX digital exchange. This initiative would be carried out as a pilot program (Reuters, 2023).

- **Sweden:** The Swedish government has also been supportive of the development of digital currencies and CBDCs. The Riksbank has demonstrated a pioneering role among central banks in the examination of CBDC while it has recently initiated technological experiments with the aim of acquiring knowledge on the technical aspects of CBDC issuance. The e-krona project was initiated by the Riksbank in 2017 with the purpose of deliberating on the goals associated with the issuance of a CBDC, as well as envisioning its potential characteristics and implementation. In the year 2018 and 2020, a pair of project reports were issued, alongside dedicated editions of the Riksbank's Economic Review. The aforementioned papers encompassed an initial examination of the primary concerns pertaining to the establishment of CBDCs (IMF, 2023). An

ongoing governmental investigation in Sweden is examining the advantages of implementing an electronic version of the national currency, known as the e-krona. The project is ongoing and is expected to last until 2023.

- **The Bahamas:** The Bahamas was the first country in the world to launch a CBDC. The Sand Dollar was launched in 2020 and is available to residents and businesses in The Bahamas. The Bahamian government has been supportive of the development of the Sand Dollar and has put in place a number of measures to promote its use. These measures include providing cashback rewards to businesses that accept the Sand Dollar and offering discounts on government services to businesses and individuals that use the Sand Dollar.

- **China:** Since 2014, the People's Bank of China (PBOC) has undertaken the development of a digital currency referred to as the digital yuan, which is alternatively known as e-yuan, e-CNY, digital renminbi, or digital RMB. China became the pioneering big country to initiate pilot programs for a CBDC in April 2020. The implementation of the currency was limited to four specific cities by the government, namely Shenzhen, Suzhou, Xiongan, and Chengdu. The Vice President of the PBOC made a public declaration regarding the expansion of the trial program for the digital yuan. This expansion entails an increase in the number of pilot areas, encompassing fifteen provinces and twenty-three cities. The inclusion of Chongqing and Guangzhou, two highly populous cities, signifies that the digital yuan is now available as a payment alternative in China's five main urban centers, collectively catering to a population of approximately 98 million individuals. In addition, six cities located in the province of Zhejiang have been included in the aforementioned list due to the upcoming hosting of the 2023 Asian Games (Guillermo, 2023). This decision has been motivated by the intention of the PBOC to conduct a trial of the digital yuan among international participants who will be attending the celebratory events.

- **Uruguay:** The pilot plan for testing an e-Peso was initiated by the Central Bank of Uruguay (CBU) in November 2017. The primary examination conducted within the CBU centers around three key facets: The legal framework refers to the system of laws, regulations, and principles that govern a certain jurisdiction or area of law. The legislative authority of the CBU was deemed adequate for the issuance of electronic bills in addition to traditional paper bills. Additionally, measures have been taken to reasonably mitigate cyber and information risks, as well as hedge against other risks such as financial and reputational hazards. 3) Technological advancements: The system's components, such as e-Peso production, digital vault, digital

wallets, transactional system, and infrastructures, have undergone rigorous testing to ensure their successful functionality. Additionally, measures have been taken to ensure business continuity in the event of any disruptions. The duration of the pilot project spanned a period of six months, with the digital money being rendered defunct subsequent to April 2018. The total issuance of Uruguayan pesos was restricted to 20 million, equivalent to 670,000 US dollars. The pilot program implemented a token-based system, wherein ANTEL, a public communications firm, provided a limited number of cell phones to 10,000 mobile phone subscribers. The e-wallets were subject to a limit of 30,000 Uruguayan pesos (equivalent to 1,000 US dollars) for individual users and 200,000 Uruguayan pesos for registered businesses. The e-Peso has the potential to facilitate transactions in authorized establishments as well as enable direct transfers between verified individuals (Sarmiento, 2022).

- **South Korea:** Since 2017, the Bank of Korea (BOK) has been consistently expanding its team of experts and established a specialized unit for CBDC in early 2020. They conducted research on CBDC-related systems and conducted a proof of concept (PoC) to assess the viability of using DLT as the technological backbone for CBDC (Bae, 2022). In 2022, as part of their ongoing efforts to lay the technical groundwork for a potential CBDC system, the BOK examined the feasibility of adding additional functionalities such as offline payments and smart contract-based transactions, like digital asset transfers and cross-border payments. They also assessed the suitability of cutting-edge technologies like distributed ledger and privacy-enhancing technologies. These experiments were conducted using a CBDC simulation system created in 2021 within a distributed ledger-based virtual environment. Furthermore, the various components of the CBDC system, initially tested in a single cloud environment, underwent reevaluation in a setting that closely resembled real-world conditions by connecting the simulation system with the systems of 14 banks and the Korea Financial Telecommunications and Clearings Institute (KFTC). The extended simulation project, which took place from July to December 2022, confirmed the proper functioning of processes related to the circulation of CBDC and the performance of essential features (Bank of Korea, 2023).

- **Cambodia:** When Cambodia's central bank introduced a digital payment system pilot in July 2019, its primary goal was to enhance financial inclusion within the country and encourage the use of the local currency instead of the U.S. dollar. However, the onset of the coronavirus pandemic brought unexpected benefits. For the National Bank of Cambodia (NBC), which had been exploring a blockchain-based payment system since 2016, the pandemic served as a

catalyst, hastening the adoption of Bakong. Officially launched in October 2020, Bakong serves as a payment system utilized by over a dozen banks and financial institutions. According to the NBC, Bakong has already attracted approximately 5.9 million users, with transactions totaling nearly $2 billion thus far (Chandran, 2021).

- **Canada:** The Bank of Canada has been involved in experiments like Project Jasper and CAD-coin to explore the use of blockchain technology for a digital version of the Canadian dollar. Project Jasper represents a joint research effort involving Payments Canada, the Bank of Canada, the financial innovation consortium R3, and various Canadian financial institutions. The primary aim of this initiative is to investigate the potential of DLT in reshaping the landscape of payments in Canada. This project was initiated in March 2016, and it has progressed through two distinct phases of inquiry into the application of DLT for settling wholesale interbank payments effectively (Payments Canada et al., 2017).

- **Japan:** The Bank of Japan is actively developing a CBDC for both retail and wholesale use, in collaboration with trusted institutions and the public. They outlined their approach in October 2020 and conducted two years of trials. To enhance the digital yen's functionality and promote wider public adoption, the Bank of Japan launched a three-year pilot program. This pilot program consisted of two proof-of-concept phases. Phase One, from April 2021 to March 2022, involved creating an experimental environment with different CBDC ledger design alternatives to assess basic functions. Phase Two, from April 2022 to March 2023, continued using the same environment to evaluate additional functions and address technical issues (Anderson & Anstey, 2023).

- **Eastern Caribbean Currency Union (ECCU):** The CBDC project known as DXCD was commenced by the Eastern Caribbean Central Bank (ECCB) in March 2019. 'D', representing digital, is prefixed to 'XCD' - the international currency code for the EC dollar also called DCash (Bank, 2023). The CBDC has been undergoing testing in specific pilot nations for a duration of six months since March 2020. The ECCB is responsible for the issuance of the Eastern Caribbean Dollar (ECD), which serves as the official currency in eight out of the 11 member states belonging to the Organisation of Eastern Caribbean States (OECS). These member states collectively constitute the Eastern Caribbean Currency Union (ECCU). The archipelago of the OECS is situated inside the Caribbean Sea and sustains a population exceeding 1.4 million individuals (Gross, 2021).

These are just a few of the pioneering countries with a supportive framework for digital currencies and CBDCs. There is a growing interest in the development of digital currencies and CBDCs around the world. It remains to be seen which additional countries will further launch a CBDC, but it is clear that this is an area of active development.

3.3.2. OIC Status

The OIC member countries have shown a mix of attitudes and initiatives toward CBDCs.

- **Saudi Arabia:** In January 2019, the Saudi Central Bank (SAMA) and the Central Bank of the UAE (CBUAE) unveiled a collaborative digital currency initiative known as Project Aber. The name, "Aber," translates to 'one who crosses boundaries,' underlining the project's cross-border emphasis. The final project report confirmed the technical feasibility of a cross-border dual-issued currency and demonstrated that it was possible to create a distributed payment system (Saudi Central Bank & Central Bank of the U.A.E., 2020). This system offered both countries substantial enhancements over centralized payment systems, particularly in terms of architectural resilience.

- **United Arab Emirates (UAE):** Apart from the Aber project with SAMA, UAE is involved other CBDC projects with different countries and institutions. UAE is partnered with BIS along with Thailand, Hong Kong and China in a wholesale CBDC project named mBridge (BIS, 2022a). Testing of sample trade settlement transactions across 11 industries has commenced on the trial platform.

- **Türkiye:** In September 2021, the Central Bank of the Republic of Türkiye (CBRT) initially revealed its interest in exploring the advantages of introducing a digital Turkish Lira through a research initiative called "Central Bank Digital Turkish Lira Research and Development" (LYONS, 2022). By December 2022, the CBRT had successfully conducted its first trial of the CBDC known as the Digital Turkish Lira. They have also indicated their intention to continue testing and development efforts throughout the year 2023.

- **Malaysia:** Malaysia, in partnership with the BIS Innovation Hub, Reserve Bank of Australia, Monetary Authority of Singapore, and South African Reserve Bank, has embarked on a collaborative effort to explore the application of wholesale CBDC for international settlements. This initiative, known as Project Dunbar, aims to create a shared platform for testing the use of CBDC in the context of global financial transactions (BIS, 2022b). Regarding retail CBDC,

Malaysia does not currently have any immediate plans for its launch (Bank Negara Malaysia, 2022). Instead, the country is actively engaged in ongoing exploration to assess the feasibility and determine the most suitable modalities for implementing retail CBDC, taking into consideration the specific economic conditions and requirements within Malaysia.

- **Indonesia:** Indonesia has taken a cautious approach to digital currencies. In terms of retail CBDC, Bank Indonesia issued a white paper concerning the development of Digital Rupiah on 30 November 2022. The White Paper elaborated the high-level design for Digital Rupiah under the hood of Project Garuda as well as initiated public communication regarding the development plan of Digital Rupiah (Bank Indonesia, 2022).

- **Pakistan:** The State Bank of Pakistan has expressed interest in exploring CBDCs but has also raised concerns about the potential impact on the country's financial system. They have been studying the feasibility and implications of CBDCs (Sarkar, 2022).

- **Qatar:** Qatar is currently in the preliminary stages of its investigation into the development of a CBDC.

- **Kuwait:** The Central Bank of Kuwait has indicated interest in CBDCs and has conducted research on the topic. However, no concrete initiatives or pilot projects were reported up to September 2023.

- **Bangladesh:** The Bangladesh Central Bank is planning to initiate a feasibility study for the implementation of a CBDC. The Ministry of Finance has indicated that the main objective behind this move is to facilitate digital payments and stimulate the growth of startups and e-commerce within the country (Insights, 2022).

- **Nigeria:** Nigeria took a significant step on October 25, 2021, by launching e-Naira, a CBDC that is fully available to the public (IMF, 2021). As an OIC member country, Nigeria has taken the lead in implementing a CBDC despite encountering certain challenges that the Central Bank of Nigeria (CBN) views as initial obstacles in its efforts to digitize its monetary and payment systems.

3.3.3. Global Institutions

Global institutions have exhibited a range of attitudes and initiatives towards digital and cryptocurrencies. These attitudes often reflect the institutions' goals, concerns, and perceptions

of the potential impact of these technologies on the global financial landscape. Here are some key points to consider:

- **The Bank for International Settlements (BIS):** The BIS assumes a prominent role in the advancement of CBDCs by establishing a platform conducive to information exchange and collaborative research among central banks. Furthermore, the BIS exercises supervision over the BIS Innovation Hub, comprising a network of innovation laboratories devoted to diverse CBDC projects (BIS, 2023) In greater detail, the BIS actively engages in CBDC initiatives through the following means: First, it conducts comprehensive research and analysis regarding CBDCs, publishing reports and scholarly papers that substantially enrich the worldwide discourse on this subject matter. Additionally, the organization convenes workshops and conferences with a specific focus on CBDCs, serving as a constructive arena for central banks, academicians, and subject matter experts to delve deeply into discussions. Moreover, the BIS extends technical support to central banks expressing interest in exploring the realm of CBDC development, offering invaluable guidance and expertise to navigate the intricate terrain associated with the implementation of digital currencies. Recognizing the inherently global character of CBDCs, the BIS promotes international cooperation, acting as a catalyst for collaboration among nations. This advocacy facilitates the mutual sharing of experiences and knowledge, mitigating redundancy in CBDC development efforts across countries.
- **International Monetary Fund (IMF)**: The IMF plays an important role in shaping the landscape of CBDC development by offering guidance and support to central banks. This engagement with CBDCs is evident through a series of instrumental measures that the IMF has undertaken. Firstly, the IMF provides guidance and insight to central banks by publishing papers and reports on CBDCs (e.g., Mancini-Griffoli et al. 2018; IMF, 2023). Secondly, the IMF extends its technical expertise to central banks interested in CBDC development. This support includes aiding central banks in formulating their CBDC strategies, establishing robust IT infrastructure, and ensuring the seamless execution of CBDC implementations. Lastly, the IMF recognizes the global implications of CBDCs and actively advocates for international collaboration.
- **Financial Stability Board (FSB):** The FSB, an international regulatory body tasked with overseeing and providing guidance on the global financial system, has diligently

monitored the ongoing developments within the realm of digital currencies. This organization underscores the paramount importance of fostering regulatory and supervisory collaboration to effectively address potential risks. The FSB expounded upon the risks associated with crypto assets, offering a comprehensive assessment of the challenges these assets present to the stability of the financial system (FSB, 2023). Furthermore, the FSB unequivocally advocates for heightened coordination among regulatory authorities, emphasizing the necessity of proactive risk mitigation strategies (FSB, 2022).

- **The United Nations (UN)**: While the UN is not directly engaged in the direct development of CBDCs, it has demonstrated an interest in this subject matter. The UN's involvement primarily manifests through its publication of comprehensive reports and research papers that delve into the prospective advantages and potential drawbacks associated with CBDCs. These studies serve a crucial purpose: to provide valuable insights and knowledge to policymakers in developing countries, aiding them in their strategic considerations regarding crypto assets (UN, 2023). This effort is part of a broader initiative to better understand the potential impact of CBDCs, especially on the least developed nations (Foster et al., 2021).
- **World Bank**: The World Bank acknowledges the transformative potential inherent in blockchain technology and digital currencies, particularly in augmenting financial inclusivity. This recognition is underscored by the World Bank's comprehensive exploration of these concepts, as evidenced by its issuance of reports addressing both the technical dimensions of CBDCs (World Bank, 2021a), and the conceptualization of CBDCs as instruments capable of expediting cross-border payments (World Bank, 2021b).
- **The World Economic Forum (WEF):** The WEF is an international organization that brings together leaders from business, government, and civil society to discuss global issues. The WEF actively contributes to the advancement of CBDCs by serving as a platform for informed discussions and debates on CBDCs, conducting extensive research and publishing reports to provide insights into the potential impacts of CBDCs on the global economy (WEF, 2023), and fostering international cooperation among nations to prevent duplication of efforts and ensure coordinated development of CBDCs.
- **Financial Action Task Force (FATF)**: The FATF issues recommendations for countries to regulate and supervise virtual asset service providers to prevent misuse for illegal

activities. While it does not directly participate in the development of CBDCs, its crucial role lies in preventing the misuse of CBDCs for unlawful purposes (FATF, 2020, 2021).

- **Academic and Research Institutions:** Universities and research establishments make substantial contributions to the comprehension of digital currencies by engaging in multifaceted activities such as empirical research, educational initiatives, and prototype development.
- **Central Banks:** A significant number of central banks are currently engaged in the exploration and development of their own CBDCs. These digital incarnations of sovereign currencies are primarily designed to augment payment systems, curtail transaction expenses, and promote financial inclusivity. Nonetheless, central banks are approaching this undertaking with judicious deliberation, taking into account the potential repercussions on monetary policy, financial stability, and the established financial infrastructure.

3.4. Level of Financial Development and Digitalization of Currencies

The degree of financial sector development within a nation can have a substantial influence on the process of digitalizing currencies, particularly in countries that are members of the OIC. The establishment of a robust financial sector lays a solid groundwork for the acceptance and effective execution of digital currencies.

The degree of financial sector development within a nation significantly impacts the progress and advancement of CBDCs. The impact is notably prominent in nations belonging to the OIC countries and is influenced by various significant elements (Kozińska, 2022). The resilience of a country's financial infrastructure is a crucial factor. In nations with sophisticated financial infrastructures, the integration of CBDCs can be achieved with greater ease due to the utilization of pre-existing payment systems, digital banking capabilities, and infrastructure to allow CBDC transactions. On the other hand, in countries with underdeveloped financial infrastructure, substantial expenditures may be necessary to provide the essential technology framework for CBDCs, potentially leading to a protracted implementation timeline (Buckley & Trzecinski, 2023).

The regulatory framework also holds significant importance in the development of CBDCs. The establishment of a well-defined and robust regulatory framework is important in order to guarantee the stability, security, and legality of CBDC operations. Nations that possess well-

established regulatory frameworks are more adept at tackling concerns pertaining to anti-money laundering (AML) and know-your-customer (KYC) adherence, safeguarding consumer interests, and mitigating fraudulent activities (Bindseil, 2019). The inclusion of these elements is crucial for the widespread acceptance and establishment of CBDC, as well as for fostering confidence and reliance among its users. On the other hand, nations that do not possess a strong regulatory framework may be required to dedicate substantial resources and time towards the establishment and enforcement of essential legislation, which might potentially result in a delay in the adoption of CBDCs (Wang & Gao, 2023).

The level of financial sector development is closely linked to financial inclusion. In countries with well-developed financial infrastructures and services, a significant portion of the population already has access to banking and digital payment options. The introduction of CBDCs in such environments may complement existing services and further enhance financial inclusion. In contrast, in countries with underdeveloped financial sectors, CBDCs might be seen as a means to bridge the financial inclusion gap by providing a secure and accessible digital payment solution to underserved populations (Ozili, 2023).

Moreover, the viability of CBDC schemes is highly influenced by economic conditions. In nations characterized by robust and enduring economic conditions, there is a likelihood of greater availability of resources for the purpose of investing in research, development, and implementation of CBDC. These countries may also possess a stronger motivation to initiate CBDCs in order to foster financial inclusivity, improve the efficacy of monetary policies, and decrease transaction expenses (Ozili, 2022). On the other hand, nations confronted with economic difficulties or crises may give precedence to alternative financial and fiscal strategies instead of focusing on the development of CBDCs, thus impeding or even dissuading their progress.

The payment ecosystem in a given country holds significant importance. In nations possessing a robust electronic payments framework, encompassing card-based transactions and digital wallets, it is plausible that a significant level of acquaintance and confidence in digital financial exchanges has already been established (Opare & Kim, 2020). The familiarity of users with digital payment systems can potentially enhance the implementation of CBDCs. On the other hand, in areas where physical currency continues to be widely used and electronic payment systems are not as common, the adoption of CBDC may necessitate more substantial

endeavors to educate and facilitate the shift of users to digital forms of currency (Banerjee & Sinha, 2023).

Financial sector development can also influence public trust in CBDCs. In countries with a well-established and trusted banking system, users may be more inclined to embrace CBDCs as an extension of the existing financial system (Hamza & Ben Jedidia, 2019). However, in regions where the banking sector is less trusted or has experienced instability, building public confidence in CBDCs may require additional efforts, such as transparency in CBDC operations and robust customer support. The integration of CBDCs into the international financial system and cross-border transactions can be impacted by the level of financial sector development. In countries with advanced financial infrastructure, it may be easier to connect CBDC systems to global payment networks and facilitate cross-border transactions. In contrast, countries with less developed financial systems may face challenges in establishing the necessary international interoperability, potentially limiting the utility of their CBDCs for cross-border trade and remittances.

The findings of Auer et al.'s (2020) ordered probit analysis substantiate the aforementioned observations, demonstrating that pivotal determinants in the adoption of CBDCs encompass parameters associated with financial development and inclusion. Specifically, variables such as GDP per capita, account ownership, and the degree of financial development emerge as significant contributors to the propensity for CBDC adoption. In addition to these financial aspects, factors exhibiting a favorable impact on CBDC adoption encompass government effectiveness, the robustness of digital infrastructure, and the capacity for innovation.

3.5. Shari'ah Perspective on Digital Currencies

Following an extensive examination of Islamic perspectives concerning the nature of money, Qadri (2023) has introduced a holistic framework for appraising the compliance of cryptocurrencies (or digital currencies) with Shari'ah principles. This framework encompasses both internal and external parameters, serving as fundamental criteria for evaluating the adherence of digital currencies to Islamic financial principles and ethical norms. This evaluation framework can be of significant importance to stakeholders in the cryptocurrency industry, regulators, and scholars seeking to understand the compatibility of these digital assets with the Shari'ah.

Hence, the **internal parameters** include acceptability of a currency as a form of payment, medium of exchange, and store of value.

1) **Acceptability**: For a currency to be Shari'ah-compliant, it must be embraced as a legitimate form of payment, thus allowing it to fulfill its intended purpose.
2) **Medium of Exchange**: A Shari'ah-compliant digital currency should not only be accepted but should also effectively function as a medium of exchange. This involves possessing attributes such as speed, scalability, and low transaction costs. These features are essential to facilitate secure, efficient, and cost-effective transactions.
3) **Store of Account**: Another vital internal parameter pertains to the currency's ability to serve as a reliable store of account over time. Stability and predictability in terms of its purchasing power and value preservation are paramount. This attribute is particularly relevant when considering the use of currencies in financial planning, wealth management, and long-term financial transactions.

Meanwhile, the **external parameters** include the following dimensions**:**

1) **Legal Tender**: Legal recognition is a fundamental requirement to ensure that the currency aligns with Shari'ah principles, thus serving as a means of settling debts and financial obligations.
2) **Compliance with Regulatory Requirements**: Shari'ah-compliant cryptocurrencies should adhere to relevant regulatory guidelines established by authorities within the jurisdiction where they operate. These regulations address critical issues related to consumer protection, financial stability, and alignment with Shari'ah principles. Compliance with these regulatory requirements is essential to ensure ethical and lawful digital transactions.
3) **Stability**: This entails avoiding excessive fluctuations in value, which could jeopardize the purchasing power of the currency. Stability is crucial for a currency to function effectively both as a medium of exchange and as a reliable store of value.
4) **Gambling and Speculation**: Islamic finance principles prohibit engaging in speculative transactions resembling gambling and excessive uncertainty. Thus, the currency transactions should not involve speculative elements or excessive risk. Transactions that are purely speculative or entail high uncertainty may be considered non-compliant with Shari'ah principles.

5) **Technology Risk Mitigation**: To ensure the Shari'ah compliance of digital currencies, robust security measures and governance frameworks should be in place to safeguard against potential risks and vulnerabilities. This includes protecting against hacking or unauthorized access and adopting governance frameworks that ensure transparency, accountability, and ethical conduct.
6) **Transparency and Disclosure**: Users should have access to comprehensive information about the digital currency's technology, transactions, and financial aspects. Transparency fosters trust and ensures that users can make informed decisions in accordance with Shari'ah principles.
7) **Asset-Backed Nature**: Some scholars recommend that Shari'ah-compliant digital currencies should be backed by tangible assets, such as commodities or real estate. This asset backing provides stability and reduces speculative elements. However, it is worth noting that opinions vary, and some scholars consider central authority issuance as a substitute for this parameter.

In summary, both internal and external parameters are required to assess the compliance of digital currencies with the Shari'ah. Each parameter plays a vital role in ensuring that a digital currency aligns with the ethical and financial principles of Islamic finance.

The CBDCs have emerged as a significant development in the financial landscape, sparking extensive discussions and debates within the realm of Islamic finance. CBDCs, being digital representations of a nation's fiat currency, possess attributes and principles that align closely with those desired in a Shari'ah-compliant currency. In an evaluation framework by Qadri (2023), CBDCs have received full scores, reflecting their favorable alignment with Shariah parameters. Several factors contribute to this alignment between CBDCs and Shari'ah principles:

1) **Centralized Issuance**: CBDCs are typically issued by a central bank, a concept that resonates with the idea of a centralized authority responsible for currency issuance. This centralized issuance ensures effective governance and regulatory oversight, crucial from a Shari'ah compliance perspective.
2) **Legitimate Authority**: Shari'ah-compliant currencies should be issued by a recognized legitimate authority under the Islamic legal system. Central banks, responsible for managing monetary policy and currency, fulfill this requirement, enhancing the credibility of CBDCs.

3) **Backing by Sovereign Assets**: CBDCs are usually backed by a country's sovereign assets, including reserves or the underlying fiat currency. This tangible backing enhances stability and reduces speculative elements, aligning with Shari'ah principles.
4) **Acceptance as Legal Tender**: CBDCs are designed to be accepted as legal tender for all transactions within their jurisdiction, in accordance with the Shari'ah principle of acceptability. This widespread acceptance ensures their effective use as a medium of exchange.
5) **Compliance with Shari'ah Principles**: Central banks can incorporate Shari'ah principles and guidelines into the design and implementation of CBDCs, including avoiding interest-based transactions and adhering to ethical norms.

CHAPTER IV: CASE STUDIES and SURVEY ANALYSIS

This chapter presents case studies on five countries, one of which is a non-OIC country, based on their region, level of financial sector development and digitalization. The selected countries are examined in detail, focusing on their efforts in CBDCs, considering their legal and regulatory framework, as well as current initiatives, coverage, challenges, and issues. It reviews their legal regimes and systems with a brief background information on their economies, and assesses their current state of digitalization efforts towards digital currencies. It also evaluates the needs, challenges, and trends in each case country on the subject matter, including legal, regulatory, and technical challenges. The lessons learnt from each case country are examined, and good practices of leading countries for knowledge and experience sharing are analyzed to identify ways and means for transferring knowledge and increasing cooperation between OIC member countries. Specific recommendations and needs are given for each case study, and these recommendations as well as identified needs are used to derive general advice for all the OIC member countries.

4.1. Indonesia

4.1.1. Background Information

- Group: Asian
- OIC Membership: Yes
- Legal System: Mixed (Shariah Law and English Common Law)

In 1951, national fervor gained momentum for the establishment of a central bank as a form of economic sovereignty in the Republic of Indonesia. Consequently, the Government decided to establish the DJB Nationalization Committee. The nationalization process was implemented by the Government of the Republic of Indonesia purchasing 97% of DJB shares. On 1st July 1953, the Government of the Republic of Indonesia issued Act No. 11 (Principal Act on Bank Indonesia), which superseded the DJB Act of 1922. On 1st July 1953, therefore, Bank Indonesia was officially established as the Central Bank of the Republic of Indonesia. Act No. 11 of 1953 contained the first laws regulating Bank Indonesia as the central bank. Bank Indonesia's duties were no longer restricted to circulation activities but were expanded to include commercial banking activities by providing loans. In accordance with Act No. 13 of 1968 concerning Bank Indonesia, Bank Indonesia was no longer permitted to disburse commercial loans, yet retained

the functions as state treasurer and development agent. Bank Indonesia issued a banking deregulation policy package, known as the 27th October 1998 Policy Package, otherwise known as Pakto 88 or Pakto 27. The monetary crisis that befell Asia in 1997 forced Bank Indonesia to implement extraordinary crisis resolution policy measures, including the introduction of a floating exchange rate regime, the closure of troubled banks and restructuring of unhealthy banks. Bank Indonesia gained central bank independence in accordance with Act No. 23 of 1999. The People's Representative Council (DPR) enacted Act No. 3 of 2004 as an amendment to Act No. 23 of 1999 concerning Bank Indonesia. The amendment affirmed Bank Indonesia's status as an independent central bank, refining regulations concerning the duties and responsibilities as well as the legal arrangements of the supervision function.

Indonesia is a country that has a growing interest in digital currencies. The Bank of Indonesia has issued several warnings about the use of digital currencies, citing concerns about their volatility and the potential for illegal activities such as money laundering and terrorism financing. Despite these warnings, the use of digital currencies in Indonesia continues to grow. One of the factors contributing to the growth of digital currencies in Indonesia is the country's large young population and rapidly growing middle class. These groups are tech-savvy and have a high level of comfort with new technologies, including digital currencies. In addition, Indonesia has a large unbanked population, and digital currencies offer a way for these people to participate in the financial system without having to go through traditional banking channels. Another factor that is driving the growth of digital currencies in Indonesia is the country's large remittances market. Many Indonesian workers abroad use digital currencies to send money back to their families in Indonesia, as they offer lower transaction fees and faster transaction times compared to traditional remittance services. In addition, digital currencies offer greater transparency and security compared to traditional remittance services, which are often subject to fraud and corruption. In conclusion, digital currencies are gaining popularity in Indonesia, despite the warnings from the central bank. This growth is driven by factors such as the country's large young and tech-savvy population, its large unbanked population, and the large remittances market. While there are certainly risks associated with the use of digital currencies, the potential benefits, particularly for the unbanked and those in the remittances market, make it an attractive option for many in Indonesia. As such, it will be important for the government and financial institutions to find a way to address the risks associated with digital currencies while also capitalizing on their potential benefits.

Indonesia's foray into the CBDCs stands as a benchmark for many, given its unique and innovative approach. What makes the implementation of the CBDC in Indonesia noteworthy is the blend of meticulous strategy and adaptability by Bank Indonesia, the nation's central monetary authority, as it navigates the intricacies of introducing Digital Rupiah (Bank Indonesia, 2022). To thoroughly understand and capture the essence of Indonesia's approach, this study engaged with regulatory bodies and experts in the domain of digital currencies, and a diverse cross-section of the Indonesian populace. Their profound domain knowledge and expertise provide nuanced insights into the design, deployment, and potential challenges of Digital Rupiah, adding depth to our understanding. Their perspectives were invaluable in charting the anticipated reception from financial consumers, the foundational objectives driving Digital Rupiah's contemplation, and the potential lessons other nations can draw from Indonesia's pioneering work on Digital Rupiah.

The 2020 census recorded Indonesia's population as 270.2 million, Indonesia remains not only Southeast Asia's most populous country but also the world's fourth (BPS, 2020). Indonesia's stature as a dominant economy within the ASEAN framework, combined with its pioneering CBDC implementation, underscores the global significance of its Digital Rupiah. The introduction of Digital Rupiah is more than a regional milestone; it serves as a paradigm in the broader context of CBDCs worldwide, highlighting Indonesia's readiness to embrace digital economic transformation (Bank Indonesia, 2022). Delving into this subject is not only primed to equip ASEAN member states with invaluable knowledge, increasing collaborative ethos within the regional fabric, but also a case study for the OIC member countries to understand how cultural, financial, and religious norms can be integrated into a CBDC framework.

As a pivotal ASEAN and OIC member, Indonesia's strides towards CBDCs carry both regional and international weight. Its position within the OIC has added layers of complexity, ensuring the alignment of digital monetary practices with Islamic financial principles (Kemlu, 2022). However, the Bank of Indonesia faced multifaceted challenges in its digital transition, from ensuring interoperability with existing financial systems to addressing concerns regarding data privacy and system resilience (Ahmadi, 2013).

In terms of digital infrastructure, while data from 2021 pinpointed Indonesia's Internet penetration at 64%, the rate increased to 68% in 2022, reflecting an upward trajectory in digital accessibility (Statista, 2021). By the fourth quarter of 2022, approximately 185 million of Indonesia's population were Internet subscribers, further showcasing the nation's rapid digital

adoption. Such figures bolster the notion that Indonesia possesses substantial potential to drive financial inclusion through fintech solutions, with the Digital Rupiah being a pivotal instrument (Kemp, 2022). Simultaneously, the prevalence of mobile Internet users in the archipelago is a testament to the nation's digital readiness. Given the sizable adult demographic equipped with mobile devices, Bank Indonesia's move towards Digital Rupiah could be an orchestrated effort to amplify financial inclusion (Bank Indonesia, 2022).

The 2022 Crypto Adoption Index, compiled by Chainalysis (2022), offers a comprehensive assessment of Indonesia's standing in the global cryptocurrency landscape. In the overall index, Indonesia secures the 20th position, reflecting its notable presence in the cryptocurrency market. Furthermore, when it comes to both centralized and retail centralized service value reception, Indonesia maintains the 16th rank, indicating a robust engagement with these services.

In the realm of peer-to-peer (P2P) exchange trade volume, Indonesia holds the 129th position, suggesting a comparatively lower level of direct P2P cryptocurrency trading activity. This implies a preference for more centralized modes of exchange.

In terms of decentralized finance (DeFi) value received, Indonesia secures the 18th rank, indicating its active participation in DeFi transactions. This suggests a growing interest in innovative financial services and protocols that operate outside traditional financial systems.

Additionally, when focusing on the retail aspect of DeFi value received, Indonesia achieves the 13th rank. This highlights a significant adoption of DeFi services by everyday users, underlining the increasing popularity and accessibility of decentralized financial solutions in the country.

These rankings collectively provide a detailed snapshot of Indonesia's position in the global cryptocurrency landscape, reflecting its level of involvement and proficiency across various segments of the cryptocurrency market.

4.1.2. Monetary and Payment Systems

In the aftermath of the unprecedented digital transformation accelerated by the COVID-19 pandemic, our global economic fabric has seen a marked shift towards digital domains, spurred by vital measures such as social distancing. This change led to a surge in digital assets, notably DeFi and the Metaverse, heralding an era aptly termed "cryptoization." This metamorphosis

prompted central banks globally, with Bank Indonesia taking the lead, to re-evaluate their operational tactics and approaches, particularly considering the growing prominence of digital payment systems (McKinsey, 2020).

The Indonesian Bureau of Statistics (NBS) reported a sharp increase in Indonesia's inflation rate, peaking at 9.37% in March 2023, a figure unfortunately not far from February's similarly elevated rate. This, coupled with a monetary policy rate of 7.50% by March 2023, highlights the significant economic hurdles faced by the nation (Bank Indonesia, 2023). A concerning statistic is the 24% of the Indonesian population, or roughly 62 million individuals, living below the poverty line, even as the country reported a GDP growth rate of 5.2% for 2022 (Statista, 2023).

Bank Indonesia has been proactive in response to these multifaceted economic challenges. Their primary objective is stabilizing the economy by neutralizing the impacts arising from volatilities in both the global and local economic milieus. This entails a dual approach: adjusting the monetary policy and revamping the payment systems in the context of the Digital Rupiah's impending implementation.

The actions of the Bank Indonesia extend beyond mere adjustments to monetary policy. They have set their sights on broader payment system reforms aiming to enhance the technological backbone of electronic payments (Bank Indonesia, 2020). Digital Rupiah is positioned as a trailblazer in this domain. Nevertheless, other concurrent reforms were equally important.

In this sprawling digital backdrop, the CBDC has taken its center stage. CBDCs, grounded in the foundational role of central banks, aspire to serve the masses, while simultaneously safeguarding the stability and resilience of the broader financial system. However, the journey to CBDC assimilation is fraught with obstacles, demanding a well-thought-out strategy that adheres to foundational tenets such as "do no harm" and promotes innovation (McKinsey, 2023).

Bank Indonesia's “Project Garuda” symbolizes the country's aspirations in these transformative times. This initiative, designed as a precursor to Digital Rupiah, embodies the institution's ambition to navigate the intertwined realms of the digital economy and finance proficiently. This project sought to stabilize monetary conditions, transform the payment landscape, and strengthen Indonesia's position in the global digital finance realm. With a three-pronged objective for the Digital Rupiah—legalizing it as an official digital payment method in Indonesia, serving as a cornerstone tool for the bank's contemporary mandates, and being a

conduit for financial inclusivity, technological innovation, and holistic efficiency—"Project Garuda" is a sign of the dawning of a new financial era (Bank Indonesia, 2022).

4.1.3. Digital Rupiah: Indonesia's Central Bank Digital Currency

4.1.3.1. Background

In response to the burgeoning global trend of digitalization and recognizing the strategic significance of securing financial infrastructure, Bank Indonesia embarked on the innovative journey of conceptualizing Digital Rupiah. This initiative parallels Indonesia's concerted efforts to strengthen its payment system infrastructure, deepen financial inclusion, and combat shadow banking challenges, thus promoting a holistic digital financial ecosystem (Bank Indonesia, 2022).

Digital Rupiah is a manifestation of the nation's endeavor to amalgamate modern technology with the traditional essence of fiat currency. Analogous to its physical counterpart, Digital Rupiah is designed to serve as a legal tender, emphasizing the primacy and sovereignty of the Indonesian financial structure. However, it provides an advantage in traceability by facilitating real-time monitoring, which is a significant advantage over physical currency. Within the existing legal framework, its issuance and regulation are under the auspices of Bank Indonesia. Bank Indonesia envisions Digital Rupiah as a cornerstone in shaping Indonesia’s future monetary policy, ensuring it aligns with the country's digital transformation aspirations. As an innovative medium of exchange, unit of account, and store of value, Digital Rupiah reflects the evolving dynamics of the nation's monetary landscape (Bank Indonesia, 2022).

According to Bank Indonesia (2022), several benefits are associated with Digital Rupiah:

1) **Augmenting Economic Vibrancy.** Emphasizing affordability and cost-effectiveness, Digital Rupiah aims to catalyze economic activities by democratizing access to financial services undergirded by a seamless digital platform.
2) **Safeguarded and Economical Remittance Services.** In a nation like Indonesia, where overseas remittances play a cardinal role, Digital Rupiah seeks to provide a more economical, expedient, and secure remittance mechanism.
3) **Reinforcing Surveillance over Unlawful Financial Activities.** Digital Rupiah is endowed with features to facilitate real-time monitoring, augment transparency, and mitigate risks associated with fraudulent transactions.

4) **Streamlining Social Welfare Disbursements.** With an increasing emphasis on social welfare programs, Digital Rupiah ensures that financial aid reaches beneficiaries swiftly, transparently, and efficiently, potentially minimizing fiscal discrepancies.
5) **Amplifying Financial Inclusion.** With Indonesia witnessing an uptick in Internet and smartphone users, Digital Rupiah could act as a linchpin, integrating the traditionally financially marginalized segments with mainstream banking tapestry.
6) **Revitalizing Domestic and Global Commerce.** The introduction of Digital Rupiah, heralding instantaneous, secure, and economical transactions, invigorates both local and international trade dynamics.
7) **Guaranteeing Currency Authenticity.** The integration of avant-garde technologies, such as DLT, ensures that the Digital Rupiah remains impervious to counterfeiting attempts.
8) **Facilitating Effective Revenue Accumulation.** By bridging the gap between fiscal and monetary policies, Digital Rupiah envisages a transformative approach to instantaneous revenue collection upon transactions.
9) **Stimulating Innovation in Financial Services**. Digital Rupiah can serve as a foundation for financial innovation, enabling the development of novel financial products and services that are not feasible using traditional money.
10) **Reducing Transactional Friction**. Digital Rupiah can significantly decrease transaction times and costs, especially cross-border transactions, and provide a smoother experience for both consumers and businesses.
11) **Promoting Economic Resilience.** By offering diversification from traditional financial systems, Digital Rupiah can provide a buffer against economic shocks, ensuring a level of stability during economic downturns.
12) **Increasing Monetary Policy Precision**. With the granular data provided by digital transactions, the central bank can gain a more nuanced and accurate understanding of economic activities, enabling more precise and timely monetary interventions.
13) **Encouraging Financial Literacy**. The push for digital currency can be accompanied by nationwide initiatives to improve financial literacy, ensuring that all citizens, especially the previously marginalized, are equipped to navigate the digital financial world safely and efficiently.

14) **Strengthening Data Security.** By leveraging state-of-the-art encryption and security measures, Digital Rupiah can ensure user data protection and transactional security, reinforcing public trust in digital transactions.

The introduction of Digital Rupiah also played a vital role in amplifying the effectiveness of the nation's monetary policy. By providing a digital trace of every transaction, the Central Bank can adjust monetary policies in real time based on the vast amount of data available, ensuring more responsiveness to economic trends and shifts. Digital Rupiah's inception reflects Indonesia's strategic vision, not only in adapting to the digital era but also in pioneering revolutionary financial paradigms for the future. With the rise in Internet and smartphone penetration, it is evident that Digital Rupiah is perfectly poised to revolutionize Indonesia's financial landscape, bridging the gap between technology and the economy.

4.1.3.2. Legal and Regulatory Framework

Digital Rupiah, supported by the overarching legal frameworks of the Republic of Indonesia, is established as a digital legal tender regulated by Bank Indonesia (BI). The BI's authority to issue such currencies is granted by Act number 23 of 1999 as amended by the Act number 6 of 2009 (Bank Indonesia, 2022).

In tandem with these legislative and operational guidelines, Project Garuda is a pioneering initiative that emphasizes Digital Rupiah's stature as a digital legal tender. The project reiterates BI's unequivocal role as the sole issuer of legal tenders in Indonesia. Project Garuda is more than just a response to the digital finance trend; it is a forward-looking measure to bolster Indonesia's global stance, seamlessly merging digital finance with the broader economy and hastening the embrace of digital financial inclusion. Through Project Garuda, BI envisions Digital Rupiah as the premier digital payment method in Indonesia, allowing them to fulfill their legal duties in this digital era. To achieve this vision, Bank Indonesia is gearing up to release a range of policies and guidelines that will cover various areas, including its use as a settlement tool for customer protection, operational risk management, and compliance with AML/CFT requirements.

4.1.3.3. Underlying Technology: Technical and Operational Standards

Digital Rupiah's foundation relies on DLT, which is fundamentally rooted in blockchain. The BI championed the use of DLT for Digital Rupiah, opting for a private blockchain system, more specifically, Hyperledger Fabric. This choice sets Digital Rupiah apart from traditional

cryptocurrencies, which often use decentralized public blockchains. The permission-based nature of Digital Rupiah's blockchain ensures a controlled and regulated environment as opposed to the decentralized nature of most public blockchains. This oversight is a direct result of BI's leadership and governance of Digital Rupiah's private blockchain, ensuring stringent access controls and increased security (World Bank, 2018).

The choice to use Hyperledger Fabric is not arbitrary; open-source DLT is renowned for its modular architecture, which offers a steadfast security framework. This security design is crucial for BI to ensure integrity while overseeing Digital Rupiah wallets. BI works closely with authorized financial institutions and integrates them as vital network nodes. These institutions play a pivotal role in Digital Rupiah's distribution by facilitating smooth transactions with currency users. Additionally, these financial bodies are central in interfacing the Digital Rupiah with existing payment structures, acting as a bridge between traditional banking and this digital innovation (Frankenfield, 2023).

According to Bank Indonesia (2022), Digital Rupiah consists of a multi-tiered technological framework comprising three layers: technology platform, digital assets, and potential use cases. The platform is meticulously crafted to enhance the resilience of Digital Rupiah, focusing heavily on safety and instant access for users.

A groundbreaking feature is its offline functionality, geared towards enhancing financial inclusion, particularly in economically marginalized areas. This feature, combined with potential developments, such as programmability via smart contracts, sets the stage for Digital Rupiah to lead financial tech innovations. The potential tokenization of securities on this platform hints at a future in which market deepening and more integrated financial ecosystems become the norm.

Considering the global shift towards CBDCs, Digital Rupiah's design might be a catalyst for discussions on global transactions and possible collaborations with other CBDCs. The aim is not just to revolutionize payment and transaction systems locally but also to make strides in the global financial landscape. Digital Rupiah seeks to be more than just a digital currency; it strives to redefine financial systems both at home and abroad. However, details of its role in cross-border or FX transactions and how fintech companies and mobile money operators would engage with its ecosystem remain unspecified in this discourse.

4.1.3.4. Anti-Money Laundering/Combating the Financing of Terrorism (AML/CFT)

Digital Rupiah, symbolic of Indonesia's progressive digital financial shift, is slated to function within a strict regulatory framework. Bank Indonesia envisions a comprehensive, recurring evaluation of a currency that encompasses diverse parameters such as monetary, macroprudential, market deepening, and legal perspectives. The essential to these evaluations is the goal of enforcing robust operational risk management, customer protection, data privacy, and upholding financial integrity. Predominantly, the design and roll-out of Digital Rupiah emphasize unwavering compliance with AML/CFT guidelines (Bank Indonesia, 2022).

One of the pivotal strategies of the Bank Indonesia is to promote traceability in transactions. To realize this, Digital Rupiah is bifurcated into two access models: account-based and token-based. The token-based variant offers granular data on transactions through information archived on the wallet addresses. This promotes a higher degree of oversight and ensures a more controlled and transparent transactional environment. W-Digital Rupiah, tailored for intricate financial market dealings, uses this token-based verification. It complements the existing Bank Indonesia Real Time Gross Settlement (BI-RTGS) account-based systems (Bank Indonesia, 2022).

On the other hand, R-Digital Rupiah provides dual transactional pathways: account and token-based. For transactions below a specific value, a token-based system has been implemented, providing flexibility similar to that of traditional banknotes. However, for transactions that exceed this cap, account-based R-Digital Rupiah is leveraged. Owing to the rigorous scrutiny and compliance prerequisites for substantial transactions, this model aligns well with AML/CFT guidelines. The Bank Indonesia's layered approach to Digital Rupiah, emphasizing both token- and account-based models, seeks to address common AML/CFT concerns inherent in CBDCs (Bank Indonesia, 2020). While all financial entities interfacing with Digital Rupiah are expected to adhere to AML/CFT guidelines, the Bank Indonesia's robust strategy places Digital Rupiah in a unique position relative to other digital currencies for transactional transparency and traceability.

4.1.3.5. The Rate of Adoption

Digital Rupiah, as part of Indonesia's evolving digital financial infrastructure, will be introduced in two primary formats: wholesale Digital Rupiah (w-Digital Rupiah) and retail Digital Rupiah (r-Digital Rupiah). A cohesive, integrated end-to-end strategy will underscore its

development, with w-Digital Rupiah being prioritized at the outset to establish a foundational basis for the entire Digital Rupiah ecosystem. The bifurcation into wholesale and retail dimensions significantly amplifies the potential scope for adoption. Specifically, w-Digital Rupiah's incorporation into the wholesale market is poised to catalyze the advancement of financial markets and seamless integration of the digital economy and financial systems. Contrary to popular misconceptions, Digital Rupiah is not intended to replace, but rather to complement, traditional financial instruments such as banknotes, coins, and third-party reserves held by Bank Indonesia. It functions as a risk-free settlement asset, cementing its role as a direct claim by its holder against Bank Indonesia. This is analogous to the mechanism and user base of the existing central bank money. While w-Digital Rupiah's accessibility is constrained to specific entities earmarked by Bank Indonesia, obtaining it necessitates these entities to convert their reserves to Bank Indonesia. As a result, the w-Digital Rupiah merely recalibrates the composition of Bank Indonesia's monetary liabilities without affecting the overall dimensions of its balance sheet, thereby ensuring monetary equilibrium (Bank Indonesia, 2022).

Conversely, the r-Digital Rupiah is designed to cater to the broader public, serving a function akin to conventional banknotes and coins. The general populace acquires r-Digital Rupiah by trading in their banknotes, coins, bank deposits, or e-money balances via intermediary entities. These intermediaries, in turn, would utilize their w-Digital Rupiah reserves to satisfy consumer demand, a system reminiscent of the existing protocols associated with banknotes and coins. Importantly, the repercussions of the r-Digital Rupiah issuance on the financial ledgers of Bank Indonesia, commercial banks, and non-bank e-money issuers are anticipated to mirror the extant procedures governing the transition from bank deposits or e-money balances to physical currencies (Bank Indonesia, 2022). A pivotal determinant of Digital Rupiah's successful adoption is rigorous adherence to cybersecurity standards. Recognizing the indispensable role of cybersecurity in Digital Rupiah's evolution, it is imperative to assist and prioritize this component from the inception of the project.

4.1.4. Digital Rupiah: Needs, Challenges, and Trends

Amid the burgeoning interest in CBDC, expert interviews, comprising industry professionals, academicians, and policymakers, were conducted to provide insight into Digital Rupiah's evolution. Exploration of Digital Rupiah's implementation will be essential as it highlighted

Indonesia's commitment to enhancing financial democratization and understanding public sentiment.

Dominant mobile money ecosystems have gained traction, particularly among unbanked Indonesians. Their facile accessibility without the requisites of conventional banking raised concerns about Digital Rupiah's adoption. From an infrastructural standpoint, the necessity for stalwart IT systems in CBDC's success of CBDCs was accentuated. Regions in Indonesia grapples with inconsistent internet connectivity and energy access, potentially stifling Digital Rupiah's expansive reach (Aron, 2018). These technological challenges, paired with public concerns about the CBDC's complexities and hesitancy to use it for significant financial transactions, reflect the challenges ahead.

Banking professionals accentuated robust regulatory frameworks and state-of-the-art technological solutions, considering the dynamic nature of CBDCs. They projected CBDCs as potential game changers in the conventional financial realm. While retail banking could experience disruptions, their significance, especially in wholesale banking, remains incontrovertible (Patnam & Yao, 2020). The Bank of Indonesia's stratified payment model underscores traditional banks' pivotal role in dispersing Digital Rupiah, highlighting their essence in navigating the bridge between old and new financial systems.

Digital Rupiah is emblematic of the technological resurgence in financial transactions. Grounded in its design are principles such as Velocity and Security and safeguarding against a gamut of operational risks. Public opinion indicated mixed feelings on Digital Rupiah against unregulated digital currencies, with the majority expressing curiosity and a wait-and-see approach. Digital Rupiah's design, while future-focused, faces skepticism about whether current technological tenets can meet the intricate design stipulations.

In 2022, a notable stride was the G20 TechSprint 2022 hackathon, incepted by Indonesia's G20 Presidency. Collaboratively envisioned by Bank Indonesia and the Bank for International Settlements Innovation Hub (BISIH), this initiative rigorously analyzed CBDC facets (BIS, 2022). Digital Rupiah's structured design, enriched by features such as smart contracts, envisions trailblazing financial innovation. The 3i connectivity model emphasizes the Digital Rupiah's synergy with Financial Market Infrastructures (FMIs), promoting a seamless interplay between diverse payment systems and other digital asset paradigms (Bank Indonesia News Release, 2022).

4.1.5. Lessons Learnt

Indonesia's journey with the Digital Rupiah serves as an invaluable guide for nations delving into CBDCs. Recognizing the diversity in economic and technological landscapes across countries, Indonesia's strategy underscores the importance of a bespoke phased implementation. A tiered approach was embraced to systematically counter challenges, such as technological glitches and user adoption rates.

This detailed approach was not merely technical, but intricately woven into Indonesia's broader financial system. Digital Rupiah was seamlessly integrated with initiatives such as the Blueprint for Indonesian Payment System (IPSB) 2025, portraying Bank Indonesia's foresight in aligning CBDCs with national digital agendas. Such alignment is vital for the CBDC to not just serve as a standalone digital currency, but also to actively complement and propel a nation's overarching goals, catering even to the unbanked and underserved.

The lessons learnt from Digital Rupiah's journey encompass multiple facets:

1) **Phased Implementation**: Gradual rollouts allow for comprehensive testing and adjustments at each stage, thus minimizing risks.
2) **Collaborative Approach**: Engaging with diverse stakeholders, both nationally and internationally, is pivotal for smooth adoption and addressing challenges.
3) **Alignment with National Initiatives**: CBDCs should reinforce and boost national objectives for a cohesive digital economy.
4) **Upholding Central Bank Attributes**: Despite digital transformation, maintaining attributes, such as stability, safety, and efficiency, is paramount for public trust.

However, although these lessons are crucial, they also highlight the importance of considering specific country contexts. Existing financial infrastructure, stakeholder alignment, socio-political backdrops, and the populace's digital readiness play an indispensable role in CBDC's success. For instance, a country's population size can affect its scalability and adoption strategies. Additionally, the design of a CBDC in terms of replicating paper currency attributes and interest yields requires careful deliberation.

Furthermore, financial literacy is linked to CBDC adoption. Equipping the populace with knowledge ensures that they understand, trust, and effectively utilize digital currency. In contrast to CBDCs with cryptocurrencies, it is evident that, while both are digital, CBDCs such as Digital Rupiah are designed with stability in mind, shielded from the extreme volatilities often

associated with cryptocurrencies. In addition, international cooperation is vital. As economies become more intertwined in the age of globalization, ensuring that CBDC systems can interoperate and align with international trade dynamics will be crucial for their success and relevance in the global market. This accentuates the need for robust international collaborations and a shared vision of the future of digital currencies.

In conclusion, as countries venture into the realm of CBDCs, drawing from Indonesia's experience can offer a roadmap with the understanding that each nation must carve its path attuned to its unique landscape.

4.1.6. Country-Specific Policy Recommendations

Bank Indonesia's Project Garuda has transcended the central bank initiative. This signifies an embodiment of national pride with the aim of protecting the sovereignty of the Rupiah. To ensure success, a holistic, cross-sectoral ecosystem is essential, embracing every stakeholder from the supply chain to the end user.

The key components driving this project include the following:

1) **Holistic Engagement**: The evolution of Digital Rupiah is a collaborative endeavor that spans beyond Bank Indonesia. This involves legal alignments that necessitate the participation of both government and parliament. Transparent communication tools such as consultative papers and focus group discussions play a vital role in this engagement.
2) **National Priority Areas**: Project Garuda has a sight set on multifaceted domains. From monetary systems, government transactions, and cyber resilience to integration with Web 3.0 crypto ecosystem, each area is meticulously addressed.
3) **Inter-agency cohesion**: Project Garuda's objectives are met, necessitating seamless cooperation among financial bodies, relevant ministries, and industry stalwarts. Interagency forums are pivotal in enhancing these collaborations.

Parallel to these domestic strides, the international perspective holds an equal gravity. The dawn of CBDCs is reshaping cross-border financial dynamics, emphasizing speed, transparency, and inclusivity. The overarching goal is to simplify these transactions by eradicating intermediaries. Notwithstanding, challenges such as interoperability remain, demanding clear stipulations for currency parameters and liquidity management.

However, lessons learnt from Indonesia's journey with Digital Rupiah are instrumental in charting its path forward. Key recommendations include the following:

- **Promotion of Financial Literacy and Public Awareness:** Before rolling out the Digital Rupiah, it is essential that Bank Indonesia prioritize comprehensive financial literacy campaigns at the grassroots level. Educating the masses about Digital Rupiah's benefits and nuances will not only preempt hurdles related to adoption and trust but also ensure inclusivity. By addressing the barriers to financial exclusion prevalent in various societal segments, CBDCs can be made more inclusive. Additionally, for the population to trust and adopt the new currency, the technological underpinnings of Digital Rupiah need to be simplified and communicated transparently.
- **Phased Introduction of Digital Rupiah:** Commencing with a pilot phase for Digital Rupiah is pivotal. This phase will allow Bank Indonesia to identify challenges, receive feedback, and refine the system before a full-scale launch, thereby ensuring user confidence.
- **Encouraging Adoption through Incentives:** Bank Indonesia could stimulate interest in Digital Rupiah by incentivizing its early users. Preloading a nominal amount into the digital wallets of initial users or offering them service discounts when they use the Digital Rupiah could effectively spur its wide-scale adoption, given the vast Indonesian populace.
- **Government Transactions via Digital Rupiah:** To amplify Digital Rupiah's adoption, it would be beneficial for the Indonesian government to mandate specific government-related transactions and levies to be transacted through it. Offering further incentives, such as discounts for such transactions, would make the transition to new digital currency more appealing. Channeling all government payments through Digital Rupiah could streamline processes, improve transparency, and promote financial digitization.
- **Robust and Scalable Technological Infrastructure:** Catering to Indonesia's sprawling archipelago requires Digital Rupiah's technological infrastructure to be formidable and scalable. It should seamlessly manage large-volume transactions, ensuring a fluid user experience. Bank Indonesia should prioritize investments in cutting-edge infrastructure that is immune to cyber threats. Collaborative endeavors

with technology specialists, both locally and internationally, would be beneficial for crafting a resilient and efficient system.

- **Privacy and Security Measures:** The Digital Rupiah System must uphold rigorous privacy standards to protect users' personal and transactional information. Implementing end-to-end encryption, multifactor authentication, and regular cybersecurity audits will ensure the integrity of the system and users' trust. It is also crucial for Bank Indonesia to collaborate with cybersecurity experts to ensure continuous monitoring and upgrading of security protocols.
- **Partnerships with Financial Institutions:** Bank Indonesia should actively collaborate with local and international banks, and other financial entities. These partnerships can facilitate smoother integration and interoperability of Digital Rupiah with existing financial systems, thus making transactions more streamlined for end-users.
- **Addressing Concerns of Economic Exclusion:** There are concerns regarding the digital divide in various segments of society. The introduction of Digital Rupiah should not alienate those without access to digital resources. Bank Indonesia could consider introducing offline transaction methods or collaborating with local businesses to provide Point-of-Service (POS) transactions for Digital Rupiah.
- **Continuous Feedback and Iteration:** A system for gathering real-time feedback from users is pivotal. By regularly collecting and analyzing this feedback, Bank Indonesia can adapt and fine-tune the Digital Rupiah system to cater to the evolving needs of users.
- **Consumer Redress Mechanisms:** With introduction of a new digital currency system, users inevitably face challenges. Thus, a responsive and efficient grievance-redress mechanism should be implemented. This not only resolves user issues promptly but also builds trust in the Digital Rupiah system.

By considering these recommendations, Indonesia can take a path forward for other nations to emulate, making CBDCs an integral part of a nation's financial ecosystem.

4.1.7. Implications of Policy Recommendations for OIC Member Countries

The evolution towards the adoption and implementation of CBDCs offers transformative opportunities for the OIC member countries. Drawing from the experiences of several nations

that have initiated the CBDC path, informed by multilateral projects led by the BIS and incorporating insights from COMCEC, there is a significant opening for the OIC to create a harmonized framework for the implementation of CBDCs. The pilot project of Digital Rupiah in Indonesia serves as an apt reference point for OIC nations. This pilot can be studied for the best practices, challenges faced, and strategies employed to align the CBDC with Shari'ah principles.

To fully leverage the advantages of CBDCs, there is a need for robust blockchain infrastructure integrated across borders. Cross-border integration is pivotal because it underpins enhanced financial cooperation among OIC nations and serves as a bedrock for secure, transparent, and efficient transactions. Consequently, there is an urgent need for a specialized technical team within the OIC dedicated to devising a comprehensive framework for CBDC deployment across member states.

Simultaneously, to ensure smooth operation of these digital currencies across borders, the OIC should contemplate crafting a regulatory architecture designed specifically for supervising cross-border transactions. COMCEC, in partnership with BIS, can play a vital role in improving collaboration, sharing expertise, and facilitating CBDC implementation among OIC member countries.

One of the most promising forms of CBDCs, particularly for OIC nations, is wholesale CBDCs. These digital currencies can substantially streamline cross-border trade among the member states. The balance of payment disparities can be addressed by enabling the settlement of imports in domestic currencies. Additionally, real-time cross-border foreign exchange transactions through CBDCs can further enhance trade efficiency.

Dispute resolution is one of the challenges faced in the realm of digital transactions. Drawing lessons from Digital Rupiah's dispute management mechanisms, it is evident that, given the foundational role technology plays in CBDCs, it becomes imperative to integrate an automated dispute resolution mechanism. Blockchain's inherent capabilities, especially when bolstered with smart contract protocols, can provide a robust framework for managing and resolving disputes related to CBDC transactions.

In conclusion, collaboration on an international front is indispensable. The emphasis on CBDCs by entities such as the FSB's Cross-Border Payment Coordination group and the G20 Presidency of Indonesia 2022 underscores the global significance of this initiative. OIC member countries can derive valuable lessons from Bank Indonesia's strategies, particularly their

collaboration with international bodies such as the IMF, BIS, and World Bank, as they navigate their journeys towards CBDC implementation.

4.2. Nigeria

4.2.1. Background Information

- Group: African
- OIC Membership: Yes
- Legal System: Civil Law

The mandate of the Central Bank of Nigeria (CBN) is derived from the 1958 Act of Parliament, as amended in 1991, 1993,1997,1998,1999 and 2007. The CBN Act of 2007 of the Federal Republic of Nigeria charges the Bank with the overall control and administration of the monetary and financial sector policies of the Federal Government. The objects of the CBN are as follows: ensure monetary and price stability; issue legal tender currency in Nigeria; maintain external reserves to safeguard the international value of the legal tender currency; promote a sound financial system in Nigeria; and act as Banker and provide economic and financial advice to the Federal Government. Consequently, the Bank is charged with the responsibility of administering the Banks and Other Financial Institutions Act (BOFIA), 2020, with the sole aim of ensuring high standards of banking practice and financial stability through its surveillance activities, as well as the promotion of an efficient payment system. In addition to its core functions, CBN has over the years performed some major developmental functions, focused on all the key sectors of the Nigerian economy (financial, agricultural and industrial sectors). Overall, these mandates are carried out by the Bank through its various departments.

Nigeria is a country that has shown significant interest in digital currencies. Despite some initial skepticism and warnings from the Central Bank of Nigeria about the risks associated with digital currencies, such as their volatility, lack of regulation, and potential for use in illegal activities, the use of digital currencies continues to grow in Nigeria. One of the factors contributing to the growth of digital currencies in Nigeria is the country's large and young population, who are accustomed to the use of new digital technologies. Given the large unbanked and rural population in Nigeria, digital currencies offer a way for these people to participate in the financial system with lower transactions costs and greater accessibility. Another driver of the rapid growth of digital currencies in Nigeria is the country's large and growing remittances market. Quite similar to other cases such as Indonesia and Pakistan, such payment systems and digital currencies offer lower transaction fees and make transactions faster compared to traditional remittance services. In addition, digital currencies offer greater

transparency and security compared to traditional remittance services, which are often subject to fraud and corruption. Finally, a huge geography with indispensable costs of investing in physical infrastructure also give digitalization of financial services an extra momentum.

The case study of Nigeria's implementation of a CBDC stands out, as the country's central bank is among the few regulatory authorities worldwide to have implemented it. Regulatory agencies and commercial banks were interviewed, in addition to a general survey of the Nigerian public, to draw insights from the Nigeria's experience. These interviews aimed to examine the philosophy driving the introduction of the e-Naira, the challenges encountered during its implementation, the reception and adoption rate among financial consumers, and the potential lessons other jurisdictions can learn from the Nigerian initiative. Since Nigeria has implemented a CBDC, it is reasonable to select a sample of experts with comprehensive knowledge of e-Naira's conception, development, and implementation for the interviews.

Nigeria, with a population exceeding 211.4 million, possesses the largest population in Africa (World Population Prospects 2022, 2022). As the leading economy on the continent (Kaminska, 2021; World Bank Open Data, n.d.), Nigeria took a significant step on October 25, 2021, by launching e-Naira, a CBDC that is fully available to the public. The e-Naira marks the second CBDC to be open to the public and presents a compelling case study for analyzing the key challenges and successes of its implementation. Such an examination will yield valuable lessons for other OIC member countries to foster knowledge and experience sharing within the regional block.

As an OIC member country, Nigeria has taken the lead in implementing a CBDC despite encountering certain challenges that the Central Bank of Nigeria (CBN) views as initial obstacles in its efforts to digitize its monetary and payment systems. One crucial aspect of the CBDC infrastructure is internet and mobile phone usage. In 2022, Nigeria had an internet user penetration rate of over 38%, with an estimated 108 million users (Statista, 2022). Similarly, the number of mobile internet users, i.e., individuals accessing the internet through mobile devices, rose to 37.3% in 2022, with over 80.93 million users (Statista, 2022). With over 80% of adults owning mobile phones, the CBN aimed to capitalize on the widespread availability of mobile phones to enhance financial inclusion by introducing the digitally enabled e-Naira (Wezel & Ree, 2023).

Furthermore, leveraging relevant data provided by the National Bureau of Statistics (NBS) on Nigeria's internet subscribers could contribute to deepening financial inclusion through fintech solutions. In the fourth quarter of 2022, the number of internet subscribers in Nigeria reached 154 million, equivalent to 70% of the country's total population (Nigeria Bureau of Statistics, 2023). However, it is worth noting that these statistics should be considered in light of the observation that 66% of active phone lines in the country are dual sim phones (Mirani & Quartz, 2022).

4.2.2. Monetary and Payment Systems

In February 2023, the NBS reported a significant increase in the country's inflation rate, reaching a 17-year high of 21.91% (Nigeria Bureau of Statistics, 2023a). As of March 2023, the current monetary policy rate is 18.50% (Olurounbi & Osae-Brown, 2023). Furthermore, with approximately 133 million individuals, representing 63% of the population, classified as poor (National Bureau of Statistics, 2022), Nigeria's GDP growth rate in 2022 was 3.1% (Nigeria Bureau of Statistics, 2023b).

To understand the developments underpinning the implementation of e-Naira in Nigeria, it is essential to briefly conduct a broad analysis of the country's monetary and payment systems and the associated legal and regulatory frameworks. From the monetary policy perspective, the CBN has recently taken measures to mitigate the adverse effects of systemic shocks on the economy, which were caused by high volatility in both global and domestic economic conditions. Additionally, maintaining the internal and external balance of payments is a key objective of the CBN's monetary policy, which is often achieved through a variety of policies, including monetary instruments.

Beyond the monetary policy reforms implemented by the CBN, significant payment system reforms have also been introduced in the country through carefully designed solutions to enhance the resilience of the technological infrastructure supporting electronic payment methods. Although the eNaira is a significant reform aimed at enhancing the payment system, other recent reforms have significantly transformed the payment systems landscape, including the Real Time Gross Settlement System (RTGS), Shared Agent Network Facility (SANEF), Open Banking, Regulatory Sandbox, and Bank Verification Number (BVN). One such reform is implementing the national card system, which aims to expand electronic payments nationwide and rival global payment cards such as Visa and Mastercard. The National Domestic Card

Scheme is also expected to provide opportunities for integrating the economy's informal sector and promote financial inclusion.

Furthermore, the CBN introduced the eNaira to facilitate payments nationwide to maintain the momentum of this reform. In addition to bolstering monetary stability, the eNaira is also expected to promote the stability of the payment system.

4.2.3. eNaira: The Nigeria Central Bank Digital Currency

4.2.3.1. Background

In the recently published 2022 Crypto Adoption Index by Chainalysis (2022), Nigeria has secured notable rankings across various categories, shedding light on its cryptocurrency landscape and adoption patterns.

- **Overall Index Ranking:** Nigeria's overall ranking in the index stands at an impressive 11th place. This signifies that Nigeria is among the top countries globally in terms of cryptocurrency adoption and activity.
- **Centralized and Retail Centralized Services**: Nigeria is ranked 18th in both centralized and retail centralized service value receiving. This suggests that Nigerian users are actively engaging with centralized cryptocurrency services, indicating trust and utilization of these platforms.
- **Peer-to-Peer (P2P) Exchange Trade**: Nigeria ranks 17th in P2P exchange trade volume, indicating a significant presence of peer-to-peer cryptocurrency trading within the country. This decentralized form of trading is a popular choice among Nigerians.
- **Decentralized Finance (DeFi)**: Nigeria holds the 20th position in DeFi value received ranking. This highlights the country's involvement in decentralized finance, an emerging sector within the cryptocurrency space that offers innovative financial services.
- **Retail DeFi Value Received**: In the category of retail DeFi value received, Nigeria again secures the 17th rank. This underscores the participation of everyday users in DeFi platforms and transactions.

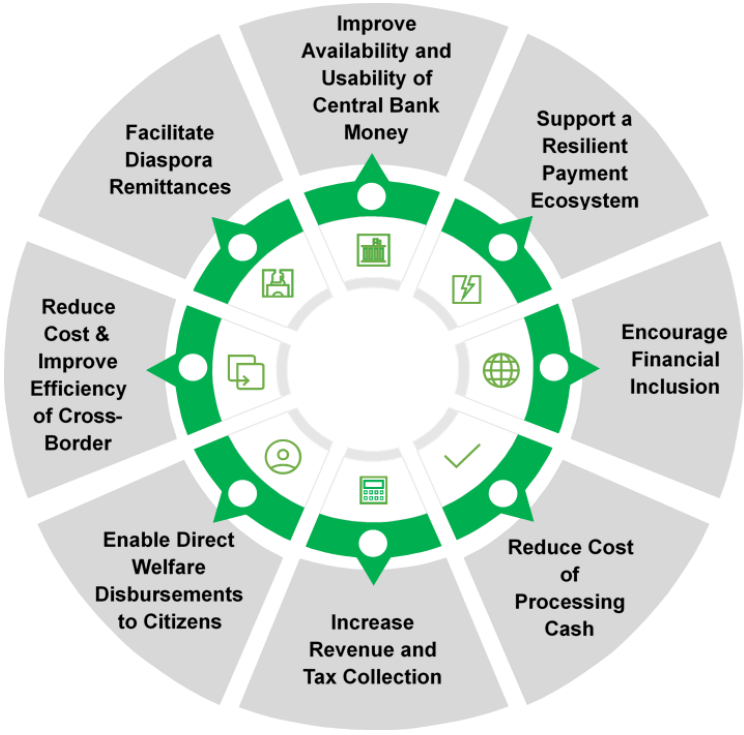
These rankings collectively portray Nigeria as a prominent player in the global cryptocurrency scene, with active involvement in centralized and decentralized services. The

country's strong presence in peer-to-peer trading and DeFi activities also demonstrates a diverse range of cryptocurrency use cases among its population. As the cryptocurrency landscape continues to evolve, Nigeria's position in these rankings reflects its evolving role within this dynamic and rapidly expanding sector.

As part of a comprehensive set of reforms to enhance the payment system infrastructure and promote financial inclusion in Nigeria, CBN introduced the eNaira as a digital currency and legal tender to complement the traditional fiat currency. Implementing the eNaira is expected to enhance the effectiveness of the CBN's monetary policy and foster financial inclusion in the country (IMF, 2021). Similar to physical currency, the eNaira is a CBDC that is legally backed and represents the full sovereignty of Nigeria. Under the applicable law, the eNaira is issued by the CBN and holds the status of a valid legal tender. It serves as a medium of exchange, unit of account, and store of value (Central Bank of Nigeria, 2021).

According to the CBN, eNaira offers numerous benefits and advantages crucial in an increasingly diverse and sophisticated financial system. *Figure 2* illustrates some of the benefits of the eNaira identified by the CBN, which have implications for various aspects of the economy and can potentially impact monetary and fiscal policies in Nigeria (Central Bank of Nigeria [CBN], n.d.).

Figure 2: Benefits of eNaira in the Financial Ecosystem



Notes: *The figure illustrates key ways the CBN envisions the eNaira which can contribute to maintaining stability in the monetary and financial sectors. Source: Central Bank of Nigeria (n.d., p.6)*

The benefits of eNaira, as highlighted by the Central Bank of Nigeria (n.d.), are:

1. **Fosters Economic Growth**. To increase economic activities at extremely low costs or zero transaction rates, the eNaira is poised to offer easy access to capital and financial services enabled by fintech through a seamless platform.
2. **Provides Secure and Cheaper Remittances**. Similar to most developing countries, diaspora remittances contribute tremendously to economic growth. According to the World Bank, the inflows into Nigeria from diaspora remittances reached $20.9 billion in 2022 (Ratha et al., 2022). Therefore, to ensure remittances pass through formal channels, the eNaira provides financial consumers a faster, cheaper, and more secure option.
3. **Strengthens Real-time Monitoring of Illicit Financial Transactions**. Unlike the traditional Naira, the eNaira would contribute to real-time monitoring of financial transactions, thereby enhancing the traceability of all transactions, which invariably

would limit the use of the digital currency for illicit transactions or fraudulent purposes.

4. **Enables Prompt Access to Social Welfare Programs**. Recently, the Federal Government of Nigeria introduced several social welfare programs, which include cash transfers to the less privileged across the country. With the introduction of the eNaira, such cash transfer, traditionally operated through the distribution of physical cash to the poor, would now be executed faster and more efficiently through electronic means. It is also expected that the eNaira would help curb the perceived and alleged corruption involved in such cash transfers to households and communities where the poor reside.
5. **Promotes Financial Inclusion**. One of the key objectives of eNaira is its potential to deepen financial inclusion in the country. With the high internet and mobile phone penetration, it is expected that people who are traditionally financially excluded from the mainstream banking system will now have direct access to financial services at their fingertips.
6. **Enhances Local and International Trade**. With the introduction of the eNaira and the possibility of real-time payments for goods and services at a cheaper, safer and faster rate, local and international trade are expected to increase over time.
7. **Ensures Security of the Legal Tender**. With the digital currency, people will be less concerned with currency counterfeits. The eNaira has very strong security features, and since it is underpinned by distributed ledger technology (DLT), it is practically impossible to forge or counterfeit the digital legal tender.
8. **Supports Revenue Collection**. eNaira enables the monetary policy of the central bank to be able to complement the fiscal policies through instant and immediate revenue collection in real-time once payments are made.

4.2.3.2. Legal and Regulatory Framework

The eNaira is a digital legal tender backed by law. As such, the CBN solely regulates it. Section 2 of the Central Bank of Nigeria Act 2007 (CBN Act) confers the exclusive powers on the CBN as the issuing authority of all forms of Naira. Both the CBN Act and the Banks and Other Financial Institutions Act (BOFIA) 2020 extensively provide for the powers of the CBN to issue a currency as legal tender, take steps to ensure financial system stability and develop the electronic payments system. Specifically, a combined effect of sections 2, 19 and 20 of the CBN Act

ultimately confers the power on the CBN to issue legal tender currency in Nigeria, which may take any form (Central Bank of Nigeria, 2007).[8] In strict legal terms, the eNaira is a direct liability of the CBN.

As a result of these provisions, the CBN issued its *Regulatory Guidelines on the eNaira*, on 25 October 2021 with the primary objective of simplifying the operation of the eNaira, promoting the general adoption of the digital currency, engendering financial inclusion and promoting low-cost transactions. The Guidelines apply to all financial institutions and consumers using the eNaira.

4.2.3.3. Underlying Technology: Technical and Operational Standards

The eNaira utilizes the DLT, which is the basis of the blockchain technology underpinning the design of the digital currency. The eNaira CBDC was developed using a private blockchain-based Hyperledger Fabric. This open-source DLT operates on a permission-based blockchain instead of the decentralized public blockchain widely used for cryptocurrencies (Androulaki et al., 2018). The private blockchain-based Hyperledger Fabric is not freely accessible to the public like cryptocurrencies, as it requires permission for access and has a controlling entity, which, in the case of eNaira, is the CBN. Given a central bank's central role and the financial system's specific requirements, the Hyperledger Fabric variant of DLT was adopted to ensure easy identification of users and prevent intrusion through permissioned payment networks.

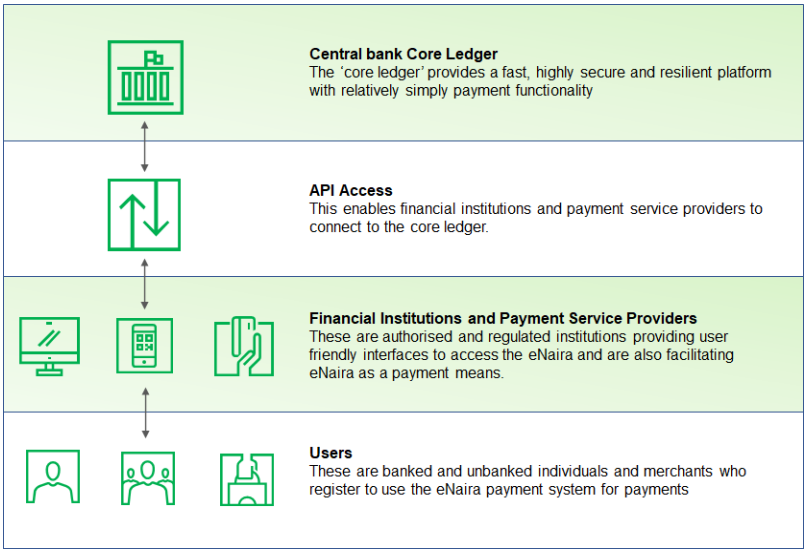
The Hyperledger Fabric's modular architecture helps ensure a robust security architecture that supports the eNaira. This helps the CBN to support and manage the eNaira wallets efficiently. In addition, the authorized financial institutions act as nodes on the network and distributors of the eNaira to the ultimate financial consumers who are the core users. Beyond the local financial market, the eNaira platform design has the potential to promote global cooperation, particularly for cross-border or FX transactions involving the eNaira and other CBDCs.

[8] Section 2. "The principal objects of the Bank shall be to – …. (b) issue legal tender currency in Nigeria..."
Section 19. (1) The currency notes and coins issued by the Bank shall be - (a) in such denominations of the Naira or fractions thereof as shall be approved by the President on the recommendation of the Board; and (b) of such forms and designs and bear such devices as shall be approved by the President on the recommendation of the Board.
(2) The standard weights and composition of coins issued by the Bank and the amount of remedy and variation shall be determined shall be determined by the President on the recommendation of the Board.
Section 20. – (1) The currency notes issued by the Bank shall be legal tender in Nigeria at their face value for the payment of any amount

The design of the eNaira incorporates the existing payment structures and roles of key stakeholders in the financial system. As such, the eNaira would provide a payment platform where layered payment services will be created. As illustrated in *Figure 3*, the platform model involves the following three key elements:

1. "a core ledger provided by CBN, which will serve as the core of the platform and will enable transactions to be recorded and payments to be processed.
2. Financial institutions suite that enables financial institutions to distribute and enable payment services for users and
3. Payment service providers module will enable organizations such as financial technology companies and mobile money operators to create an additional payments functionality, thereby building the e-Naira payment ecosystem" (Central Bank of Nigeria [CBN], n.d. p.12).

Figure 3: Platform Model for r-CBDC



Source: Central Bank of Nigeria (n.d., p.13)

Note: *The figure illustrates the design approach of the eNaira which involves constructing a technology platform and utilizing the current structures and positions within the payment system to provide more benefits for users.*

4.2.3.4. Anti-Money Laundering/Combating the Financing of Terrorism (AML/CFT)

One of the main objectives of the eNaira as a CBDC is its ability to contribute to the anti-money laundering/combating the financing of terrorism (AML/CFT) policies and promote

traceability of all transactions. For the eNaira operations, the relevant CBN Guidelines require full compliance with the existing AML/CFT guidelines. To ensure such compliance, the CBN adopted the account-based CBDC, where users on the platform are identified using the traditional identity framework previously implemented by the central bank, which is the Bank Verification Number (BVN) and the National Identification Number (NIN). All financial institutions are required to conduct the AML/CFT checks since the CBN uses the layered platform model. Therefore, the usual concerns relating to AML/CFT when discussing CBDCs should have been properly addressed with the approach adopted by the CBN.

4.2.3.5. The Rate of Adoption

Despite the laudable efforts of the CBN in introducing the eNaira, there are concerns about its adoption rate. Considering the massive internet and mobile phone penetrations in Nigeria it was expected that the eNaira would launch successfully with wide adoption. Despite an initially positive response, the adoption rate has been slow, as evidenced by the low percentage of wallet downloads relative to the total number of bank accounts and merchants with point-of-sale terminals. According to the *IMF Selected Issues Paper on Fostering Financial Inclusion through CBDCs*, most wallets (92%) appear inactive. The average number of weekly transactions is only a small proportion of the total number of wallets, with a weekly transaction volume of only N53,000 (about US$120) (Wezel & Ree, 2023). In essence, a year after the initial adoption of the eNaira, active users of the digital currency constituted less than 0.15% of the country's total population (Zamora-Pérez et al., 2022; Lukonga, 2023)

However, with the recent cash crunch occasioned by the redesign of the physical Naira, it appears more Nigerians have turned to digital currency. The shortage of banknotes bolstered the demand for other payment methods, such as using eNaira. Out of the 10 billion Naira worth of digital currency minted, about 3.4 billion Naira is in circulation. More users have continued to utilise the eNaira for transactions. According to data from the CBN, the value of eNaira transactions increased by 63% to 22 billion Naira as of March 2023 with the opening of over 13 million e-wallets that hold the eNaira (Osae-Brown et al., 2023; Onu, 2023). This finding is also reflected in the general survey conducted for this report, where 35% of respondents said they used the eNaira during the cash crunch, a 7.8% increase from regular usage.

Despite the recent increase in the use of eNaira as a result of the cash crunch, the overall rate of adoption remains remarkably low relative to Nigeria's entire population. The rate of

adoption, based solely on e-wallet downloads, is estimated to be 5.9% compared to the total population. However, downloading the e-wallet does not necessarily imply using eNaira for transactions. Additionally, the number of eNaira e-wallet holders compared to the number of bank account holders in Nigeria serves as another benchmark for measuring the adoption rate.

It is anticipated that forthcoming initiatives from the CBN may expedite the acceptance of the eNaira, especially among rural communities and individuals who are unbanked or underserved. These initiatives include the introduction of unstructured supplementary service data (USSD) (Agboola, 2023) and eliminating the need for a legacy bank account as a requirement for owning an eNaira wallet (IMF, 2021), which can lower the barrier to owning an eNaira wallet, enhance access to financial services through an expanded range of digital channels while reducing transaction costs and bolstering credit flow to consumers and businesses.

4.2.4. The eNaira: Needs, Challenges, and Trends

Expert interviews were conducted with Commercial Money Deposit Banks and Regulatory Agencies, supplemented by insights from a public survey (Ree, 2023). This investigation is essential for understanding Nigeria's distinctive experience in implementing its CBDC. In Nigeria, the implementation challenges perceived by primary and secondary sources revolve around policy, regulation, and infrastructure, which are believed to impede the full potential of the CBDC.

The public survey indicates that approximately 84.4% of respondents are aware of the eNaira implementation, and a lower percentage, precisely 58%, understand how it works. Nevertheless, only 35.1% of respondents reported actual ownership of an eNaira wallets, which corroborates earlier reports on low rate of adoption (Ree, J, 2023).

Perceptions about the e-naira and its subsequent adoption are significantly influenced by factors such as awareness and supportive policies—strategies aimed at bolstering awareness, security and privacy will impact its adoption rate. Concerns relating to security, reliability, and privacy were raised as critical considerations in adopting the CBDC, evident from a substantial proportion who express security (83.6%), trustworthiness (80.1%) and privacy (79%) concerns.

It is clear that CBDCs present a reliable alternative to unregulated digital currencies, with 70.7% of respondents favoring eNaira over unregulated digital currencies such as Ethereum or Bitcoin. However, despite this preference, there persists a prevailing inclination to utilize the CBDC for less significant transactions, such as online shopping (66.2%) and person-to-person transactions (66%). In contrast, a more cautious stance was taken regarding matters such as converting entire deposits to eNaira (34.9%) or receiving salary/wage payments through the CBDC (28.3%). This hesitancy underscores lingering reservations concerning the security and trustworthiness of the CBDC for important financial transactions.

Despite these considerations, an underlying optimism emerges regarding the future adoption rate of the eNaira. A notable proportion, approximately 62.5% of respondents, express a desire for the new government to continue the implementation of the eNaira. Furthermore, a substantial majority, accounting for 75%, are willing to engage with the eNaira provided that existing technical challenges are effectively resolved.

Implementation challenges have prevented the eNaira from its full potential. For instance, experts believe that its real-time monitoring of monetary data holds promise to enhance monetary policy interventions, enabling the CBN to influence macroeconomic indicators efficiently, yet it appears using the eNaira for its monetary policy efficacy remains underdeveloped.

A significant consensus of the eNaira for regulators, private sector experts and the public lies in its potential for cross-border transactions, particularly remittances. The eNaira has excellent potential to improve cross-border payments, with over 50% of participants anticipating its integration. From the regulatory perspective, experts point out that cross-border payments and trade financing capabilities of the eNaira will reduce the inefficiencies and rent-seeking behaviors of middlemen and convertible currencies, thereby shortening the payments value chain in international trade. They emphasize that there is a need to ensure that such cross-border payment options and trade financing do not create unnecessary opportunities for capital flight. Consequently, designing CBDCs to address existing frictions in cross-border payments will necessitate extensive international collaboration while putting the national interest ahead. The eNaira's potential in this regard is hampered by hurdles, including the currency's acceptance for cross-border exchange, given the Naira's volatility, regulations, and jurisdictional laws, and establishing a universal digital asset clearing exchange.

Furthermore, according to experts, financial inclusion is one of the most significant advantages of implementing the CBDC. Survey results highlight the importance of user-friendliness and understanding of the CBDC's functionality as prerequisites for successful adoption. Insufficient awareness and understanding could hinder its role in bolstering financial inclusion. Moreover, mobile money, though different in structure and regulatory framework to the eNaira, offers similar functionality for unbanked Nigerians with even easier access as users do not need a formal bank account to make transactions (Fabian et al., 2022).

Additionally, reliable IT infrastructure is essential for CBDC functionality, a challenge in areas with limited internet and unstable energy access. Achieving the eNaira's full financial inclusion potential could promote the cashless policy of the CBN and ease the transition of the country to a cashless economy.

Experts from commercial banks emphasize regulatory and technical considerations as well. CBDCs, being nascent innovations, are yet to be fully understood, particularly regarding underlying blockchain technology and encryption protocols. Seamless updates in API and connectivity between the Central Bank and commercial banks are crucial. Improved responsiveness of technical teams addressing infrastructure and connectivity concerns is necessary for commercial banks to integrate the eNaira into their systems.

The introduction of CBDCs presents a dynamic change that can disrupt the established financial system and conventional financial service offerings, prompting traditional institutions to devise innovative strategies to remain relevant. While concerns exist about changes in the commercial banking landscape due to the eNaira's adoption, traditional banks are expected to remain relevant in their commercial banking/wholesale segment due to the diverse, voluminous, and complex services they render in those areas, which will take much longer to be replaced. Yet, the risk of losing retail clients seeking basic financial services is always emphasized discussions relating to CBDCs. However, with the layered payment system model adopted by the CBN, it appears the financial institutions cannot be excluded from the entire ecosystem since the central bank requires them to help distribute the eNaira and enable payment services for financial consumers.

4.2.5. Lessons Learnt

Nigeria's experience with the eNaira offers valuable insights for other countries contemplating the launch of their CBDCs. These insights underscore the significance of

addressing context-specific questions and developing a well-defined project strategy with appropriate timelines. The challenges the eNaira encountered, such as limited adoption, technical issues, and competition with established networks like mobile money, hold instructive implications for countries embarking on CBDC implementations.

The progress of the eNaira's project strategy necessitates the resolution of critical issues. These issues encompass addressing regulatory, technical and infrastructure gaps, the expansion of the eNaira into cross-border remittances and extending its accessibility to unbanked and underserved populations, especially those residing in regions with constrained internet connectivity and unstable power supply.

The Nigerian context emphasizes the indispensable role of a comprehensive evaluation of institutional frameworks, stakeholders, and the political, social, and economic landscape in devising a successful CBDC implementation strategy. Furthermore, introducing CBDCs requires new regulations and legal framework, which require ample time to develop and implement. Countries must ensure the availability of robust infrastructural foundations and human capital resources to support the CBDC.

The key lessons learnt from the Nigerian experience include the following:

1) Financial literacy is key in implementing CBDCs.
2) A country with huge population may not necessarily result in full adoption of CBDC.
3) Technology architecture must be sound and resilient from the onset.
4) Financial consumers should be incentivized to use CBDC.
5) CBDCs should be designed to replicate the paper currency and should not yield interest.

Unlike cryptocurrencies underpinned by fully decentralized ledge technology, CBDCs should be relatively stable in their values and not be subject to high market volatility.

In pursuing enhancing international cooperation and coordination, particularly among OIC countries, the adoption of standardized and compatible technologies assumes paramount importance. Achieving seamless interoperability between systems hinges on the implementation of standardized financial protocols at a global level. This synchronization of systems and international collaboration are mutually reinforcing and aptly aligned with the ongoing trends of globalization and international trade.

4.2.6. Country-Specific Policy Recommendations

Stemming from the lessons learnt from the Nigerian case study, it is pertinent to make some country-specific recommendations to address the teething problems identified and enhance the implementation of the eNaira.

1. ***Financial literacy and education***. Before implementing a CBDC such as the eNaira which is relatively new even in the global financial system, the CBN should embark on massive financial literacy programmes and ensure the people are well educated about the benefits of eNaira. Financial literacy would ensure the eNaira is inclusive for all groups by considering current root causes of exclusion for major groups in the country. While it is not too late to embark on such grassroot financial literacy initiatives, the CBN should ensure the concerns relating to the underlying technology are addressed appropriately.
2. ***Piloting the eNaira Project***. From the interviews and surveys conducted as well as views from analysts, it appears the CBN was not fully ready for the implementation of the eNaira when it launched it. In introducing such a new form of currency, it is advisable for the CBN to start with a pilot phase of the project where they would have identified the usual teething problems and address them appropriately before a full rollout.
3. ***Incentivizing the usage of eNaira***. One way to enhance the adoption of the eNaira is to consider introducing financial incentives by prefunding e-wallets of users who download the wallet during certain period. With the level of poverty in the country, an incentive as low as $1 would encourage millions of Nigerians to download the wallets.
4. ***Government levies to be paid through eNaira*****.** Once all technological and operations issues relating to the eNaira have been resolved, the government could channel all government levies and payments through the eNaira but with some discounts to encourage people to download the wallet.
5. ***Enhancing the resilience of the underlying technology***. To encourage wider adoption of the eNaira, the CBN should ensure the underlying technology is resilient to cater to large volume transactions anticipated when more users are onboarded.

4.2.7. Implications of Policy Recommendations for OIC Member Countries

Based on the experiences of some countries that have implemented the CBDCs and in collaboration with other pilot projects spearheaded by the BIS and other multilateral initiatives, COMCEC could develop a template framework for implementing CBDCs in OIC member countries to foster trade and cross-border transactions. The OIC member countries could explore the use case of cross-border remittances as the first pilot project to be rolled out among its members. This also requires cross-border integration of the blockchain infrastructure used for the CBDC. It is expected that this would further enhance financial cooperation among member countries. As a by-product of this current study and against the backdrop of this recommendation, a high-level technical team should be established to develop the template framework for CBDC implementation in OIC member countries. Among other factors, this considers the efficiency of cross-border payments among OIC member countries, interoperability across the OIC region and other regulatory issues.

The OIC member countries should consider establishing a cross-border regulatory framework to regulate cross-border transactions. This could be achieved through a Convention or multilateral treaty framework among OIC member countries. Beyond this joint initiative, the OIC should also consider introducing Model Laws for member countries who intend to introduce legal frameworks for their respective jurisdictions. Similar to the United Nations Commission on International Trade Law (UNCITRAL) framework where Model Laws relating to international commercial transactions are developed, the OIC could provide a high-level adoptable legal framework in form of a model legislation for member countries' adoption or adaptation.

To promote cross-border trade among the OIC member countries, w-CBDCs has huge potentials. This could help address balance of payment issues among member countries since settlement for imports will be done in local currencies. In addition, trade efficiency could be enhanced among member countries. With CBDCs, one could guarantee real-time cross-border FX transactions.

There is a need for dispute management protocols on the blockchain to address disputes emanating from CBDC payments and transactions. While the eNaira generated many disputes within the financial system, there was no standard complaints remedial framework. Since technology is being fully adopted with the CBDC, it is also pertinent to build in an automated

dispute management system to resolve complaints and disputes in real-time. Some smart contract protocols built into the blockchain would help manage emerging disputes relating to CBDCs. The OIC Arbitration Centre could play a major role in developing the dispute management protocols.

Finally, from the Nigerian case study, it is revealed the eNaira does not yield any interest (Kaminska, 2021). Therefore, the eNaira, and of course, other CBDCs, helps to address issues relating to two major prohibited elements in Islamic commercial and financial jurisprudence, which have been the bedrock of conventional monetary and financial policies. Going by the explanations provided by the CBN, if the eNaira is the digital form of the paper Naira and if the latter is considered to be Islamic as a legal tender, then similar treatment could be extended to the digital form of the currency subject to the rules on *ribā* and *gharar*. Therefore, the OIC member countries could learn from the eNaira design to promote Sharīʿah-compliant monetary and payment systems.

4.3. Qatar

4.3.1. Background Information

- Group: Arab
- OIC Membership: Yes
- Legal System: Mixed (Shariah Law and Civil Law)

Prior to 1966, currencies in circulation in Qatar were those linked to the Pound Sterling, like the Indian Rupee and Gulf Rupee. When India devalued the Rupee (including the Gulf Rupee) by approximately 35%, Qatar and Dubai decided to replace the Gulf Rupee with the Saudi Riyal as an interim measure until the issuance of a new currency. On the 21st of March 1966, Qatar and Dubai signed a currency agreement to set up the Qatar-Dubai Currency Board. The new board issued the first national currency, known as the Qatar-Dubai Riyal (QDR) on September 18, 1966 at a gold par value of 0.186621 grams of pure gold—the same as the pre-devaluation rate of the Gulf Rupee. The Pound Sterling continued to provide cover for the new currency. On December the 2nd 1971, Dubai became a part of the UAE. Therefore, it was decided to relinquish the Qatar Dubai Currency Board in accordance with Amiri Decree No. 6 of May 1973. On May 13th 1973, Law No. 7 of 1973 was issued, establishing the Qatar Monetary Agency (QMA) to assume the duties of a central bank. Further Amiri Decree—No. 24 of 1973—was issued authorizing the redemption of QDR and the issuance of a new currency known as the Qatari Riyal (QR), with the same par value against gold as the QDR. QMA was responsible for maintaining the stability of the QR exchange rate against, and its free convertibility into, other currencies. In 1975, as per Decree No. 60 of 1975, the QR was pegged to the Special Drawing Rights (SDR) at a rate of 0.21 SDR per QR with a fluctuation margin of ± 2.25% (QR 4.7619 ± 0. 2.25% per an SDR unit). Over the period 1973-1993, QMA adopted the United States dollar (USD) as an intervention currency to fix the daily value of the QR. The QR exchange rate against the USD was to be determined on basis of the latter's exchange rate against SDR as determined by the IMF. The QR exchange rate against other currencies was to be determined on basis of USD exchange rate against other currencies in the international financial markets. The tolerable flux margin of the QR against the SDR was increased to ± 7.25% in early 1976 due to appreciation of the USD against the SDR in late 1975. Hence, the QR exchange rate used to fluctuate against currencies other than the USD, in line with the fluctuations of the latter against those currencies. During the second half of the seventies, QMA revalued the QR against the USD many times in order to stabilize its value

against other major currencies of Qatar's trading partners and to alleviate pressures of imported inflation. Over the period March 1976 to June 1980, the QR was revalued twelve times against the USD. On the whole, the QR was revalued against the USD by 8.5%, compensating for 13.4% depreciation in the value of the latter against the SDR. When the USD started its upward trend (in July 1980) vis-à-vis other major currencies, QMA had maintained a de facto exchange rate of QR 3.64 per a USD unaltered. The immediate impact of this link was the appreciation of the QR with the appreciation of the USD against major currencies of Qatar's trading partners, particularly the European countries. Established in August 1993, the Qatar Central Bank (QCB) has inherited the QMA monetary strategy of targeting the exchange rate. QCB kept adopting the policy of fixed exchange rate against the USD at the same rate of QR 3.64 per USD.

Qatar, like many other countries, has been grappling with how to regulate digital currencies. The country has taken a cautious approach, with the Central Bank of Qatar issuing warnings about the risks associated with digital currencies, including their volatility, lack of regulation, and potential for use in illegal activities such as money laundering and terrorism financing. Despite these warnings, interest in digital currencies continues to grow in Qatar. One of the factors contributing to the growth of digital currencies in Qatar is the country's thriving financial sector. Qatar has a well-developed banking system and a high level of financial literacy, and many people in the country are looking for new investment opportunities. Digital currencies offer a way for these people to diversify their portfolios and potentially earn higher returns compared to traditional investments. Another factor that is driving the growth of digital currencies in Qatar is the country's efforts to become a digital hub in the region. Qatar has been investing heavily in technology and innovation, and is working to position itself as a leader in the digital economy. The growth of digital currencies fits in well with this overall strategy, and the government is reportedly exploring the possibility of launching its own digital currency.

Qatar's oil and natural gas resources are the country's main economic engine and government revenue source, driving Qatar's high economic growth and per capita income levels, robust state spending on public entitlements, and booming construction spending, particularly as Qatar prepared and hosted the World Cup in 2022 (Forbes, 2018). Although the government has maintained high capital spending levels for ongoing infrastructure projects for FIFA 2022, low oil and natural gas prices in recent years have led the Qatari government to tighten some spending to help stem its budget deficit (Forbes, 2018). With oil and natural gas exports accounting for over 50% of GDP and almost 70% of government revenues, Qatar's economy

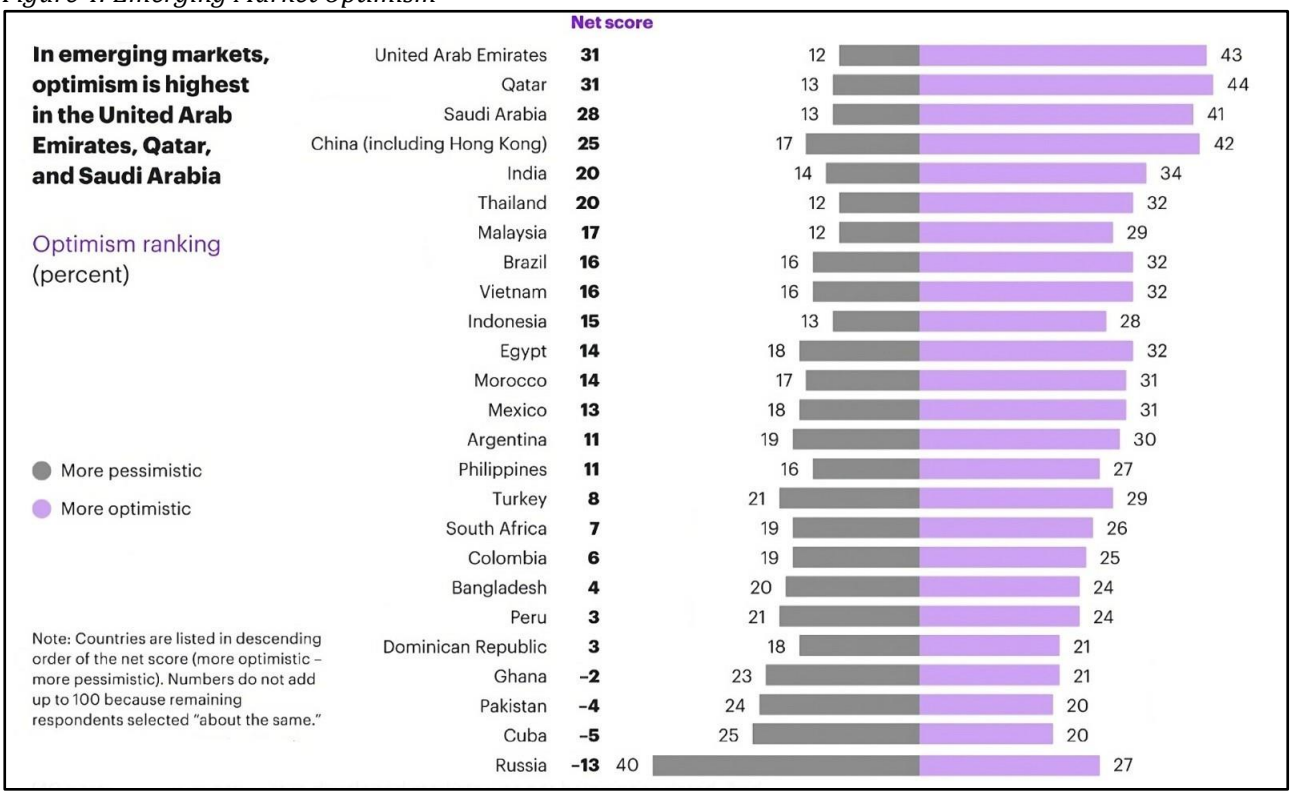
relies heavily on leveraging its hydrocarbon resources (OBG, 2012). International business analysts also share this view (Forbes, 2018). Despite the dominance of oil and natural gas, Qatar has made significant gains in strengthening non-oil sectors, such as manufacturing, construction, and financial services, leading non-oil GDP to steadily rise in recent years to just over half the total (Forbes, 2018).

One of the drivers for the comprehensive development in Qatar is the Qatar National Vision (QNV), the development vision that has been adopted pursuant to the Amiri decision No. 44 of 2008 (The Amiri Diwan, 2023). The QNV's fundamental objective is the achievement of progress and prosperity for the citizens (The Amiri Diwan, 2023). The QNV aims that – by 2030 – Qatar will become an advanced society capable of sustaining its development and providing a high standard of living for its people (GCO, 2023). Qatar's National Vision defines the long-term goals for the country and provides a framework for developing national strategies and implementation plans (GCO, 2023).

Qatar is ranked 9th in 2022 in global average Islamic Finance Development Indicator (IFDI) scores, according to the Islamic Finance Development Indicator 2022 (Refinitive, 2022). It ranked 5th in the top countries by Islamic finance assets of $186 billion and in the top countries by Sukuk value outstanding with 23 billion (Refinitive, 2022). It also ranked 8th in the top countries by Takaful Assets with $1 billion (Refinitive, 2022). It finally ranked 4th in the top countries by Other Islamic Financial Institutions (OIFI) assets growth with $12 billion (Refinitive, 2022).

Qatar also ranked 21st in the world ranking of developed markets index, and ranked 4th in the emerging market indicator which give the business leaders insights into the most appealing market to investors (Kearney, 2023). As shown in Figure 4 below, Qatar ranked 2nd in emerging markets optimism indicator and had the same net score as the 1st emerging market optimism.

Figure 4: Emerging Market Optimism

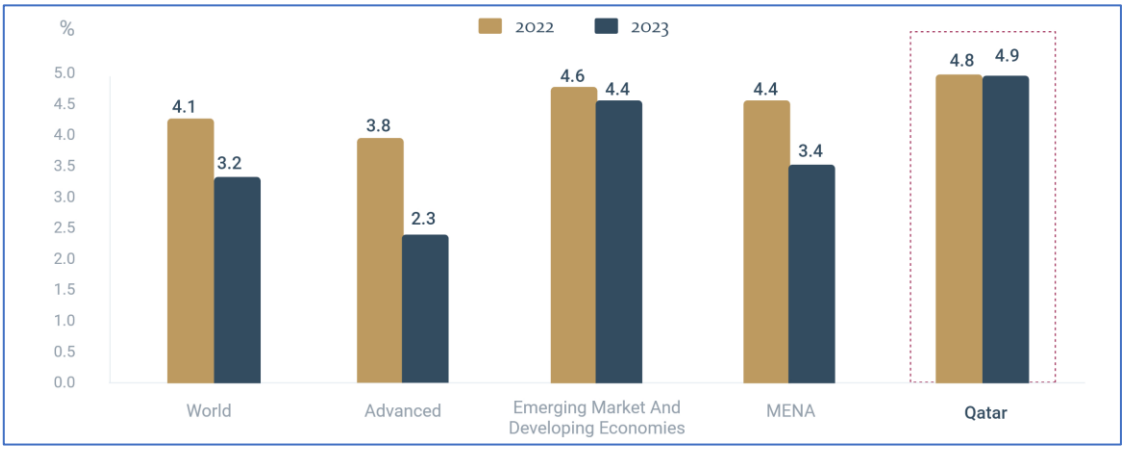


Source: 2023 Kearney FDI Confidence Index (Kearney, 2023)

Qatar is recognized in the international arena for many reasons, such as its extensive portfolio of investment abroad and substantial infrastructure projects at home, the latter of which led to the population growing by an estimated 50% between 2010 and 2020 due to an influx of foreign workers (OBG, 2022). Qatar has actively sought foreign investment and amended laws to facilitate higher foreign ownership rates (OBG, 2022). Performance in the areas of trade and investment is set to improve further as countries around the world recover from the economic effects of the pandemic (OBG, 2022).

Qatar's stable and competitive economy has been growing at a faster rate on average than its peers and advanced economies (InvestQ, 2023a). The country's high per capita income, vast hydrocarbon reserves, and strong economic fundamentals support its strong credit profile as Figure 5 shows (InvestQ, 2023a).

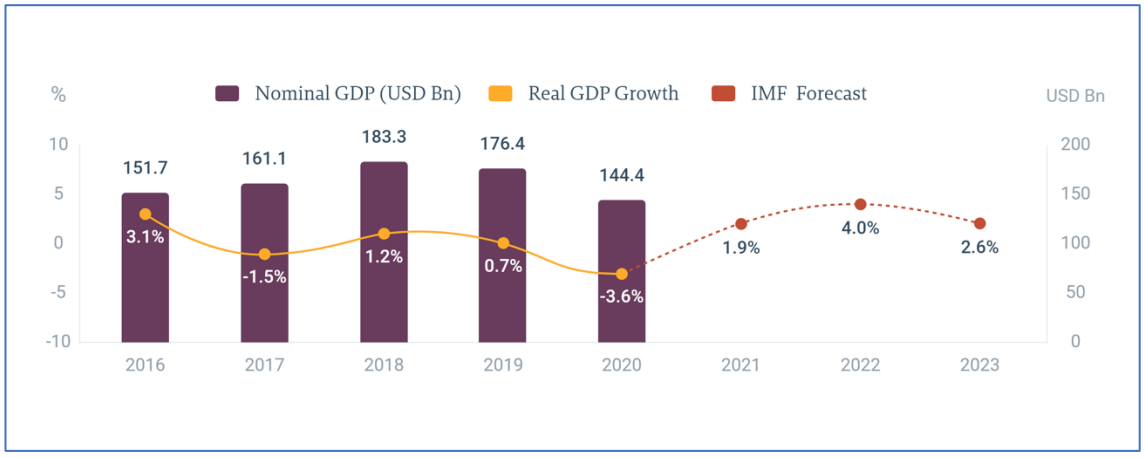
Figure 5: GDP Growth Forecast – Qatar



Source: World Bank – Global Economic Prospects 2022

Qatar's economy has been resilient amidst the COVID-19 pandemic, and the latest forecasts demonstrate a positive outlook (InvestQ, 2023a). Early indicators are signaling robust economic activity and strong business conditions as Figure 6 shows (InvestQ, 2023a).

Figure 6Figure 6: Economic Growth of Qatar



Source: Economic Performance (InvestQ 2023)

Qatar follows a law legal system that is primarily influenced by Islamic law (Shari'ah) and is governed by a combination of written and codified laws. The legal structure in Qatar operates on a hierarchy of laws and regulations with the Constitution of Qatar serving as the country's law. Adopted in 2003 the Constitution outlines Qatar's legal framework highlighting the importance of democracy and the rule of law. It also guarantees rights and freedoms to Qatari citizens & residents.

An independent judiciary is responsible for interpreting and applying the law. The Supreme Judicial Council oversees the functioning of the judiciary to ensure its independence and impartiality. The court system consists of three levels: the Court of Cassation (highest court), the Court of Appeal, and the Court of First Instance. Additionally, specialized courts were created to handle specific legal matters, like the Family Court, Traffic Court, Investment & Trade Court, Rental Committee, and Labor Committee.

The legal framework encompasses laws and regulations that govern different aspects of life including commercial activities, labor relations and family affairs. These laws are often influenced by principles while being regularly updated to adapt to changing societal and economic needs in Qatar. The country has taken measures to update its legal system in order to attract foreign investment and foster economic development all while safeguarding its cultural and religious heritage (i.e., Arbitration Law in 2017, Mediation Law in 2021, and the establishment of the Investment & Trade Court in 2022).

The state's tax legislation is derived from three main laws: the Income Tax Law (Law No. 24 of 2018), the Excise Tax Law (Law No. 25 of 2018), and the QFC Tax Law and Regulations (ECB, 2007). Qatar has 84 tax treaties in force and is also a signatory of the Organization for Economic Cooperation and Development Multilateral Instrument (InvestQ, 2023a).

4.3.2. Monetary and Payment Systems

The monetary and payment systems in Qatar are operated by the QCB. The QCB is responsible for issuing the Qatari riyal (QAR), managing the country's foreign exchange reserves, and regulating the banking sector.

The main payment systems in Qatar are:

1. Qatar Payment System (QPS) is a Real Time Gross Settlement (RTGS) system that settles interbank payments in real time (QCB 2014a). It is used by all banks in Qatar to make and receive payments.
2. Qatar Mobile Payment (QMP) is an instant mobile payment system that allows users to make payments and transfer funds using their smartphones. It is operated by the QCB and licensed payment service providers (QCB, 2014b). There are ten banks and two telecom companies participating in the system.

3. Third Party Payment Services: there are several third-party service providers that provide payment services with different features. Two of those services are:

    - SADAD is a payment system operated by a FinTech company to allow user to have a secure third -party electronic payment service to avoid having to carry money. It allows users to make payments for goods and services online, over the phone, and in person (Solutions FinTech, 2022).

    - FATORA is a payment system allowing generation of invoices and generate payments (Fatora, 2020).

The use of electronic payments is growing in Qatar, and it is expected to continue to grow in the coming years. This is due to the convenience, security, and efficiency of electronic payments.

Other payment methods that are commonly used in Qatar include: Credit cards, Debit cards, Bank transfers, and Cash.

4.3.3. CBDC Initiatives

In Qatar, there is not currently a published CBDC initiatives. Qatar is still in the early stages of developing a CBDC. In June 2022, the QCB Governor said that the bank is "still in the foundation stage"[9] of investigating a CBDC, and that it is evaluating the pros and cons of issuing one. He also said that the bank is looking into the different technologies that could be used to issue a CBDC.

Qatar has strong connections to markets in Africa and Asia and investment protection ties with many countries, including China, Finland, France, India, Germany, and Switzerland (QFC, 2023a). Furthermore, the country's future-ready digital and physical infrastructures and abundant natural and connectivity resources make it a major global hub that ensures international investors experience an increasingly seamless flow of trade and capital and can build the networks and relationships they need to succeed (QFC, 2023a). In addition, Qatar is a small country with a near population of 3 million and is internationally integrated; therefore, a CBDC implementation project would be ideally suited. Qatar also aims to be a leading onshore business and financial center. For that, it created the Qatar Financial Center (QFC), a one-stop-

[9] Source: https://www.coindesk.com/policy/2022/06/22/qatar-at-foundation-stage-of-cbdc-exploration-governor-says/

shop for commercial registration that welcomes international and domestic companies to register as QFC entities, thus benefiting from flexible legal and regulatory services that meet international best practices (QFC, 2023b).

According to the CIA World Factbook and Forbes, Qatar holds the title of the "richest country of the world," boasting an annual average per capita income of $103,768.60 (ITA, 2023). For a little perspective, that's more than double the average annual per capita income in the United States (ITA, 2023).

Financial Technology (FinTech) has been identified as a crucial tool to achieve long-term development for Qatar's financial sector as part of the Second National Development Strategy 2018-2022 (Clarke, 2021). As an industry, FinTech offers a significant opportunity to drive Qatar's economic diversification, one of the four pillars of QNV 2030, and regulations, as well as support dynamics (i.e., access to funding), have been put in place, bringing up an exciting future for this rising sector (Clarke, 2021). Qatar Development Bank (QDB) facilitates funding through its QR365 million VC fund, and there is a lot of potential to source funds from other countries (Clarke, 2021). The current funding structure of QFTH, Qatar Business Incubation Center (QBIC), and Qatar Science and Technology Park (QSTP) can be used to attract funding for startups (Clarke, 2021).

FinTech and CBDC are closely associated with increased financial inclusion by providing alternative channels through which unbanked adults can access formal financial services and offer cost-efficient advantages (Ozili, 2022). Thus, the present ecosystem environment of FinTech in Qatar would facilitate the CBDC added benefits if Qatar decides to publish its CBDC.

4.3.4. Needs, Challenges, and Trends

Qatar's forward-looking digital and physical infrastructure, coupled with its abundant natural resources and strategic connectivity, positions it as a significant global hub. The popularity of E-commerce in Qatar comes on the back of high internet and mobile penetration rates — two key conditions among many to spur the sector (InvestQ, 2023b). The advent of digital payment services has added momentum to online transactions, as has the pandemic that made online buying popular (InvestQ, 2023b).

From the literature review, there are a few commonly known challenges that any country would face if planning to launch its CBDC. If Qatar is planning to launch its CBDC, then the

following points needs to be studied and evaluated. These aspects were also stated by some of the interviewees as it can be seen from the next section.

- **The security of a CBDC.** A CBDC would be a digital version of the Qatari riyal, and it would need to be secure from fraud, cyberattacks and newly emerging technologies that could alter the basic features of a digital riyal.
- **The impact of a CBDC on the financial system**. A CBDC could potentially disrupt the traditional financial system, and the central bank will need to carefully consider the impact of a CBDC before issuing one.
- **The acceptance of a CBDC by the public**. The central bank will need to educate the public about the benefits of a CBDC and encourage them to use it.

In addition, the literature review of CBDC indicated a number of inherent benefits that were also believed by the majority of our interviewees to benefit Qatar such as:

- **Facilitating cross-border payments**. A CBDC could make it easier and cheaper to make cross-border payments as well as reducing the transaction's time.
- **Promoting financial inclusion**. A CBDC could make it easier for people who do not have access to traditional banking services to participate in the financial system.
- **Improving the efficiency of the financial system**. A CBDC could help to improve the efficiency of the financial system by reducing the need for intermediaries.

4.3.5. Lessons Learnt

In the course of this research, we conducted interviews with high-ranking executives, directors, managers and division heads representing diverse array of financial institutions. We wish to extend our heartfelt appreciation to the leaders of these institutions, and to all the interviewees for their invaluable contributions to this research project. The findings derived from these interviews have been examined and analyzed and will be synthesized in the forthcoming recommendation section.

In the design of the interview questions, the first four questions were about the aspects of Strength, Weakness, Opportunity, and Threat (SWOT) that CBDC brings and what are the opinions of the interviewee on each aspect. The remaining questions were about cross-border transactions, impact on the financial sector, international collaboration, and regulatory framework.

When it comes to the strength aspect of CBDC, one of the interviewees said, "the technologies that come with it." That was an all-encompassing answer, which included the immediate settlement finality, the lower transaction cost, and the accessibility. Some interviewees had chosen payment processing as a prime advantage, which can work better than cash drawn from ATMs to be paid for rendered services. One of the interviewees saw that from a central bank perspective, CBDC can effectively enhance monetary policy. The interviewee gave an example of setting an expiry date on CBDC concerning the government's fiscal policy on spending certain allowances. Another interviewee thought that CBDC would bring clarity to the market, and bring the added security of digital currency over physical cash currency.

When it came to the key features of CBDC, which gives it an advantage over traditional financial systems, one of the interviewees summarized the answer in 5 words by saying, "The central bank is behind it". In contrast, another interviewee saw that the key feature of CBDC will be that the central bank and other government authorities can identify problem areas in finance and the wider economy and implement a solution using real-time data. An interesting perspective was brought by the feature of CBDC trackability, which, at least for amounts outside of pocket money, will not work without strong identification, rendering the traceability both a strength and a threat.

For the weakness aspect of CBDC, many interviewees thought of the high cost of the infrastructure required for CBDC implementation and the readiness of Qatar's market. An interviewee stated, "No system is free," hinting at the spending expenditure for the CBDC infrastructure. Some interviewees chose the cybersecurity sensitivity of the CBDC as a prime weakness, stating "even crime is digitized these days"; others thought of potential risk from emerging technologies as an exceptional weakness. Another interviewee saw the weakness could also be in the operational resilience required for a currency considering the threat of cybersecurity and privacy concerns. While this opinion is shared with another interviewee, he was concerned about the CBDC's system's capacity to handle a large number of users and the possible large amount of energy it may consume when the system is implemented. Another interviewee said that the learning curve might be a weakness to some people and acceptability by people, which put pressure on the central bank to carry out awareness campaigns to get people's acceptance.

For the opportunity aspect of CBDC, the interviewees' point of view was that CBDC would improve transactions, especially when it relates to the Gulf Corporation Council (GCC), as it may

create a quicker payment environment for both the individual and the banking sector. Other interviewees saw that CBDC would improve the monetary policy through the real-time data about the money circulating in the financial system in Qatar. Another interviewee saw that the unbanked would participate more in the economy. In contrast, another interviewee said this would be true for countries with sizeable unbanked populations, which is not valid for Qatar. The same interviewee thought that CBDC is an opportunity for emerging new technological companies that will contribute toward economic growth, and another interviewee shared that point but stated that growth is not clear at this stage. One interviewee gave an interesting opinion that CBDC is an opportunity to set effective standards for AML/CFT as it is a feature of digital currency called "traceability."

For the threat aspect of CBDC, privacy protection, and cybersecurity threats were almost chosen by all the interviewees. In addition, other threat points ranged between the teething problems associated with new system implementation. However, interestingly, some viewed "emerging technologies risks" as the primary threat as it is not proven that those risks are fully mitigated at this time. This was not discussed in detail in the interviews, but these emerging technologies are due to the advances in artificial intelligence and quantum computing. Therefore, the presently available technology to combat today's cybersecurity threats will not be sufficient for tomorrow's threats due to these emerging technologies. As a result, the CBDC system's design must be capable of adapting to a rapidly changing threat scenario. Another interesting point made by one of the interviewees was the threat of the crowding-out of the local CBDC with other country CBDC taking over transactions due to its popularity or built-in features.

When it comes to cross-border transactions, some of the opinions were linked to GCC connection joining currency conversion projects. In contrast, other views pointed out that organizations can play a vital role between member countries that issue their own CBDC to improve efficiency and reduce transaction costs. One interviewee said that "the cross-border transactions would be one of the biggest benefits as it will reduce transaction costs and time because currently for each $1, there is $0.28 of cost and delivery time is t+3 days". Many interviewees shared this opinion as they see the benefit to both the individual and the trade. However, two challenges may arise in cross-border transactions: the different legal frameworks in each jurisdiction and the different governance requirements. Other opinions saw that some of those challenges would be reduced if there was a common CBDC design standard. Another

interviewee saw an opportunity for the central banks of any two countries to agree to settle transactions between them directly.

On the aspect of CBDC's impact on the financial sector, almost all the viewpoints were on the possibility of severe negative impact on the banking sector as it would challenge them to innovate an alternate source other than deposits (usually used to give loans). They saw this as a good thing, forcing innovations in the financial sector. One interviewee stated that "a growing body of research suggests that the commonly held belief of CBDC displacing bank deposits is not entirely accurate and that the effects on bank lending and intermediation may be controllable. Therefore, it would be prudent to gain experience from issuance of wholesale CBDC and then transit to retail CBDC". Other viewpoints saw that CBDC with tier 2 would have a minimal negative impact on the financial sector.

On the topic of international collaboration and coordination during CBDC development and deployment, many viewed that agreeing on a standard CBDC model will harmonize the interoperability of each country's CBDC with another country's CBDC. Another viewpoint saw collaboration between regional block (i.e., GCC), international organizations, and oil-producing countries. In that regard, one interviewee said that CBDC design is a complex process and that sharing ideas during the design stage is vital to benefit from international collaboration. He continued that from the central bank's standpoint, it is likely beneficial to focus on the national CBDC and leave the currency conversions to be handled by projects. An interesting perspective of one of the interviewees was that as all countries are creating regulations and laws for Anti-Money Laundering/ Countering the Finance of Terrorism (AML/CFT), the international collaboration would make a better CBDC design if it focused on AML/CFT and fraud-prevention at the design stage.

On the aspect of the regulatory framework necessary for the successful implementation and management of CBDC in Qatar, most interviewees agreed on the requirement for a clear regulatory framework to ease the technology use. One interviewee stated as there are different regulators for banks, securities, insurance, and privacy issues, there is a need to talk to all of the regulators and engage lawyers in the final cycles. Other views elaborated that to develop the needed regulatory framework, knowledge-sharing with countries in the pilot program of CBDC or those countries that already launched their CBDCs are prime ingredients to create a concise framework. Other views saw the need for high-technology standards, linking digital identification with the Qatar identification card, introducing more effective privacy regulation,

and AML/CFT regulation updates would all help create the required regulatory framework. One interviewee brought up an interesting point by pointing out the concern of privacy being tied to the chosen CBDC design, which should be copied into transparent regulations and operations by the authorities, which was shared by another interviewee point for the need for clear mandate and aligned regulation and not to over-regulate.

4.3.6. Country-Specific Policy Recommendations

From our findings based on interviews and the secondary data from reports and academic outputs, we conclude the following points as prime policy recommendations when implementing CBDC deployment in Qatar.

i. CBDC Design. CBDC design and development should not only consider the cybersecurity threat elimination by using the highest available fraud-detection and protection technology standard. The design must also be modular, considering artificial intelligence and quantum computing as possible risk components. The CBDC system's design must be capable of adapting to a rapidly changing threat scenario.

ii. Regulatory Review. Before launching a CBDC system, a public consultation process should be opened with all the stakeholders and regulators. There are banks, securities, insurance, and privacy regulators. All those must be consulted to come to a new legal framework. It is anticipated that new laws will be created and existing laws will be modified before the launching of the CBDC system.

iii. Whole CBDC First. The gradual introduction of the CBDC will help to mitigate the negative impact on the financial sector, and for that purpose, Qatar can start with a Wholesale CBDC. If the Central Bank sees a need and demand to go for a Retail CBDC, it can do that transition in a controlled timeframe. For both cases, it is highly recommended to use the lessons learnt from countries that issued their CBDCs and share knowledge in specialized regional/international forums with other countries piloting their CBDCs.

iv. Gradual CBDC Introduction. The gradual introduction of the CBDC will also allow the financial sector to react to the CBDC as it will take the banking systems time to change their systems and to innovate new sources of income (other than the margins

between the deposits and the loans). This gradual introduction will mean that both cash currency (i.e., Qatari Riyal) will exist along with the digital riyal.

v. Privacy Consideration Design. Through the implementation of CBDCs, central banks can access comprehensive individual data, subject to individuals' consent. Alternatively, central banks may impose transaction limits within specific temporal boundaries, harnessing data analytics to discern patterns indicative of money laundering or other illicit financial activities.

Does Qatar need CBDC this year, 2023, or next year?

Most probably not, as the current payment system is sufficient for the purpose. However, we recommend that Qatar continue evaluating CBDC and the existing technical solutions available for various strategic reasons. CBDCs can potentially improve the efficiency and openness of the country's financial system. Therefore, when the QCB digitizes the Qatari Riyal through a CBDC, it is expected to expedite payment processing by reducing the time and expenses associated with traditional banking operations. This reduction in costs and time would benefit both the individual and the trade within the state, which would be especially useful in a global financial hub like Qatar is positioning itself to be. Both foreign investors and foreign workers in Qatar rely on quick and safe cross-border transfers. Moreover, CBDCs can promote financial inclusion by making digital payment methods available to all individuals in Qatar, including low-wage workers who do not have (currently) access to traditional banking services. Therefore, this availability would encourage more participation in the local economy and thus promote economic development in Qatar.

Establishing Qatar's CBDC can help strengthen Qatar's reputation as a forward-thinking and technologically sophisticated financial hub, attracting foreign investment and stimulating economic growth. A well-implemented CBDC can also improve the QCB's ability to monitor and supervise the financial system, maintaining its stability and resilience in the face of changing financial problems.

4.3.7. Implications of Policy Recommendations for OIC Member Countries

CBDC may allow central banks to tap the benefits of new digital technologies while retaining the power of a primary regulator and might be more efficient than traditional fiat money in transfer

fees, time reduction, and reach through digitalization (ADB, 2023). Our findings are specific to the state of Qatar, but the following points would apply to any OIC Member country.

1. **Harmonizing a common standard**. Promoting this standard between OIC Member Countries planning to issue their CBDC will mitigate cross-border transaction delays and enhance interoperability, "as there is no need to reinvent the wheel."
2. **Minimum Requirement based on Basic Needs**. Despite different budgeting requirements for each OIC Member Country to establish CBDC, a minimum requirement based on basic needs and goals should be discussed and agreed upon to prevent future incompatibilities based on different digital infrastructure solutions fit for each OIC Member Country.
3. **Sharing CBDC Cyber-Threats**. The immediate sharing of details on any cyber threat targeting CBDCs in any OIC Member Countries between the members to eliminate possible similar threats to another member country.
4. **An OIC Currency-Conversion Project**. Developing a CBDCs conversion project (similar to mBridge) between the OIC Member Countries where the value of one CBDC of a member country is exchanged immediately to another CBDC member country according to a real-time digital exchange rate platform.
5. **OIC-CBDC Forum**. Creating a specialized forum between OIC Member Countries to share knowledge and lessons learnt of CBDC design and development. The same forum can be the starting platform for a unified standard of regulation and supervision.
6. **Sustainable CBDC Design**. To have a sustainable solution, the design of the CBDC should aim to reduce carbon emissions and energy consumption by utilizing green technology and lowering the environmental footprint.

4.4. Pakistan

4.4.1. Background Information

- Group: Asian
- OIC Membership: Yes
- Legal System: Mixed (Common Law, and Shariah Law)

The State Bank of Pakistan (SBP) is incorporated under the State Bank of Pakistan Act, 1956, which gives the Bank the authority to function as the central bank of the country. The SBP Act mandates the Bank to regulate the monetary and credit system of Pakistan and to foster its growth in the best national interest with a view to securing monetary stability and fuller utilization of the country's productive resources. Under financial sector reforms, the State Bank of Pakistan was granted autonomy in February 1994. On 21st January, 1997, this autonomy was further strengthened by issuing three Amendment Ordinances (which were approved by the Parliament in May, 1997) namely, State Bank of Pakistan Act, 1956, Banking Companies Ordinance, 1962 and Banks Nationalization Act, 1974. The changes in the State Bank Act gave full and exclusive authority to the State Bank to regulate the banking sector, to conduct an independent monetary policy and to set limit on government borrowings from the State Bank of Pakistan. The amendments in Banks Nationalization Act abolished the Pakistan Banking Council (an institution established to look after the affairs of NCBs) and institutionalized the process of appointment of the Chief Executives and Boards of the nationalized commercial banks (NCBs) and development finance institutions (DFIs), with the State Bank having a role in their appointment and removal (State Bank of Pakistan, n.d). The amendments also increased the autonomy and accountability of the Chief Executives and the Boards of Directors of banks and DFIs. Established under the SBP Banking Services Corporation (SBP-BSC) Ordinance 2001, SBP-BSC supports SBP in performing functions such as handling of currency and credit management, facilitating the inter-bank settlement system, and sale/purchase of savings instruments of the Government on behalf of Central Directorate of National Savings. SBP-BSC also collects revenue and makes payments for and on behalf of the Government. It also carries out operational work relating to development finance, management of public debt, foreign exchange operations and export refinance. The Board of Directors of SBP-BSC, chaired by the Governor SBP, comprises of all members of the Central Board of SBP and the Managing Director of SBP-BSC. NIBAF is the training arm of SBP, providing executive development trainings to new

inductees and various levels of SBP employees. The subsidiary also conducts international courses on central and commercial banking in collaboration with the federal Government. Furthermore, NIBAF offers training to SBP-BSC and other financial institutions. NIBAF is incorporated under Companies Ordinance, 1984 and has a separate Board of Directors. Deposit Protection Corporation (DPC) has been established as a wholly owned subsidiary of SBP under the DPC Act 2016. Upon commencement, this entity will be responsible to provide protection of deposits of member financial institutions operating in Pakistan. The objective of DPC is to compensate the depositors to the extent of protected deposits in the event of failure of a member Financial Institution. The limit of protected deposits shall be determined by DPC and will be announced in due course. For the purpose of protecting depositors of Islamic Banks and branches, a separate Shariah compliant mechanism of deposit protection shall be put in place (State Bank of Pakistan, n.d.).

Pakistan is a country that has shown a growing interest in digital currencies, with many people in the country exploring the potential benefits of these new forms of money. Despite this interest, the use of digital currencies in Pakistan is still in its early stages and is facing many challenges, including a lack of regulation, limited awareness and understanding, and concerns about their potential for use in illegal activities such as money laundering and terrorism financing. One of the key factors contributing to the growth of digital currencies in Pakistan is the country's large and young population, many of whom are tech-savvy and have a high level of comfort with new technologies, including digital currencies. In addition, digital currencies offer a way for people in Pakistan to bypass the traditional financial system, which is often perceived as slow, bureaucratic, and prone to corruption. Another factor that is driving the growth of digital currencies in Pakistan is the country's efforts to promote financial inclusion. Despite significant progress in recent years, many people in Pakistan still do not have access to basic financial services, including bank accounts and credit. Digital currencies offer a way for these people to participate in the financial system, even if they do not have access to traditional financial services.

Pakistan has a mixed economic system, with a combination of free-market activity and government intervention. The country's economy is based on agriculture, manufacturing, and services.

- **Agriculture**: Agriculture is the largest sector of the Pakistani economy, accounting for about 22.9% of GDP and employing about 37.4% of the workforce (Ministry of

Finance, 2023). The main crops grown in Pakistan are wheat, rice, cotton, and sugarcane.

- **Manufacturing**: The manufacturing sector is the second-largest sector of the Pakistani economy, accounting for about 12.79% of GDP (Ministry of Finance, 2023) and employing about 16.1% of the workforce (Ministry of Finance, 2022). The main industries in the manufacturing sector are textiles, food processing, and chemicals.
- **Services**: The services sector is the fastest-growing sector of the Pakistani economy, accounting for about 58.61% of GDP (Ministry of Finance, 2023) and employing about 37.2% of the workforce (Ministry of Finance, 2022). The main services in the services sector are transportation, communication, and financial services.

The government of Pakistan plays a significant role in the economy. The government owns and operates a number of businesses, including banks, insurance companies, and airlines. The government also regulates the economy through a variety of laws and regulations.

The financial system of Pakistan is subject to oversight and regulation by various governmental entities, which encompass:

- **The Securities and Exchange Commission of Pakistan (SECP)**: This institution holds the responsibility of overseeing the securities markets within Pakistan.
- **The State Bank of Pakistan (SBP)**: Tasked with the regulation of commercial banks and other financial institutions, the SBP plays a pivotal role in maintaining the stability and integrity of the financial sector.
- **The Ministry of Finance (MoF)**: Entrusted with the formulation and execution of financial policies, the MoF plays a critical role in shaping the fiscal landscape of Pakistan.

In Pakistan, a nation with a population of 238.1 million, technology is making significant inroads. Mobile phones have become a ubiquitous tool, with ownership among adults reaching an impressive 80.5% (DataReportal, 2023). This widespread access to mobile devices has paved the way for digital inclusion, particularly in the realm of the internet. Internet penetration has surged to 55%, indicating that more than half of the population now has access to the vast wealth of information and services available online. Furthermore, mobile internet usage has soared to 53.1%, highlighting the preference for mobile devices as the primary means of accessing the internet. This trend is further corroborated by the fact that 54.46% of the

population are now internet subscribers, signifying a growing commitment to staying connected and harnessing the opportunities presented by the digital age (PTA, 2023). In 2023, Pakistan's economic landscape is marked by a modest GDP growth rate of 0.29% (Shahzad et al., 2023), reflecting the challenges of inflation and a high monetary policy rate of 22% (Reuters, 2023). Notably, inflation stands at a concerning 31.4%, exerting pressure on the cost of living and the purchasing power of its citizens (Shahid & Shahid, 2023).

The case study of Pakistan's journey of CBDC is comparatively unique, as the country's central bank is among the few regulatory authorities worldwide who are proactive yet careful in launching CBDC. For this case study policymakers, industry experts and academicians in Pakistan were interviewed to connect the dots for the Pakistan's digital financial landscape and to see the status of launching CBDC in the country. These interviews helped us to understand the issues and challenges encountered at the government and especially the regulatory level.

4.4.2. Monetary and Payment Systems

The monetary and payment system of Pakistan is regulated by the SBP, that is the central bank of Pakistan, responsible for issuing currency, managing monetary policy, and overseeing the banking system.

The monetary system of Pakistan is based on the fiat currency, the Pakistani rupee. The rupee is divided into 100 paise. The SBP is the sole issuer of the rupee and is responsible for maintaining its stability.

The status of digital currencies in Pakistan is still evolving. The SBP has not yet issued a clear regulatory framework for digital currencies. However, the SBP has taken some steps to regulate their use.

- In 2018, the SBP issued a circular that prohibited banks from dealing in cryptocurrencies. The circular stated that cryptocurrencies are not legal tender in Pakistan and that they pose a number of risks, such as money laundering and terrorist financing (State Bank of Pakistan, 2018).

The SBP's position on cryptocurrencies is still evolving. It is likely that the SBP will issue a more comprehensive regulatory framework in the future.

Despite the lack of a clear regulatory framework, the use of digital currencies in Pakistan is growing. There are several cryptocurrency exchanges operating in Pakistan, and there is a growing community of cryptocurrency users.

According to 2022 Crypto Adoption Index (Chainalysis, 2022), Pakistan exhibits notable standings across various categories:

i. **Overall Index Ranking**: Pakistan secures the 6th position in the global ranking, indicating a substantial adoption of cryptocurrencies within the country.
ii. **Centralized Service Value Reception**: Pakistan ranks 10th in this category, signifying a significant utilization of cryptocurrencies on centralized platforms.
iii. **Retail Centralized Service Value Reception**: Again, Pakistan holds the 10th position, indicating a strong presence of cryptocurrency use in regular commercial transactions.
iv. **P2P Exchange Trade Volume:** In this aspect, Pakistan stands at the 50th position, implying a moderate involvement in direct peer-to-peer cryptocurrency trading.
v. **DeFi Value Reception**: Pakistan is positioned at 22nd place, suggesting a growing engagement with decentralized financial protocols.
vi. **Retail DeFi Value Reception**: Pakistan secures the 16th position, indicating a noteworthy adoption of DeFi services among everyday users.

These rankings provide insights into Pakistan's cryptocurrency landscape, showcasing its level of involvement and proficiency in various aspects of the crypto market.

Payment systems in Pakistan have evolved significantly over the last decade, driven by the development of new payment instruments, electronic payment infrastructure and changing consumer needs. This development has resulted in a rapid shift from the use of traditional paper instruments to a diverse range of electronic payment instruments, supported by efficient and reliable clearing and settlement infrastructure.

Mainly, Pakistan has two types of payment systems: Large Value Payment Systems and Retail Payment Systems. Both are explained below:

4.4.2.1. Large Value Payment System

An RTGS system is defined as a gross settlement system in which both processing and final settlement of funds transfer instructions can take place continuously (i.e. in real time). As it is a real-time settlement system, the system effects final settlement continuously rather than

periodically at pre-specified times provided that a sending bank has sufficient covering balances or credit. Moreover, this settlement process is based on the real-time transfer of central bank money. An RTGS system can thus be characterized as a funds transfer system that is able to provide continuous intraday finality for individual transfers.

The need for RTGS system in Pakistan was recognized as a response to the growing awareness of the need for sound risk management in large-value funds transfer systems. RTGS systems offers a powerful mechanism for limiting settlement and systemic risks in the interbank settlement process, because these risks effect final settlement of individual funds transfers on a continuous basis during the processing day. Further, RTGS can also contribute to the reduction of settlement risk in securities transactions by providing a basis for delivery-versus-payment (DVP) mechanisms. Therefore, RTGS is very much essential while considering risk management in payment and settlement systems.

The RTGS in Pakistan has been named as Pakistan Real-time Interbank Settlement Mechanism (PRISM). PRISM System is Pakistan's is the only Large Value Payment System. It is a RTGS which provides a central platform for the settlement of large-value interbank funds transfers, Government Securities, retail clearing and customer transfers (over a certain minimum amount limit). It was launched in July 2008 and has expanded its operation significantly. At present there are 42 Direct Participants of PRISM comprising of Commercial Banks, Development Financial Institutions, Micro-Finance Banks and Central Depository Company (CDC). PRISM system Operating Rules (2009) was issued to provide the level playing file to the participants.

Some broad features of PRISM system are as under:

- The participant banks have the facility of online monitoring of their interbank payments via one settlement account and their fate (like settled, queued, or rejected). They would also be able to change their payment priority (if transaction is queued) giving them more control over their funds;
- SBP departments have the ability to monitor the inter-bank transactions and take immediate action as and when required;
- Intraday Liquidity Facility (ILF) would be offered to banks collateralized against Government Securities so that the payments may be cleared immediately;

- The system also has queue management features and mechanisms for Grid Lock resolution;
- The system also holds government securities portfolios and enables securities trade matching for Delivery Vs Payment and intra-day liquidity management;
- The IT security component of the system provides PKI infrastructure, transactional and link encryptions for data security; and
- "Centralized Multilateral Netting" of retail clearing was a mandatory pre-launch requirement for smooth functioning of the PRISM System. Previously the country-wide retail clearing operations were settled in the sixteen field offices of SBP across the country.
- The main purpose of introducing the RTGS systems is to handle the large value interbank funds transfers on Gross Basis and in Real Time. Interbank funds transfer systems are arrangements through which funds transfers are made between banks for their own account or on behalf of their customers. Of such systems, large-value funds transfer systems are usually distinguished from retail funds transfer systems that handle a large volume of payments of relatively low value in such forms as cheque, credit transfers, automated clearing house transactions and electronic funds transfers at the point of sale.

4.4.2.2. Retail Payment System

Retail payments usually involve transactions between consumers and businesses where it generally has higher transaction volumes and lower average values than wholesale payments. The retail payments in Pakistan comprise of various paper-based and electronic instruments from conventional cheques to modern plastic cards. The system handles high volume and low value transactions through paper based (such as cheque) and non-paper-based transactions (such as e-Banking). Over the years, and important trend has been the shift from paper to electronic payments. The statistics show that consumer use of electronic payments in Pakistan has grown significantly in recent years, and the trend will accelerate in coming years due to Vision of SBP on provision of Digital Financial Services (DFS) especially to financially excluded segment of population. In Pakistan, the retail payment instruments can be broadly categorized into:

- ***Paper Based Instruments***

The paper-based instruments in Pakistan have generally been the preferred mode of payments. Though there are various modes of paper-based transactions available such as cheques, pay order, demand draft telegraph transfers etc., the volume and value of paper-based transactions has largely driven by cheques. These are used for cash withdrawals and for funds transfers through cheque clearing. Cheques are the preferred mode of payment for commercial transactions, as well as for government payments. The share of other paper-based instruments is fairly insignificant in terms of the total value and volume of paper-based transactions. NIFT was incorporated in September 1995 as joint venture between a consortium and is responsible to improve the efficiency of clearing and settlement of paper-based instruments in Pakistan.

To safeguard the interests of general public by reducing the risk of counterfeiting, State Bank of Pakistan has issued guidelines on Standardization of layout and Security features of Cheques, Pay Orders (Pos) and Demand Drafts (DDs). This is also aimed at addressing the risk of fraud, forging in paper-based instruments. Moreover, to facilitate customers, Banks/Microfinance Banks (MFBs) have been advised to devise a centralized mechanism for the verification of genuineness of POs and DDs. In this regard, Banks are required to Set up 24/7 helpdesks / call centers, so that the person in possession of instruments is easily able to verify the genuineness of the instrument.

In FY23, the value of paper-based transactions experienced significant growth, increasing by 20.1% to reach PKR 228.7 trillion compared to PKR 190.4 trillion in FY22. However, the number of paper-based transactions declined by 4.5% year-on-year (YoY) to 374.3 million in FY23. This trend suggests that customers are increasingly choosing e-banking channels for smaller payments while preferring paper-based instruments for higher-value transactions. It's worth noting that the average transaction sizes were PKR 295,925 and PKR 217,549 for cash deposits and cash withdrawals at banks' counters, respectively. Similarly, for utility bill payments, the average ticket size was PKR 32,742 per transaction (State Bank of Pakistan, 2023a).

- ***Electronic Instruments***

The growth of electronic based payment instruments is gaining momentum in recent years owed to SBP's efforts to create an enabling policy environment, and launch of innovative products by banks.

Electronic retail payments in Pakistan consist of various instruments and channels for payments such as payment cards, Real Time Online Branches (RTOBs), banking through Call Centre/Intra Voice Response (IVR), internet and mobile banking. Usually, these payments link to an existing account relationship with a financial institution for both payee and payer. Consumers may use credit, debit, or stored-value cards to initiate retail payments in face- to-face or remote transactions. Real time online branches (RTOBs) and ATM transactions have been the major contributor to the electronic based transactions growth due to their general acceptability among people.

SBP has been cognizant of the recent development internationally in the area of electronic payments. Since the security of electronic channels has become a major concern SBP has issued Regulations for Prepaid Cards of Internet Banking which aims to develop a formal Internet Banking Security Framework containing administrative, technical and physical safeguards based on best international practices to mitigate the risks associated with Internet Banking and safeguard the interests of customers. Moreover, to provide and use of efficient and secure electronic payment instruments SBP issued Regulations for Prepaid Cards with the aim of providing an enabling regulatory framework for prepaid card issuance and providing a level playing field to all the banks.

- ***Automated Teller Machines (ATMs)***

ATMs provide consumers with online access to their account information and allow them to make withdrawals and deposits. ATM channels are the most commonly used electronic mode of banking in Pakistan. The ATM network in Pakistan is interoperable and available 24 hours a day, 365 days a year. Financial institutions in Pakistan offer a host of banking services through ATMs, including cash withdrawals, fund transfers, payment of utility bills, balance inquiries, statement and cheque book requests, and the facility to change Personal Identification Numbers (PINs) at ATM locations.

In Pakistan, traditional ATM usage for cash withdrawals remains widespread, despite the availability of other electronic banking payment options. During the current fiscal year, there were 809.7 million transactions processed through ATMs, totaling PKR 12.2 trillion. Remarkably, 97.2% of all transactions conducted by customers at ATMs were for cash withdrawals. The total cash dispensed during FY23 amounted to PKR 11.0 trillion, marking a significant increase of 26.1% compared to the previous fiscal year (FY22) when it was PKR 8.7

trillion. The remaining 2.8% of transactions included Intra/Inter-Bank funds transfers (1.90%), utility bill payments (0.5%), and cash/instrument deposits through CDMs (0.4%) (State Bank of Pakistan, 2023a).

- ***Internet or e-Banking***

Internet banking has emerged as a crucial delivery channel for banking services, allowing banks to provide traditional banking functions such as access to one or multiple accounts, fund transfers, bill payments, and card payments through the internet. Customers equipped with internet access, a web browser, and a registered internet banking account with their financial institution can conveniently conduct banking and make payments from the comfort of their homes, offices, or virtually anywhere in the world.

As of the end of FY23, there were 9.6 million registered internet banking users with banks and MFBs (Microfinance Banks). These users conducted a total of 171.8 million transactions through the internet banking channel, amounting to PKR 16.3 trillion in value. In addition to the growth in the number of users, both the number and value of internet banking transactions increased during FY23 by 21.3% and 59.3%, respectively, compared to the previous year. The majority of transactions conducted through this channel were funds transfers (83.4%), followed by bill payments (13.4%) (State Bank of Pakistan, 2023a).

- ***POS Network***

POS (Point of Sale) terminals in Pakistan have experienced significant growth and are now widely used to enable consumers to make payments through debit and credit cards. The POS network processes, routes, clears, and settles ATM and online POS debit card transactions by connecting financial institution card issuers, merchant acquirers, consumers, merchants, and third-party service providers through telecommunication gateways.

With the expansion of the POS network from 104,865 to 115,288 terminals in 2023 by merchant acquiring banks, POS transactions saw significant growth in both volume and value. In terms of volume, POS transactions increased by 44.9% year-on-year (YoY) to 199.3 million, while their value rose by 50.4% YoY to PKR 1.1 trillion. Purchases made using domestically issued payment cards at POS terminals accounted for 95% of total transactions, while transactions with foreign-issued cards made up the remaining 5% (State Bank of Pakistan, 2023a).

- ***Mobile Banking***

Mobile banking is similar to Internet banking in that it provides a fast and convenient way of performing common banking transactions. Many Financial Institutions in Pakistan are providing Mobile Banking facility to customers. Customer can get a registered account for mobile banking from banking institution, to do banking transactions from anywhere that has your mobile telecommunication network coverage.

Mobile phone banking is currently offered by 30 banks in Pakistan and serves 16.1 million users, reflecting a 30.2% expansion over the past year. Similar to internet banking, mobile banking transactions have also surged during this fiscal year, reaching 660.6 million in volume and amounting to PKR 23.8 trillion in value. This represents an impressive annual year-on-year (YoY) growth of 70.5% in volume and 100.5% in value (State Bank of Pakistan, 2023a).

- ***Branchless Banking (BB)***

Branchless Banking has emerged as a new and innovative channel of provision of financial services to customers, especially to financially excluded population in Pakistan. The use of agent by Financial Institutions in partnerships with Mobile Network Operators (MNOs) or using their own platform have been instrumental in providing basic financial services such as fund transfer, utility bill payment, retail payments, donations etc to customers who earlier didn't have access to banking services at their close proximity. Moreover, the government has been using BB channel to distribute government payments such as Benazir Income Support Programme (BISP), Watan Cards and payments to Internally Displaced People (IDPs) and flood affected people.

As of FY23, 16 banks and MFBs (Microfinance Banks) are offering BB services in Pakistan. On the BB channel, the number of BB mobile app users has increased to 57.8 million, and the number of BB accounts has reached 106.9 million as of June 30, 2023. Additionally, BBs have established a network of 630,033 agents to cater to their customers' over-the-counter (OTC) transaction needs. Through these BB mobile applications and agents, a total of 3,483.1 million transactions were performed, amounting to PKR 15.7 trillion in FY23. This represents significant growth compared to the same period in the previous fiscal year when there were 2,725.3 million transactions with a value of PKR 10.6 trillion. During FY23, 92% of transactions were carried out through mobile wallets/apps, while agent-based transactions accounted for 8% of total BB transactions (State Bank of Pakistan, 2023a).

- ***RAAST P2P Payment***

SBP has developed Pakistan's first Instant payment system, known as Raast, to provide instant, reliable, and zero-cost digital payment services to the people of Pakistan. The primary objective is to promote the adoption of digital financial services within the country. With the introduction of Raast, Pakistan has joined the select group of countries that have either launched or are in the process of launching Instant payment systems. Raast is fully owned and operated by the State Bank of Pakistan. Following the initial launch of Raast Bulk Payments in January 2021, SBP is now introducing Raast Person-to-Person (P2P) payments[10].

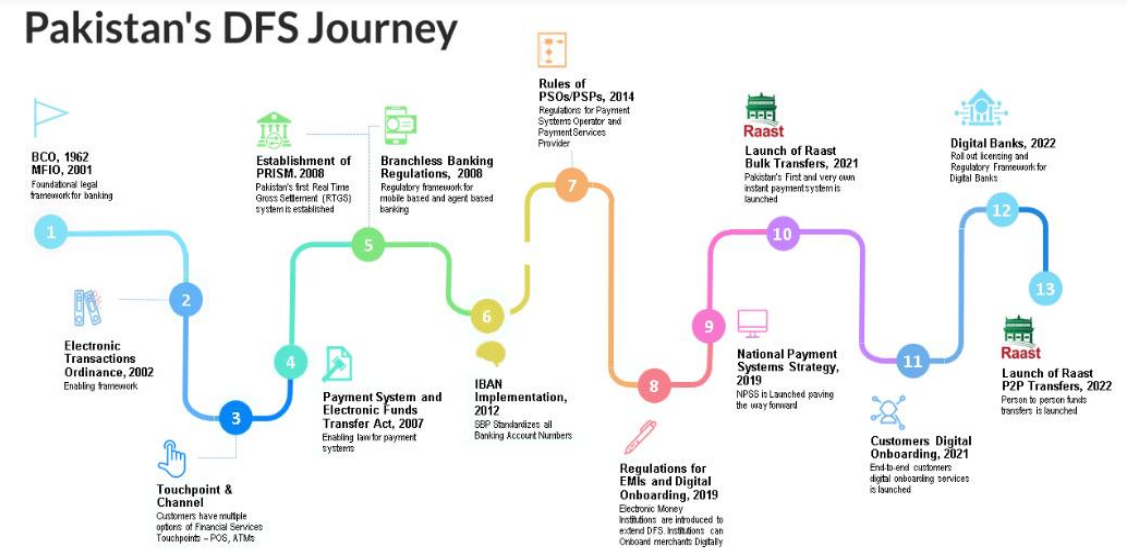
In 2023, Pakistan's payment systems infrastructure remains robust and continues to evolve. The country boasts 44 banks, 33 specialized institutions, 11 microfinance providers, 5 Payment System Operators/Service Providers (PSOs/PSPs), and 4 Electronic Money Institutions (EMIs). Among the banking services, Banks/MFBs have expanded their offerings, including ATMs, Point of Sale (POS) machines, Internet Banking, Mobile Phone Banking, Call Center Banking/IVR, and Cash Deposit Machines (CDMs). In the payments network, Pakistan has seen an increase in the number of branches, ATMs, CDMs, POS machines, and payment cards, with a notable surge in payment card adoption, reaching 58,078,972 cards in circulation. This reflects the nation's commitment to modernize its financial infrastructure and promote electronic payment methods, contributing to financial inclusivity. Additionally, branchless banking agents, though slightly reduced from the previous year, continue to play a vital role in extending financial services accessibility to the population, with over 630,000 agents operating across the country (State Bank of Pakistan, 2023a).

4.4.3. Digitalized Finance and CBDC Initiatives

Pakistan’s Digital Financial Services journey started in 1962 with the implementation of Banking Companies Ordinance 1962 and currently the focus is on RAAST that is launched in 2022.

[10] https://www.sbp.org.pk/dfs/Raast-P2P.html

Figure 7: Pakistan and Its DFS Journey



Source: SBP Digital Financial Services (2023)[11]

The SBP had been considering the potential of issuing a CBDC and launch of RAAST shows the commitment of the regulator for CBDC. According to the SBP, it is investigating the possible advantages and disadvantages of CBDCs and is considering alternative models and technologies for their implementation. The State Bank of Pakistan underwent restructuring on June 25, 2021, and as a result, a group called the Digital Financial Services Group (DFSG) was established, which included the following two departments:

i. Digital Innovation & Settlements Department (DI&SD)

ii. Payment Systems Policy & Oversight Department

The DI&SD strives to carry out innovative projects in the field of digital financial services and innovations, including but not limited to: Open Banking, Central Bank Digital Currency (CBDC), Distributed Ledger Technology (DLT), and other developing technological advancements. This is in consideration of SBP's vision for the digitization of banking and payments in Pakistan. Roshan Digital Account (RDA), the SBP's revolutionary flagship product, is likewise located under DI&SD. The department must also construct and manage crucial payment infrastructures

[11] https://www.sbp.org.pk/dfs/index.html

for the present and the future. Digital Financial Services (DFS) include a broad range of financial services accessed and delivered through digital channels. DFS can be a catalyst in improving living standards, reducing poverty, decreasing fiscal deficit, and providing equal income opportunity to all Pakistanis. What DFS is doing is to:

i. Enhancing payments systems for digital age
ii. Championing a platform to boost financing for small businesses.
iii. Developing an all-inclusive non-discriminatory data strategy
iv. Promoting an enabling regulatory environment for new players.
v. Facilitating firms' use of technology for operational resilience.
vi. Forming new contractual relationships between financial institutions and third parties.

4.4.3.1. Legal and Regulatory Framework

The Digital Financial Services are broadly governed by the following by the SBP Act of 1956, Electronic Transactions Ordinance in 2002, Payment Systems and Electronic Funds Transfers Act in 2007, Foreign Exchange Regulations Act (FERA) in 1947 and Anti-Money Laundering (AML) Act in 2010. There are various regulations revised and new regulations are introduced by SBP in terms of creating a robust digital ecosystem in the country.

Regulatory Framework and Licensing for Digital Banks

SBP has launched licensing and regulatory framework for setting up digital banks[12] in Pakistan as a separate and distinct category in the banking business. Digital bank is defined as a bank which offers all kinds of financial products and services primarily through digital platforms or electronic channels instead of physical branches. The objective of SBP are:

i. Promote financial inclusion.
ii. Provide credit access to unserved and underserved.
iii. Provide affordable/cost effective digital financial services.
iv. Encourage application of financial technology and innovation in banking
v. Forster new set of customer experience

[12] https://www.sbp.org.pk/bprd/2022/C1-Annex.pdf

vi. Further develop digital eco-system

Under this framework, SBP may grant two types of digital bank licenses: 1) Digital Retail Bank (DRB); and 2) Digital Full Bank (DFB). DRBs will primarily focus on retail customers and DFBs can deal with retail customers as well as business and corporate entities. SBP have shared the eligibility of Digital Bank Sponsors.

There are five stages for Digital Bank Licensing Stages:

Step 1- No objection Certificate

Step 2- In-Principle Approval (IPA)

Step 3- Operational Readiness

Step 4-Pilot Stage under Restricted License

Step 5-Commencement of Commercial Operations

In January 2022 SBP introduced a licensing and regulatory framework for digital banks and by March 31, 2022, approximately 20 applications were received by the regulatory authority. After a rigorous assessment process 5 licenses are given by SBP in 2023[13] to the following institutions:

i. Easy Paisa DB

ii. Raqami

iii. Mashreq Bank

iv. KT Bank

v. Hugo Bank

Revised Regulations for Electric Money Institutions (EMIs)

SBP issued Regulations for Electronic Money Institutions (EMIs) in April 2019, which were revised in 2023 (State Bank of Pakistan, 2023b), with the objective of removing entry barriers for non-banking entities. These regulations establish a regulatory framework that enables non-bank entities to offer digital payment services in Pakistan. Since the issuance of these

[13] https://www.sbp.org.pk/press/2023/Pr1-13-Jan-2023.pdf

Regulations, SBP has received a positive response from market participants, resulting in the licensing of several entities to provide e-money services.

Recognizing the sector's potential for further growth and innovation, SBP revised the EMI Regulations in June 2023. The revisions were based on insights from both domestic experiences and international best practices. Notable changes include increasing the e-wallet limits for biometric-verified accounts to PKR 400,000, introducing an enhanced e-wallet with an upper limit of PKR 1.0 million, along with additional documentary requirements. Basic minor e-wallets were introduced to encourage saving habits, and enhanced minor e-wallets were allowed to facilitate young freelancers. Furthermore, EMIs in the commercial stage with successful business operations and regulatory compliance may apply for exemptions to the limits of biometrically verified e-money wallets for salary credited from employers, inward home remittances, and bill payments (State Bank of Pakistan, 2023a).

Standard for Unified QR Code for Fund Transfer

SBP issued Standard for Interoperable QR Code in March 2022[14] to enhance the uptake of digital payments. This initiative has provided a convenient, real time and hassle-free mechanism to make payments through mobile phones and internet banking. The Standard comprises of two variants (i) Person-to-Person (P2P QR) and (ii) Person-to Merchant (P2M QR).

Rules for Licenses and Approvals

In 2014[15], the SBP introduced Rules for Payment Systems Operators (PSOs) and Payment Systems Providers (PSPs) to empower fintech companies to offer innovative digital products and services to customers. Under these In principal approval, followed by approval for Pilot operations, and concluding with approval for Commercial launch. Since the introduction of these regulations, five entities have obtained authorizations to operate commercially as PSOs/PSPs. In the current fiscal year (2023), M/s Safepay (Pvt.) Ltd. obtained approval for pilot operations as a PSO/PSP.

4.4.3.2. SBP's initiative of Asaan Mobile Account (AMA)

In partnership with BB service providers, telecom carriers, and other development partners, the SBP and Pakistan Telecommunication Authority (PTA) launched the AMA platform. The

[14] https://www.sbp.org.pk/disd/2022/CL1.htm
[15] https://www.sbp.org.pk/psd/2014/C3-Annex.pdf

National Financial Inclusion Strategy (NFIS), which aims to let the public, especially the low-income groups, access the existing financial services in a quick, simple, and affordable manner, has developed the AMA platform. Any Pakistani with a valid CNIC can open a bank account digitally in any AMA participating bank from anywhere at any time by utilizing the SIM of any mobile operator using the AMA platform. The programme enables users to access the AMA platform using the short code *2262# and conduct transactions using a basic or smart mobile phone without an internet connection. With the help of AMA Services, customers can do balance inquiry, send money, change Account Pin, account closure, bill payment, account linking and mini statement [16].

4.4.3.3. SBP's initiative of Roshan Digital Account for Overseas

The Roshan Digital Account (RDA) is an initiative by the SBP for the digital onboarding of overseas citizens of Pakistan by allowing them to open accounts with Pakistani banks. These accounts offer innovative banking solutions for millions of Non-Resident Pakistanis (NRPs), including Non-Resident Pakistan Origin Card (POC) holders who wish to engage in banking, payment, and investment activities in Pakistan. The account opening process requires only a basic set of information and documents, with banks committed to completing all necessary customer due diligence within 48 hours.

Various financial products are available under the umbrella of the Roshan Digital Account initiative. NRPs can not only open accounts and send home remittances but also purchase property in Pakistan, access car financing at attractive rates for their family members in Pakistan, contribute to social welfare through charity, donations, and zakat, invest in the Pakistan Stock Exchange, secure their post-retirement life through the Roshan Pension Plan, and invest in sovereign instruments issued by the Government of Pakistan. As of June 30, 2023, a total of 585,885 accounts have been opened under the RDA scheme, compared to 441,344 in FY22. Since its inception, RDA has received a total of USD 6.35 billion, with USD 1.45 billion repatriated and USD 3.78 billion utilized locally. The outstanding deposit position as of the end of FY23 is USD 1.12 billion, down from USD 1.69 billion as of the end of FY22 (State Bank of Pakistan, 2023a).

These are steps taken by the SBP for improving the infrastructure and preparing masses for digital transformation and digital transactions.

[16] https://www.sbp.org.pk/Finc/AMAscheme.html

The CBDC Challenge

The SBP is exploring the possibility of issuing a CBDC in Pakistan. The SBP has set up a working group to study the feasibility of CBDC and to develop a roadmap for its implementation. Based on the most recent note provided for this study (Javaad, Rasheed and Syed, 2023), SBP has been researching on the topic of CBDC for past two years as a transformative technology which will have impact on financial and monetary aspects and help in resolving public policy issues like financial inclusion and digitization.

SBP is cognizant of the fact that CBDCs are a long-term, technology-intensive project with far-reaching implications and considerations like:

i. How exactly can CBDC improve the existing payment system, keeping in view the innovations being offered by the public and the private sectors? For instance, SBP has implemented Pakistan's Instant Payment System (Raast) which will have a huge positive impact on digitization and financial inclusion agenda. So SBP is gauging the relative benefits of having a CBDC along-side the instant payment system.
ii. Another consideration is whether a CBDC would reduce complexity in payments and improve end-to-end processing, or will it simply act as another payment system.

SBP is studying various technological solutions being offered by different vendors for the provision of CBDC processing systems as the technology behind CBDC is still evolving. It is vital to ensure that the chosen technology can handle a high volume of transactions efficiently. Scalability is crucial to prevent network congestion and maintain low transaction fees. There is also need to focus on security measures and resilience against cyber threats and implement robust encryption, authentication, and cybersecurity protocols to protect against hacks and data breaches.

Apart from complexity, SBP is also endeavoring to understand what type of intermediaries may provide CBDC transaction accounts (or issue tokens) for consumers. New types of intermediaries can also emerge which can create a need for new types of accounts and new forms of oversight. On the other hand, CBDC may have potential benefits like reduced cost of providing digital payment services at retail level, enhanced documentation and effective KYC and AML controls. Striking a balance between privacy and security is also critical. CBDC transactions should be secure to prevent fraud and cyberattacks while preserving user privacy.

Here are some of the initiatives taken by the SBP in relation to CBDC:

- SBP working on strategy for launching CBDC[17].
- SBP arranged multiple sessions with stakeholders to discuss adoption of innovative technologies including CBDC[18].
- The SBP is also working with other central banks and international organizations to share knowledge and experience on CBDC[19].
- According to current media statement by SBP officials, SBP has announced plans to issue a CBDC in Pakistan in 2025. SBP officials have stated their intention to commence a feasibility study to explore the possibility of developing a CBDC that is safe, secure, and beneficial for the Pakistani economy (Insights, 2023).

The SBP has not yet decided on whether to issue CBDC in Pakistan or not. However, the SBP is committed to exploring this possibility and to developing a CBDC that is safe, secure, and beneficial for the Pakistani economy. Nevertheless, one should not expect any concrete step forward soon with efforts to carry out extensive research are expected to move on.

4.4.4. Needs, Challenges, and Trends

Currently, Pakistan is trying to improve economic growth. There are challenges of political stability, high inflation, high interest rate, increase in petrol and commodity prices and it is difficult to launch CBDC at this point of time. Thought the Ex-Deputy Governor of State Bank was very optimistic in launch of CBDC but due to the challenges at the economic and politic front, it seems difficult to launch CBDC. There are 47.2 million payment cards in the country and 12 million people are mobile phone banking users, which shows the trend of digital payment systems in the country. There are approximately 4,445 E-commerce merchants and POS machines are 96,975showing a shift from paper money to digital mode of payment[20].

In terms of the preparedness of SBP for the launch of CBDC, the central bank is very clear in terms of not launching it sometime soon but there are several meetings between the stakeholders so when it is the right time to launch then SBP is all set. CBDC is not a one size fits all, every country may have its own reasons for exploring/issuing the CBDC. The most common objectives include Financial Inclusion, Payment System Efficiency, Resilience of Financial

[17] https://www.bis.org/review/r220206m.pdf
[18] https://www.sbp.org.pk/PS/PDF/FiscalYear-2020-21.pdf
[19] https://www.sbp.org.pk/departments/disd.htm
[20] https://www.sbp.org.pk/dfs/index.html

Infrastructure, Monetary Policy Transmission, Cross Border Payments, Diversity and Competition. SBP understands there is a growing demand for CBDC in the country and this is why SBP is vigilant for the demand of CBDC. However, the development and implementation of CBDCs are complex processes that involve regulatory considerations, technology infrastructure, and security measures. Central banks typically take their time to study the potential benefits and risks associated with CBDCs before moving forward with any concrete plans.

SBP has been monitoring the developments in CBDC happening around the globe. Meetings were conducted in series of workshops for the capacity building of SBP officers regarding CBDC with World Bank. SBP is working on a concept note to assess the feasibility of CBDC. Even though the State Bank of Pakistan initially envisioned to introduce a Central Bank Digital Currency to mitigate growth of digital currencies and the potential threat of dollarization in the economy. It was soon realized that a more appropriate evaluation of a digital rupee, would be, whether a CBDC can contribute to the regulator's agenda or not, which is in reference to State Bank of Pakistan it is to preserve stability of the financial system and promote inclusion and innovation.

Pakistan had been exploring the possibility of introducing a CBDC, but no concrete implementation had been announced till now.

There are a number of potential benefits of CBDC in context of Pakistan, including:

i. Increased efficiency of the payment system,
ii. Improved financial inclusion,
iii. Reduced cost of remittances,
iv. Enhanced monetary policy transmission,
v. Mitigation of financial risks.

However, there a number of challenges that need to be addressed before CBDC can be implemented in Pakistan, including:

i. Technical challenges,
ii. Legal and regulatory challenges,
iii. Public acceptance,
iv. Financial stability risks.

The SBP is working to address these challenges and is committed to developing a CBDC that is safe, secure, and beneficial for the Pakistani economy.

Here are some of the issues and trends related to CBDC in Pakistan

Issues:

- **Technical challenges:** The development of a CBDC requires a high level of technical expertise and resources. The SBP is working to build up its technical capacity in this area.
- **Legal and regulatory challenges**: The issuance of CBDC would require new laws and regulations. The SBP is working with the government to develop these laws and regulations.
- **Public acceptance**: The success of CBDC will depend on public acceptance. The SBP is working to educate the public about CBDC and to build trust in this new technology.
- **Financial stability risks**: The issuance of CBDC could pose risks to financial stability. The SBP is working to mitigate these risks.

Trends:

- **Increasing interest from the SBP**: The SBP is increasingly interested in the potential benefits of CBDC.
- **Growing international cooperation**: The SBP is working with other central banks and international organizations to share knowledge and experience on CBDC.
- **Technological advancement**: The development of new technologies, such as blockchain, is making CBDC more feasible.

Like many central banks, SBP is also currently studying the CBDC and experimenting with the overall idea. In this respect, SBP is talking to peer central banks, vendors and thought leaders to understand various design choices and how they can have maximum positive impact towards achieving our policy objectives of financial inclusion. Apart from this, SBP also initiated capacity building for its officials by arranging workshops on CBDC with World Bank. Apart from this, SBP is also in coordination with IMF to start a TA on CBDC in upcoming weeks on various areas such as design choices, technological aspects, monetary implications, and design thinking.

In conclusion, before making a final decision regarding the way forward, SBP wants to be very clear about what benefits CBDCs would offer over and above the existing and newer digital payments options, what challenges including costs and risks a CBDC might entail, and how it might affect broader policy objectives of the Central Bank. Before creating digital public

infrastructure for CBDC, SBP is engaging in thorough testing and prototyping phases to identify potential issues, vulnerabilities, or shortcomings in the chosen technology (Javaad et al., 2023). The SBP is committed to exploring the possibility of issuing CBDC in Pakistan. The SBP is aware of the challenges and risks involved, but it is also confident that CBDC can be a valuable tool for promoting financial inclusion and economic growth.

4.4.5. Lessons Learnt

State Bank of Pakistan's focus is on how CBDC will contribute to preserve stability of financial system, promote inclusion, and provide innovative solutions to the problems faced by the customers as well as banking industry. Pakistan has a well-structured and well-functioning Real Time Gross Settlement system for the payments. The ex-governor Dr. Reza Baqir mentioned in his address at Bank for International Settlement that SBP learned from experiments of project Jasper by Bank of Canada and Project Setlla by Bank of England. The question posed by the ex-governor was how to ensure the settlement finality and integration of blockchain system with core banking. He further referred to project Helvetia of Bank of International Settlement innovations hub and Swiss National Bank to work on finding the answers for the viability and usability of CBDC.

There is strong commitment by SBP to timely launch CBDC but the security aspect of it is a huge concern. SBP's focus is on compatibility of CBDC with legal and regulatory framework, primarily with cyber security, online frauds, robustness of telecom infrastructure, foreign exchange management, accessibility, value storage and acceptance at the global level in different countries.

Hence, the country is observing and learning from the experiences of other countries to launch efficient CBDC frameworks. It is important that CBDC have strong footing from operational and technological viewpoint.

As the central banks are responsible for the safety, security, and soundness of financial services, it is important that central banks take their time for establishing robust CBDC system based on DLT.

4.4.6. Country-Specific Policy Recommendations

Comprehensive examination of different economic, technological, and policy variables is necessary for CBDC implementation. Here are some suggestions for CBDC implementation policy:

Privacy and Security: Implement robust security measures to protect against cyber threats, fraud, and counterfeiting. Consider privacy concerns by balancing the need for transparency with the protection of users' personal data.

Interoperability and Accessibility: Ensure interoperability with existing payment systems and digital currencies to promote adoption. Guarantee accessibility for all segments of the population, including those without access to smartphones or the internet.

Regulation and Compliance: Develop a regulatory framework that addresses issues related to anti-money laundering (AML) and know your customer (KYC) requirements. Collaborate with relevant authorities to prevent illegal activities facilitated by the CBDC.

Monetary Policy and Financial Stability: Carefully consider the impact of CBDC on monetary policy tools and transmission mechanisms. Establish mechanisms to mitigate risks to financial stability, such as bank runs or excessive capital flows.

Transaction Monitoring and Reporting: Implement transaction monitoring and reporting mechanisms to track the usage of CBDC and detect potential illicit activities.

User Education and Awareness: Launch an educational campaign to inform the public about CBDC, its benefits, and how to use it safely. Provide resources for users to understand the risks and responsibilities associated with CBDC.

Technology Infrastructure: Develop a robust, resilient, and scalable technology infrastructure that can manage high transaction volumes and adapt to future technological advancements.

Pilot Programs and Feedback: Conduct pilot projects to evaluate the CBDC in a controlled setting and collect user and stakeholder input. Before complete implementation, use this input to make the necessary enhancements and modifications.

Financial Inclusion: By focusing on underserved and unbanked groups, CBDC can be used to increase financial inclusion. Establish collaborations with fintech firms and financial institutions to deliver CBDC services that are easily accessible.

Legal Framework: Make that a legal framework is in place that defines the duties and obligations of regulators, issuers, and CBDC users.

Transparency and Accountability: Keep CBDC management, distribution, and issuance transparent. Create systems for audits and public accountability.

Implementing a CBDC is a complex and multifaceted task that requires careful planning and coordination. These policy recommendations provide a starting point for Pakistan to consider when developing their CBDC strategies.

4.4.7. Implications of Policy Recommendations for OIC Member Countries

1. **Collaborative Learning Networks:** Establish collaborative learning networks within the OIC to share knowledge and expertise related to CBDC implementation. Create forums where countries can exchange insights and lessons learned, helping those who are less advanced in their CBDC journey benefit from the experiences of others.
2. **Digital Infrastructure Development:** Prioritize investment in digital infrastructure across OIC countries, especially in regions with limited access to technology. Improving digital connectivity and access to the internet is essential to ensure that CBDCs can be accessed by a broader population.
3. **Flexible Regulatory Frameworks:** Develop regulatory frameworks that are adaptable and scalable, allowing countries to tailor their CBDC policies to their specific needs and stages of development. Encourage countries to establish baseline regulatory requirements while providing flexibility for further refinement as their CBDC projects progress.
4. **Inclusive Financial Education:** Implement comprehensive financial education programs that target underserved populations, focusing on digital literacy and CBDC awareness. These programs can help build trust in CBDCs and empower individuals to use them responsibly.
5. **Collaborative Research Initiatives:** Foster collaborative research initiatives among OIC countries to explore innovative use cases and potential benefits of CBDCs in regional contexts. Joint research can help identify common challenges and opportunities and guide the development of CBDC strategies tailored to the region.

4.5. Singapore

4.5.1. Background Information

- Group: Asian
- OIC Membership: No
- Legal System: Common Law

Prior to 1970, the various monetary functions associated with a central bank were performed by several government departments and agencies. As Singapore progressed, the demands of an increasingly complex banking and monetary environment led to streamlining of the functions to facilitate the development of a more dynamic and coherent policy on monetary matters. In 1970, Parliament passed the Monetary Authority of Singapore Act leading to the formation of Monetary Authority of Singapore (MAS) on 1 January 1971. The passing of the MAS Act gave MAS the authority to regulate the financial services sector in Singapore. MAS has been given powers to act as a banker to and financial agent of the Government. It has also been entrusted to promote monetary stability, and credit and exchange policies conducive to the growth of the economy. In April 1977, the Government decided to bring the regulation of the insurance industry under MAS. The regulatory functions under the Securities Industry Act (1973) were also transferred to MAS in September 1984. MAS now administers the various statutes pertaining to money, banking, insurance, securities and the financial sector. Following its merger with the Board of Commissioners of Currency on 1 October 2002, MAS also assumed the function of currency issuance.

Singapore is a country that has shown a strong interest in digital currencies and has established itself as a hub for fintech innovation in the region. The MAS has taken a proactive approach to the development of digital currencies, recognizing their potential to increase financial inclusion, reduce costs, and increase the efficiency of financial transactions. One of the key factors contributing to the growth of digital currencies in Singapore is the country's highly developed infrastructure, which includes robust internet connectivity, a well-developed financial sector, and a high level of technological literacy. In addition, the government and financial institutions in Singapore have been proactive in promoting the use of digital currencies, recognizing their potential to drive economic growth and innovation. Another factor that is driving the growth of digital currencies in Singapore is the country's efforts to promote financial inclusion. Despite being a highly developed economy, many people in Singapore still

do not have access to basic financial services, including bank accounts and credit. Digital currencies offer a way for these people to participate in the financial system, even if they do not have access to traditional financial services.

In 2023, Singapore is experiencing a steady but somewhat cautious economic trajectory. The GDP growth rate for the year is projected at 1.5% (Lin, 2023), indicating a moderate expansion of the nation's economy. To support this growth, the Monetary Policy Rate stands at 3.6% (MAS, 2023c), which signals a balanced approach by the central bank to manage interest rates and stimulate economic activity. However, one challenge the country faces is inflation, which is currently at 5.5% (Lin, 2023). This relatively high inflation rate may put pressure on the cost of living and consumer spending, warranting careful economic management. Singapore, known for its resilience and adaptability, is likely to employ a combination of monetary policies and fiscal measures to maintain stability and ensure sustainable growth in the face of these economic dynamics.

The case study of Singapore's implementation of a CBDC is a remarkable example, as the country's monetary authority has been at the forefront of global financial innovation. To gain insights into Singapore's experience, interviews were conducted with regulatory bodies and financial institutions, along with a comprehensive survey of the Singaporean public. The objective was to delve into the underlying principles guiding the development of the digital Singapore Dollar (SGD), and the valuable lessons that can be drawn for other jurisdictions contemplating similar initiatives.

Singapore, a dynamic city-state with a population of approximately 5.5 million, is renowned for its status as a global financial hub and a technology-driven economy. Singapore boasts remarkable connectivity and digital penetration rates in 2023. Mobile phone ownership stands at an impressive 153.8% of adults, reflecting the widespread use of multiple devices by individuals for both personal and professional purposes. Internet penetration is equally remarkable, with 96.9% of the population having access to the web. The prevalence of mobile internet users at 85.7% showcases the growing importance of smartphones as a primary means of online access. Moreover, internet subscriptions cover 96% of the population, emphasizing the accessibility of digital services to Singaporeans. Interestingly, with 59% of active lines in dual SIM (DataReportal, 2023), it underlines the convenience and adaptability of modern communication, where individuals often manage multiple phone numbers and connections for various needs. These statistics affirm Singapore's commitment to staying at the forefront of

digital innovation and technology adoption, making it a global leader in the digital landscape. As a leading financial center in Asia embarked on its journey of CBDCs in 2016 with a project named “Ubin” and for r-CBDC in 2021. An in-depth examination of Singapore's journey promises to provide valuable insights and best practices for other countries, particularly those within the ASEAN region, seeking to embark on a similar path of financial innovation and inclusion.

4.5.1.1. Digital Robustness and Crypto Ecosystem

According to the report, in the span of the initial nine months of 2021, technology startups within Singapore garnered a notable sum of $11.2 billion in investments. This achievement remarkably surmounts the preceding year's cumulative total of $5.5 billion for the entirety of 2020, signifying a more than twofold increase (Chong, 2021). This trajectory bespeaks an upsurge in investor confidence and enthusiasm, tangibly underscoring the burgeoning prospects and developmental trajectory of Singapore's tech sector.

Singapore boasts an expansive tech ecosystem, encompassing nearly 2,600 technology startups and a robust contingent of 200 ancillary entities, comprising accelerators, incubators, and research institutes (Crunchbase, 2023). This diverse cohort collectively spans a comprehensive array of technological domains, engendering a rich tapestry encompassing artificial intelligence, cloud computing, cybersecurity, e-commerce, fintech, healthtech, edutech, and other pertinent fields. The confluence of these innovative startups and facilitating organizations is buttressed by a suite of government-endorsed initiatives, programs, and resources, synergistically offered by industry associations and vested stakeholders. This collective support mechanism buttresses the developmental and expansionary aspirations of these emerging ventures.

Singapore's ascendancy in the tech arena further finds resonance in its enviable global rankings. Leading the charge is Singapore's pre-eminence in digital infrastructure, an accolade underscored by its first-place ranking among 11 prominent Asian economies (Board, 2019). This assessment emanates from the prestigious Asian Digital Transformation Index formulated by the Economist Intelligence Unit. Singapore's digital infrastructure prowess is underscored by its robust metrics across diverse dimensions, encompassing parameters like broadband velocity, mobile penetration, cloud readiness, and the tenets of cybersecurity. This cutting-edge digital architecture not only fosters seamless connectivity but also propels the adoption of emergent technologies and best practices across various sectors and domains.

The ascendancy of the Singaporean tech sector is distinctly delineated by its prime investment domains. Within this spectrum, the foremost categories commanding investment include Crypto/Blockchain, Payments, and Wealthtech. This strategic allocation of resources is emblematic of the sector's strategic inclinations and orientations.

Nurtured by the confluence of supportive policies, infrastructural prowess, and a dynamic startup ecosystem, Singapore stands as an exemplar of forward-looking technological advancement poised at the intersection of innovation and pragmatism.

An instrumental determinant bolstering the triumph of Singapore's burgeoning tech sector is its resolute intellectual property rights safeguarding framework. This construct serves as a catalyst that nurtures ingenuity and inventiveness within the realms of its tech entrepreneurs and researchers. As per the discerning evaluation of the World Economic Forum, Singapore acquires a distinguished second position globally among 131 economies for its intellectual property rights protection (IPOS, 2023). This commendable standing derives from notable accomplishments across diverse indicators, including patent applications, trademark registrations, contract enforcement, and judicial autonomy. Remarkably, Singapore's intellectual property rights protection ecosystem serves as an alluring beacon for foreign investors and corporations, prompting them to consider the establishment of their regional or global headquarters and research centers within its confines.

Singapore's tech milieu is strategically poised to harness the manifold prospects and complexities characteristic of the digital economy. This landscape is characterized by escalating cross-border data exchanges and digital trade. To address this transformative context, Singapore has orchestrated Digital Economy Agreements (DEAs) in collaboration with Australia, Chile, New Zealand, and the UK. These seminal agreements serve as instrumental conduits for cross-border data transfers and digital commerce amongst the participating nations. Rooted in the principles of interoperability and mutual recognition of digital protocols, these DEAs pave the way for collaborative frameworks encompassing digital standards, systems, and paradigms. Additionally, these accords propel synergistic cooperation and coordination in domains such as data security, cybersecurity, fintech, and e-commerce.

4.5.2. Monetary and Payment Systems

Singapore boasts a highly developed financial and payment system, integral to its thriving economy. The Monetary Authority Singapore (MAS) serves as the central bank and regulatory authority responsible for overseeing and governing the financial sector.

The country's banking sector is robust, with a mix of domestic and international banks, including DBS Bank, United Overseas Bank (UOB), and OCBC Bank, offering a comprehensive range of financial services. Singapore's electronic payment systems are renowned for their efficiency, enabling seamless fund transfers and transactions. Notable systems include FAST (Fast and Secure Transfers), PayNow, and SGQR, a national QR code standard simplifying payments (Sloane, 2018). Digital banking has gained traction, with digital banks like Grab Financial and Sea Group's SeaMoney providing a wide array of online financial services. Payment cards, including credit and debit cards from major networks like Visa and MasterCard, are widely accepted. Mobile payment solutions like Apple Pay, Google Pay, and Samsung Pay are also commonplace. The country's capital markets, notably the Singapore Stock Exchange (SGX), are known for their strength, while the asset management industry thrives stringent regulation and compliance measures, including AML/CFT efforts, are priorities for MAS.

Singapore actively promotes fintech innovation through regulatory sandboxes and initiatives, attracting fintech investments and fostering innovation in financial technology. As a global financial hub, Singapore offers an extensive range of financial services, including wealth management, insurance, and trade finance, solidifying its position in the global financial landscape.

In addition to the traditional payment regulations, Singapore has also established itself as a cryptocurrency-friendly jurisdiction. The Payment Services Act, which came into effect in January 2020, regulates cryptocurrency service providers and aims to provide a framework for licensing and supervision (Chainalysis, 2020). On the 15th of August, 2023, MAS expressed its commitment to overseeing stablecoin-related operations through the implementation of a novel framework known as the single-currency stablecoin (SCS) framework (MAS, 2023d). This framework will necessitate that issuers of stablecoins regulated by the MAS adhere to a set of explicit criteria pertaining to reserve assets, redemption at par, disclosures, as well as prudential and solvency prerequisites. In its approach to CBDCs and digital currencies, MAS often seeks input from the public and the financial industry through public consultations. This

approach ensures that regulatory decisions take into account a wide range of perspectives and expertise.

4.5.3. Digital SGD

4.5.3.1. r-CBDC: A Journey Towards Digital SGD

MAS has been actively engaged in the exploration and implementation of CBDCs and DLT in partnership with the financial industry and other central banks. This initiative commenced with the inception of Project Ubin in 2016 (Accenture, 2020). MAS has predominantly directed its experimental efforts towards wholesale cross-border transactions involving financial institutions. This strategic focus acknowledges the significant potential of such transactions in effectively tackling both longstanding and emerging difficulties within the realm of payments.

On the front of r-CBDC, MAS has conducted a comprehensive initial appraisal of the economic rationale underpinning its potential issuance in Singapore. This preliminary assessment encompasses a deep-seated examination of its implications for financial stability and the tenets of monetary policy (Monetary Authority of Singapore (MAS), 2021). The MAS's findings have underscored that, as of the present juncture, the exigency to introduce a r-CBDC in Singapore is not resounding. This judgment stems from the fact that the existing pantheon of payment systems and services stands characterized by efficiency, reliability, and inclusivity. However, the MAS is quick to acknowledge the prospect of future scenarios wherein a r-CBDC might engender benefits, ranging from augmenting financial inclusion and empowering programmable money to mitigating systemic vulnerabilities. Thus, the MAS is poised to remain vigilant in monitoring the unfolding developments and demand dynamics concerning r-CBDCs, both domestically and internationally.

Project Orchid. After this initial assessment, MAS embarked its journey towards digital SGD by launching a project called “Orchid” at the Singapore Fintech Festival (SFF) 2021 (MAS, 2022). The primary aim of Project Orchid is to establish the fundamental technological infrastructure and technical capabilities required for the potential issuance of a r-CBDC in Singapore. This CBDC would serve as a digital representation of the Singapore dollar currency, if the decision to implement such a system is made in the future. Project Orchid is a comprehensive and long-term exploratory initiative aimed at investigating the diverse design and technical elements relevant to a r-CBDC system in Singapore. This project encompasses multiple phases and spans

several years, to evaluate different aspects such as the system's functionality and its interaction with the existing payment infrastructures.

Orchid Model. The Purpose Bound Money (PBM) model, which is being investigated in the initial stage of Project Orchid, is to enhance the existing concept and functionalities of programmable payment and programmable money. It denotes a set of guidelines and specifications that outline the criteria under which a digital currency can be utilized. PBM can be classified as bearer instruments because of their inherent characteristics of including self-contained programming logic and being transferable between two parties without the need for middlemen.

One essential element of PBM pertains to the inherent digital medium of exchange, which is intrinsically equipped with programmable logic. This feature enables its utilization across many platforms and systems. PBM has the potential to facilitate the digitization of vouchers.

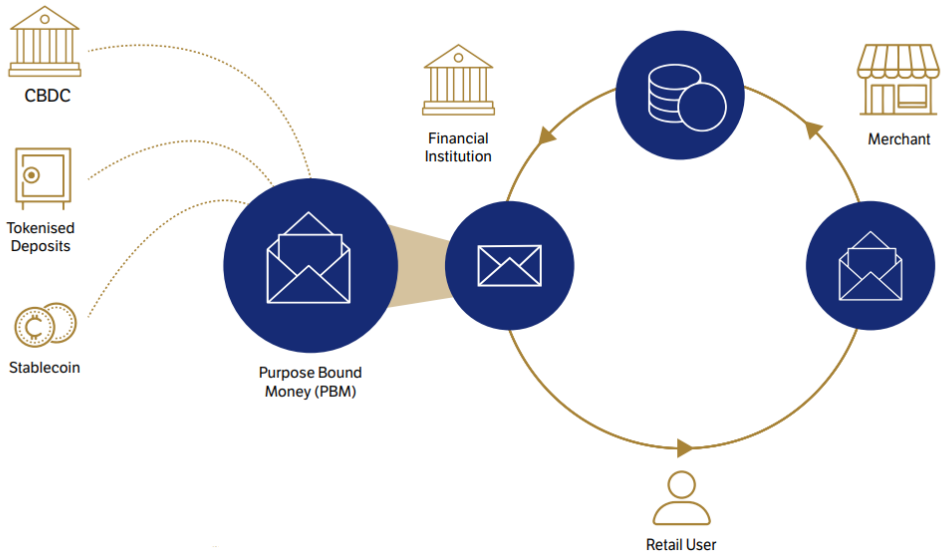
A coupon is accompanied by a predetermined set of conditions that dictate its utilization. The individual in possession of the voucher has the ability to show it to merchants who are part of the program and, in return, get products or services through a programmable payment mechanism. In certain cases, the provisions of the voucher scheme provide its transferability among individuals, incorporating a programmable money element. Therefore, a consumer can get a gift voucher and transfer it to another individual, who can then utilize it at a merchant in the program. Vouchers could be allocated as a means of facilitating government disbursement initiatives. As an illustration, the Community Development Council (CDC) vouchers, included in the Household Support Package in Singapore, have been specifically devised to mitigate the expenses associated with daily life and assist hawkers and local merchants the pandemic has adversely impacted. The distribution of vouchers is targeted towards households who meet the eligibility criteria, and these coupons are specifically designed to be utilized at merchants located in the heartlands.

The PBM functions as a digital instrument that serves as a bearer, potentially facilitating government disbursements. In terms of conceptualization, the PBM possessor can show the PBM and withdraw funds without necessitating the possession of a bank account.

Although the initial focus is on a r-CBDC, the PBM technology has been developed to be independent of the specific liabilities it is based on. There are three fundamental factors that support this design decision:

MAS anticipates that any forthcoming r-CBDC will constitute a minor proportion of our overall money supply. It is expected to serve a valuable yet limited function in the economy, similar to real cash. Currently, the monetary supply in our economy is mostly composed of privately issued money in the form of bank deposits, constituting approximately 92%. In contrast, banknotes and coins issued by MAS represent a mere 8% of the total money supply.

Figure 8: Illustration of Digital Currencies Backing PBM



Source: (MAS, 2023b)

Furthermore, the r-CBDC system will be integrated into Singapore's comprehensive national digital infrastructure. This infrastructure encompasses many components such as payments, digital identification, data sharing, and authorization and permission processes. The primary objective is to safeguard the privacy and well-being of individuals in a more comprehensive manner. In its capacity as a public payment infrastructure, it is anticipated to assume a significant function in guaranteeing the presence of essential criteria for payments, such as safety, expediency, convenience, and costs. MAS envisions the r-CBDC system as a shared and accessible backend platform that is seamlessly compatible with other established payment systems.

Finally, it should be noted that MAS acknowledges that the possibility of a r-CBDC in Singapore is still under consideration. The current quick rate of global developments implies that it is presently premature to determine the eventual trajectory of the future of money and

payments. In light of these uncertainties, MAS aspires to enhance its technical capabilities in order to develop a r-CBDC. MAS aims to contribute to the collective body of knowledge that will be utilized to advance the field of payments, irrespective of the ultimate decision made by MAS.

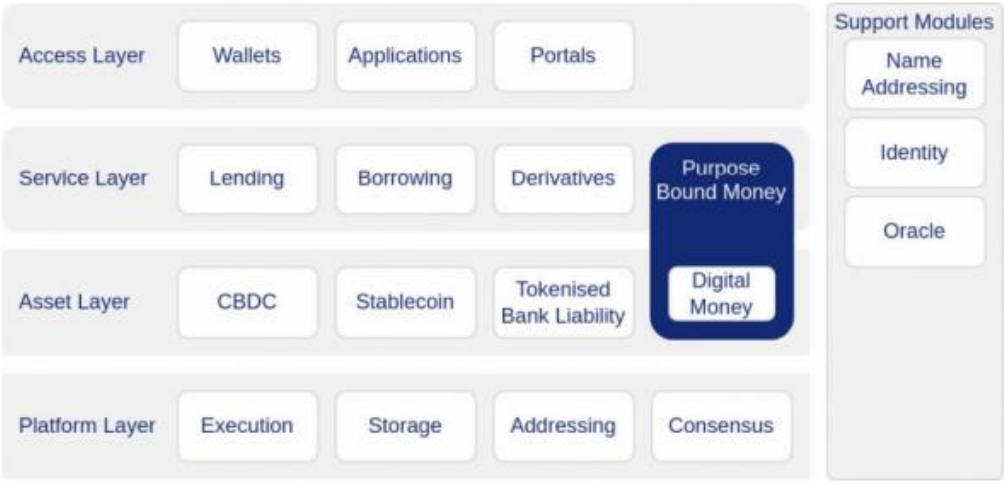
These considerations indicate that in order for the PBM technology to be considered "future-ready" and aligned with MAS' vision, it would be advantageous for it to be compatible with other upcoming digital currencies.

PBM Technological Infrastructure

The PBM solution has been specifically developed to be compatible with both DLT and non-DLT based ledger infrastructure. The initial phase of Project Orchid involved conducting experiments to investigate the interoperability of Permissioned Blockchain Model across various types of ledgers. These ledgers included both public and permissioned, as well as centralized and decentralized systems. The incorporation of both public and private blockchains is mostly driven by the need for experimentation and exploration, with a focus on technological justifications. The inclusion of these entities in no way implies an endorsement by MAS, suggesting their suitability as financial market infrastructure.

The PBM protocol utilizes a four-layered paradigm to delineate the technological framework employed in a digital asset-centric network. The network components can be classified into four distinct layers, namely the access layer, service layer, asset layer, and platform layer, as depicted in *Figure 9*. The programming logic of a PBM can be classified as a service, whereas digital money operates at the asset layer. When digital currency is designated as a PBM, it operates inside the realms of both service and asset levels (MAS, 2023b).

Figure 9: System Architecture Overview



Source: (MAS, 2023b)

The design of the PBM is characterized by its technical neutrality, allowing it to function seamlessly across various ledger systems and asset kinds.

Use cases

The concept has been subjected to several testing by MAS, in collaboration with government agencies and industry stakeholders.

1) **Government Vouchers.** During the 2022 Singapore FinTech Festival (SFF 2022), DBS Bank Ltd (DBS) and GovTech's Open Government Products Division conducted a trial to assess the feasibility of utilizing PBM technology for the purpose of disbursing funds to a specific group of individuals. Participants in the trial have the ability to utilize RedeemSG coupons at designated food and beverage establishments. Upon redemption of these certificates, the merchants will directly receive the digital SGD equivalent associated with the vouchers.
2) **Commercial Vouchers**. Temasek, Fazz Financial Group Pte. Ltd (FAZZ) and Grab Holdings Ltd (Grab) tested the issuance of PBM as commercial digital vouchers at SFF 2022 participants on 2nd to 4th November 2022. Trial participants can utilise these vouchers through their preferred wallet applications to make purchases at participating merchants at the Festival.
3) **Government Payouts**. The utilization of PBM for the delivery of payments from government agencies, specifically by OCBC Ltd (OCBC) and the Central Provident Fund

Board (CPFB), is set to be examined. This method aims to facilitate the distribution of government payouts to individuals, eliminating the need for recipients to own a bank account. The experiment will be carried out utilizing a test distribution scheme within a controlled setting, including a specific group of volunteers.

4) **Managing Learning Accounts**. United Overseas Bank Ltd (UOB) and SkillsFuture Singapore (SSG) have initiated a trial to assess the effectiveness PBM in augmenting the existing SSG Credit disbursement process. This initiative aims to facilitate the automatic release of SkillsFuture grants to training providers that meet the eligibility criteria.

4.5.3.2. w-CBDC Projects

In its pursuit of excellence within the realm of w-CBDCs, MAS has embarked on a series of notable international initiatives and synergistic ventures, including:

- **Digital Currency Global Initiative (DCGI):** In tandem with the International Monetary Fund (IMF) and the World Bank Group, MAS engages in a far-reaching partnership aimed at advancing research and galvanizing policy dialogues pertinent to CBDCs and diverse digital currency configurations.
- **Project Dunbar:** The central banks of Australia, Singapore, Malaysia, and South Africa began exploring a platform for international settlements through Project Dunbar. The project was launched in 2021. As of March 2022, the project was successful in building two prototypes to allow international settlements across multiple CBDCs (BIS, 2022).
- **Project Mariana:** In November 2022, Banque de France, Monetary Authority of Singapore and the Swiss National Bank in partnership with the Eurosystem BIS Innovation Hub announced a cross-border automated market maker (AMM) project. This explores using AMMs to facilitate exchange between Swiss franc, euro and Singapore dollar on the wholesale level (MAS, 2023a).
- **Project Onyx:** The Onyx/Multiple CBDC project is a collaboration between the Banque de France and MAS to explore the use of CBDCs for cross-border payments. The project is using JP Morgan's Onyx platform, which is a permissioned blockchain platform that is used for wholesale payments (Banque de France & Monetary Authority of Singapore, 2021). The project has two main objectives:
  i. To explore the technical feasibility of using CBDCs for cross-border payments.
  ii. To explore the potential benefits and risks of using CBDCs for cross-border payments.

The project is still ongoing, and the project team has successfully completed a cross-border payment experiment. The experiment involved transferring euros from the Banque de France to Singapore dollars at the MAS. The transfer was completed in real time and at a low cost.

Table 4: Summary of w-CBDC Projects

Project	Announcement/ Completion Date	Objective	Connected countries/ organizations	Use Case	Technical Design/ Technologies
Ubin	2016	to explore the use of Blockchain and DLT for clearing and settlement of payments and securities.	Monetary Authority of Singapore (MAS) in collaboration with J.P. Morgan and Temasek	Wholesale	DLT
Dunbar	09/2021	to explore the use of CBDCs for international settlements.	Bank for International Settlements (BIS) Innovation Hub Singapore Centre, the Reserve Bank of Australia (RBA), the Bank Negara Malaysia (BNM), MAS and the South African Reserve Bank (SARB)	Wholesale	Two different DLT platforms – Corda and Quorum
Mariana	11/2022	improving the effectiveness, safety and transparency of FX trading and settlement	Banque de France, Monetary Authority of Singapore and the Swiss National Bank in partnership with the Eurosystem BIS Innovation Hub	Wholesale	DeFi protocols and based on public blockchain
Onyx	06/2021	to explore the use of CBDCs for cross-border payments	Banque de France and MAS	Wholesale	Permissioned and Private DLT
Cedar x Ubin+	11/2021	to explore the use of	Federal Reserve Bank of New	Wholesale	HTLC Smart contracts

	DLT for cross-border multi-currency transactions.	York's New York Innovation Center (NYIC) and MAS

Source: Authors 'own compilation

Project Ubin

Project Ubin emerges as a testament to MAS's collaborative stance with the financial industry, with its overarching objective being the exploration of blockchain and DLT applications within the intricate terrain of payments and securities clearing and settlement. This project unfurls across multiple years and phases, each earmarked to tackle specific industry challenges and to address the evolving needs of the burgeoning blockchain ecosystem.

Through a pragmatic approach, Project Ubin has yielded transformative outcomes, notably in the following domains:

- **Cross-Border Payments:** The project underscores how DLT can confer expeditiousness, cost-efficiency, and transparency to cross-border payments via the utilization of diverse CBDCs. An exemplar of this endeavor is the creation of a prototype platform called m-CBDC Bridge, a collaborative creation alongside the Bank of Thailand, the Hong Kong Monetary Authority, the Central Bank of the United Arab Emirates, and the BIS Innovation Hub.
- **Delivery versus Payment (DvP)**: The utility of DLT shines through in its capacity to facilitate simultaneous exchange and definitive settlement of tokenized digital currencies and securities assets. This augments operational efficiency and curtails settlement risks. Notably, the project has collaborated with the Singapore Exchange to cultivate DvP capabilities conducive to the settlement of tokenized assets across disparate blockchain platforms.
- **Payment versus Payment (PvP)**: The project delineates how DLT can revolutionize the realm of foreign exchange transactions by affording real-time and atomic settlement. This paradigmatic shift mitigates settlement risk and elevates liquidity management. In a testament to its collaborative ethos, the project has collaborated with the Bank of Canada and the Bank of England to explore alternative models that can fortify PvP settlement across divergent time zones.

As the curtain descends on Project Ubin's journey, it enters its fifth and ultimate phase. This pivotal phase assumes a panoramic stance, aiming to facilitate pervasive ecosystem collaboration and seamless integration across platforms and networks. With a commitment to fostering continuous advancement and innovation, the project has disseminated the source codes and technical documentation of its prototypes to the public domain. This strategic move is poised to catalyze further research and innovation endeavors undertaken by central banks, financial institutions, academic entities, and other key stakeholders. The 2023 report of this project showed that DLT has the potential to enhance interoperability and achieve 30-second atomic settlement in cross-border multi-currency payments.

The present collaborative research endeavor investigated a cross-border multi-currency scenario wherein vehicle currencies serve as intermediaries for the exchange of currency pairs that have limited trading activity. The study investigated the potential of DLT to facilitate connectivity among diverse simulated currency ledgers, mitigate settlement risk, and expedite settlement time.

4.5.4. CBDCs: Needs, Challenges, and Trends

These are following some of the key needs, challenges, and trends related to CBDC in Singapore. As CBDC developments continue, Singapore is likely to address these aspects to ensure a successful implementation and integration into its financial ecosystem.

Needs:

1. **Payment System Modernization:** One of the primary needs for CBDC in Singapore is to modernize the payment system. CBDC can enable faster, more efficient, and secure payments, benefiting both businesses and consumers.
2. **Enhanced Financial Inclusion:** Singapore recognizes the need to improve financial inclusion. CBDC can provide unbanked and underbanked populations with access to digital financial services, fostering greater financial inclusion.
3. **Cross-Border Trade Facilitation:** As an international trading hub, Singapore needs a digital currency solution that simplifies cross-border trade. CBDC can streamline transactions, reducing costs and delays for businesses engaged in global trade.

4. **Monetary Policy Tools:** CBDC offers the Monetary Authority of Singapore (MAS) additional monetary policy tools. Real-time transaction data can provide insights into economic activity, helping in making more informed policy decisions.

Challenges:

1. **Security Concerns:** Ensuring the security of CBDC transactions and wallets is a paramount challenge. Singapore must implement robust cybersecurity measures to protect against cyber threats and fraud.
2. **Privacy Considerations:** Striking a balance between privacy and transparency is challenging. Singapore needs to address privacy concerns while maintaining compliance with AML and CTF regulations.
3. **Interoperability:** Achieving interoperability with other CBDCs and digital currencies is a complex challenge. Singapore should work on international standards and protocols to enable cross-border CBDC transactions.
4. **User Adoption:** Encouraging the widespread adoption of CBDC can be challenging. Singapore must educate the public about CBDC's benefits and ensure user-friendly interfaces and applications.

Trends:

1. **Environmental Sustainability:** Sustainability is a growing trend. Singapore may explore green CBDC solutions that are more energy-efficient and align with global environmental goals.
2. **DeFi Integration:** DeFi (Decentralized Finance) integration with CBDC is a notable trend. Singapore could explore DeFi applications built on the CBDC infrastructure.
3. **Digital Identity:** Integrating digital identity with CBDC is becoming common. Singapore might adopt digital identity solutions to enhance security and user verification.
4. **Cross-Border Collaboration:** Collaborating with other countries on CBDC initiatives is a trend. Singapore may seek partnerships and agreements to facilitate cross-border CBDC transactions.

5. **Regulatory Framework Refinement:** Evolving regulatory frameworks to accommodate CBDC and digital assets is an ongoing trend. Singapore may refine its regulations to adapt to changing technology and market dynamics.

4.5.5. Lessons Learnt

The experience of Singapore with its CBDC offers valuable lessons for countries considering the launch of their own digital currencies. Singapore's journey underscores the importance of addressing context-specific challenges and developing a well-defined project strategy. Singapore's adoption of a purpose-bound money model for testing a r-CBDC highlights the importance of tailoring CBDC designs to a country's strengths, needs, and unique circumstances. This approach offers several valuable lessons for other countries:

1. **Contextualization is Key:** Rather than simply emulating models from other countries, nations should conduct a thorough assessment of their own strengths, weaknesses, and economic context. Singapore's decision to create a purpose-bound CBDC aligned with its specific requirements and financial ecosystem.
2. **Leverage Existing Infrastructure:** Singapore wisely leveraged its advanced financial infrastructure to build a CBDC that seamlessly integrates with its existing systems. This lesson emphasizes the importance of maximizing the use of existing capabilities and infrastructure when developing a CBDC.
3. **Flexibility for Innovation:** Singapore's approach allows for flexibility in the use of the digital SGD for various purposes, such as business transactions or cross-border trade. This adaptability encourages innovation and diverse use cases, supporting economic growth.
4. **Avoid One-Size-Fits-All Approach:** Not all CBDC models are suitable for every country. Singapore's choice to develop a purpose-bound CBDC model underscores the importance of tailoring the digital currency's features and capabilities to align with a nation's economic goals and financial ecosystem.
5. **Regulatory Alignment:** Singapore's regulatory framework was aligned with the purpose-bound CBDC, ensuring that the digital currency could operate within existing legal and compliance structures. This lesson emphasizes the need for regulatory harmonization when introducing CBDCs.

6. **Collaboration with Stakeholders:** Engaging key stakeholders, including financial institutions, technology providers, and regulators, is crucial when designing purpose-bound CBDCs. Collaboration ensures that the digital currency aligns with the interests and requirements of all relevant parties.
7. **Iterative Development:** The development of purpose-bound CBDCs should be an iterative process that allows for adjustments based on feedback and changing economic conditions. Singapore's approach encourages continuous improvement and adaptation.

4.5.6. Country-Specific Policy Recommendations

1. **Continue to promote fintech innovation**. Singapore has a strong track record of promoting fintech innovation, and this should continue to be a priority as the country explores the potential of CBDCs. The government can do this by providing funding for fintech startups, creating regulatory sandboxes, and encouraging collaboration between the public and private sectors.
2. **Develop a clear regulatory framework for CBDCs**. It is important to develop a clear regulatory framework for CBDCs before they are launched. This will help to ensure that CBDCs are used in a safe and responsible manner, and it will also help to protect consumers.
3. **Partnership and agreements with neighboring countries**. To maximize the benefits of a CBDC, Singapore should actively seek cross-border partnerships and agreements with neighboring countries and major trading partners. This will allow the country to share knowledge and experience, and it will also help to ensure that CBDCs are developed in a way that is compatible with international standards.
4. **Digital Identity Ecosystem Integration:** Seamlessly integrate CBDC with a comprehensive digital identity ecosystem. This integration can enhance security, reduce fraud, and enable efficient customer onboarding and authentication, improving the overall user experience.
5. **Carbon-Neutral CBDC:** Explore the development of a carbon-neutral CBDC to align with global sustainability goals. Implementing blockchain technologies with lower energy consumption and promoting green practices in CBDC operations can contribute to Singapore's commitment to environmental responsibility.

Here are some additional specific recommendations that could be considered by the MAS:

- Conduct a public consultation on the potential benefits and risks of CBDCs. This would help to gather feedback from a wide range of stakeholders, including the public, businesses, and financial institutions.
- Establish a task force to develop a roadmap for CBDC development. This task force could be composed of representatives from the MAS, the financial industry, and academia.
- Launch a pilot program for wholesale CBDCs. This would allow the MAS to test the feasibility of CBDCs and to identify any potential risks.
- Develop a contingency plan in case of a cyberattack on CBDC systems. This would help to mitigate the impact of a cyberattack and protect the integrity of CBDCs.

4.5.7. Implications of Policy Recommendations for OIC Member Countries

Drawing policy implications for OIC member countries from Singapore's CBDC case study can offer valuable insights. OIC countries can consider several policy implications based on Singapore's approach to digital currencies and its robust financial ecosystem:

1. **Investing in Digital Infrastructure**. OIC countries should prioritize investments in digital infrastructure, including high-speed internet access and reliable mobile networks, to ensure that citizens have the necessary digital tools to access and use CBDCs.
2. **Fintech Ecosystem Development**. OIC countries can encourage the growth of fintech ecosystems by supporting startups, innovation hubs, and accelerators. This can help build local expertise in digital technologies, including blockchain and DLT, which underpin CBDCs.
3. **Cybersecurity and Data Privacy**. Strengthening cybersecurity measures and data privacy regulations is crucial to protect digital assets and user data associated with CBDCs. OIC countries should prioritize cybersecurity education and training.
4. **Enhancing Cybersecurity Measures**. OIC countries can prioritize investments in cybersecurity to safeguard CBDC systems against cyber threats and ensure the trust and security of digital currencies.
5. **Cross-Border Collaboration**. Collaborating with neighboring OIC member countries and international partners can facilitate cross-border payments and trade.

Learning from Singapore's approach to fostering interoperability and cross-border partnerships can be valuable.

6. **Supporting Digital Literacy**. OIC countries can implement educational initiatives to raise digital literacy levels among their populations, ensuring that citizens understand the benefits and risks associated with digital currencies.
7. **Fostering Innovation Ecosystems**. Building a conducive environment for fintech innovation, similar to Singapore's thriving fintech ecosystem, can promote economic growth and technological advancement within OIC member countries.
8. **Monetary Policy Considerations**. OIC countries should carefully consider the implications of CBDCs on their monetary policies, exchange rate regimes, and financial stability, considering lessons learned from Singapore's experience.

4.6. Survey Analysis

A survey carried out across the OIC and non-OIC countries among professionals, students, regulatory agencies and business owners to see the overall awareness and familiarity on the CBDCs as well as prospective expectations and assessments. The survey questions and quick statistical overview are as follows.

Table 5: Distribution of Respondents

Country	*Very familiar*	*Familiar to some extent*	*Not familiar*	*Total*
Belgium	1	-	-	1
Ecuador	1	-	-	1
Germany	2	1	-	3
Indonesia	-	12	6	18
India	-	-	1	1
Iraq	-	1	-	1
Malaysia	1	1	-	2
Morocco	1	-	-	1
N/A	1	-	1	2
Nigeria	4	2	-	6
Pakistan	1	1	1	3
Palestine	-	3	-	3
Qatar	2	3	-	5
Saudi Arabia	-	2	-	2
Thailand	1	-	-	1
Türkiye	4	18	6	28
UAE	2	-	-	2
United Kingdom	5	2	-	7
Uruguay	1	-	-	1
United States	1	-	-	1
Grand Total	**28**	**46**	**15**	**89**

Q1: To what extent are you familiar with CBDCs?

The structured survey results provide insights into the level of familiarity with CBDCs among a diverse group of 89 respondents from 19 countries, including academicians, practitioners, and regulators. The question asked respondents to gauge their familiarity with CBDCs, and the responses are categorized as follows:

- **Very familiar** (28 respondents): This category indicates a substantial level of knowledge and understanding regarding CBDCs. Respondents who chose "Very familiar" are likely well-versed in the concepts, features, and potential implications of CBDCs. They may have actively engaged with CBDC-related research, developments, or practical applications.
- **Familiar to some extent** (46 respondents): This group represents individuals who possess a moderate level of familiarity with CBDCs. They have some knowledge of CBDCs but may not be as deeply informed as those in the "Very familiar" category. They may have encountered CBDC-related information or discussions in their field but might not have extensive expertise.
- **Not familiar** (15 respondents): These respondents indicated that they are not familiar with CBDCs. This group likely includes individuals who have not encountered CBDC-related information, have not had exposure to the topic, or have not engaged in discussions or research related to CBDCs.

Table 6: Survey Results

Question	SA	AG	NA	DA	SD	DK
A: CBDCs have the following potential strengths						
A1: Increased financial inclusion	29%	48%	16%	3%	2%	3%
A2: Reduced transaction costs	40%	44%	9%	6%	0%	1%
A3: Greater control over monetary policy	31%	31%	22%	8%	4%	2%
A4: Reduced risk of fraud and counterfeiting	15%	37%	28%	15%	3%	2%
A5: Improved security and transparency	21%	40%	21%	11%	3%	2%
A6: Greater speed and efficiency	38%	44%	16%	0%	0%	2%
A7: Reduced need for intermediaries	35%	42%	13%	8%	1%	1%
B: CBDCs have the following potential weaknesses						
B1: Complexity in implementation and management	18%	54%	13%	11%	2%	1%
B2: Risk of cyber-attacks and hacking	38%	42%	11%	7%	0%	2%
B3: Privacy concerns	36%	40%	9%	9%	4%	1%
B4: Risk of financial fraud and money laundering	17%	33%	9%	31%	8%	2%
B5: Over dependence on technology and infrastructure	30%	42%	16%	6%	4%	2%
C: CBDCs have the following potential opportunities						
C1: Greater transparency and accountability in financial transactions	28%	51%	10%	9%	0%	2%
C2: More effective management of monetary policy	18%	46%	20%	6%	6%	4%
C3: Reducing the risk of bank runs and financial crises	9%	25%	37%	20%	6%	3%
C4: Improving access to credit and reducing financial exclusion	19%	43%	18%	12%	3%	4%
D: CBDCs have the following potential threats						
D1: Too much centralization	22%	44%	18%	9%	3%	3%
D2: Disruption of traditional banking systems	17%	39%	20%	17%	4%	2%
D3: Building trust and acceptance among the public	19%	38%	20%	12%	6%	4%
D4: Addressing concerns over privacy and security	27%	35%	19%	10%	6%	3%
D5: Increasing state control over individuals	31%	40%	19%	4%	2%	2%

E: CBDCs can potentially affect the banking industry in various ways						
E1: Decreased demand for traditional bank deposits	19%	42%	22%	12%	2%	2%
E2: Increased competition among banks	15%	51%	19%	13%	0%	2%
E3: New business opportunities for banks	22%	54%	13%	7%	1%	2%
E4: Greater financial stability	11%	28%	37%	13%	6%	4%
E5: Enhanced regulatory oversight	21%	46%	22%	6%	2%	2%
F: Developing and implementing CBDCs in OIC countries require international collaboration and coordination in the following areas:						
F1: Fostering technical development and standards	45%	43%	9%	1%	0%	2%
F2: Improving regulatory and legal framework	43%	48%	2%	3%	1%	2%
F3: Easing cross-border payments	39%	50%	9%	0%	0%	2%
F4: Enhancing trust and transparency among countries	30%	46%	16%	2%	2%	3%
F5: Enhancing political and economic cooperation	27%	48%	17%	2%	3%	2%
F6: Increasing bilateral trade & investments	26%	49%	16%	1%	3%	5%

Notes: **SA** = Strongly Agree, **AG** = Agree, **NA** = Neither agree nor disagree, **DA** = Disagree, **SD** = Strongly Disagree, **DK** = I do not know.

Q2: To what extent do you agree or disagree with the following statements?

The table presents survey responses to a set of statements regarding the potential **strengths, weaknesses, opportunities, and threats** of CBDCs. Respondents were asked to indicate their level of agreement with each statement, with options ranging from "Strongly agree" to "Strongly disagree," along with an "I do not know" option. Here is an interpretation of the findings:

A) CBDCs have the following potential strengths:

- **A1: Increased financial inclusion:** The majority of respondents (SA 29% + AG 48%) believe that CBDCs have the potential to increase financial inclusion. This indicates a positive perception of CBDCs' ability to extend financial services to a broader population.
- **A2: Reduced transaction costs:** Respondents are generally in favor of the idea that CBDCs can lead to reduced transaction costs, with a majority (SA 40% + AG 44%) expressing agreement.
- **A3: Greater control over monetary policy**: A substantial number of respondents believe that CBDCs offer the potential for greater control over monetary policy, with a majority (SA 31% + AG 31%) expressing agreement. However, one-fifth of respondents remained neutral.
- **A4: Reduced risk of fraud and counterfeiting**: Respondents are divided in their views regarding whether CBDCs can reduce the risk of fraud and counterfeiting. While a significant number agree (SA 15% + AG 37%), a notable portion remains neutral (NA 28%) or disagrees (DA 15% + SD 3%).

- **A5: Improved security and transparency**: Most respondents (SA 21% + AG 40%) believe that CBDCs have the potential to improve security and transparency, indicating a positive perception of these attributes. Meanwhile, some respondents tend to disagree (DA 11% + SD 3%) or remain neutral (19%).
- **A6: Greater speed and efficiency:** The majority of respondents (SA 38% + AG 44%) anticipate that CBDCs can offer greater speed and efficiency, reflecting a positive outlook on these aspects.
- **A7: Reduced need for intermediaries**: Most respondents (SA 35% + AG 42%) believe that CBDCs can reduce the need for intermediaries, indicating a perception that CBDCs may streamline financial processes.

Hence, the survey results reveal a generally positive outlook on the potential strengths of CBDCs, with respondents expressing agreement on various aspects such as financial inclusion, reduced transaction costs, greater control over monetary policy, improved security, efficiency, and reduced need for intermediaries. However, there are also areas of divergence, particularly regarding the reduction of fraud and counterfeiting, where opinions vary.

B) CBDCs have the following potential weaknesses:

- **B1: Complexity in implementation and management**: A majority of respondents (SA 18% + AG 54%) acknowledge the potential complexity in implementing and managing CBDCs, indicating concerns about the challenges associated with their adoption and operation.
- **B2: Risk of cyber-attacks and hacking:** Many respondents (SA 38% + AG 42%) express concern about the risk of cyber-attacks and hacking associated with CBDCs. This reflects a recognition of the importance of cybersecurity in the context of digital currencies.
- **B3: Privacy concerns**: A significant number of respondents (SA 36% + AG 40%) share concerns about privacy in relation to CBDCs. This suggests that privacy considerations are a salient issue for these respondents.
- **B4: Risk of financial fraud and money laundering**: Respondents are divided in their views regarding the risk of financial fraud and money laundering associated with CBDCs. While a significant number express agreement (SA 17% + AG 33%), there are also respondents who disagree (31%) or strongly disagree (8%) with this concern.

- **B5: Over-dependence on technology and infrastructure**: The majority of participants (SA 30% + AG 42%) recognize the potential risk of overdependence on technology and infrastructure with CBDCs. This suggests an awareness of the importance of maintaining robust technological foundations.

Overall, the survey results reveal a mix of concerns and recognition of potential weaknesses associated with CBDCs. Respondents express a wide range of opinions regarding issues such as complexity, cybersecurity risks, privacy, financial fraud, technology dependence, and centralization. These findings highlight the multifaceted nature of discussions surrounding the adoption and implementation of CBDCs, with varying levels of agreement and concern among the respondents.

C) CBDCs have the following potential opportunities:

- **C1: Greater transparency and accountability in financial transactions:** A majority of respondents (SA 28% + AG 51%) believe that CBDCs offer the potential for greater transparency and accountability in financial transactions, reflecting a positive perception of these attributes.
- **C2: More effective management of monetary policy**: Many respondents (SA 18% + AG 46%) anticipate that CBDCs can enhance the effectiveness of monetary policy management. However, there is also a notable portion of respondents who either disagree (6%) or strongly disagree (6%) with this statement or neutral (20%).
- **C3: Reducing the risk of bank runs and financial crises:** Respondents' opinions vary regarding whether CBDCs can reduce the risk of bank runs and financial crises. While there are those who agree (25%) or strongly agree (9%), a substantial number are neutral (37%) or express disagreement (DA 20% + SD 6%).
- **C4: Improving access to credit and reducing financial exclusion**: A majority of respondents (SA 19% + AG 43%) believe that CBDCs can improve access to credit and reduce financial exclusion, indicating a positive outlook on these aspects.

The results suggest varying opinions and perceptions regarding the potential opportunities associated with CBDCs. While there is agreement on some aspects, such as greater transparency and accountability in financial transactions as well as improved access to credit, there are divergent views on others, including the effectiveness of monetary policy management and the risk of bank runs. However, no responses received on the potential centralization, disruption of

traditional banking systems, and public trust-building aspects of CBDCs, concerns over privacy and security, and state control.

D) CBDCs have the following potential threats:

- **D1: Too much centralization**: Most respondents (SA 22% + AG 44%) express concern about the potential for too much centralization with CBDCs, suggesting anxieties regarding centralized control.
- **D2: Disruption of traditional banking systems**: Respondents' opinions vary regarding whether CBDCs could disrupt traditional banking systems. While there are concerns expressed (SA 17% + AG 39%), there are also respondents who disagree (17%) or strongly disagree (4%) with this threat, and 20% are neutral.
- **D3: Building trust and acceptance among the public:** Respondents hold mixed views on the challenge of building trust and acceptance among the public for CBDCs. While some agree (38%) or strongly agree (19%), others are neutral (20%) or disagree (DA 12% + SD 6%) with this potential threat.
- **D4: Addressing concerns over privacy and security:** Respondents express a range of opinions regarding the ability of CBDCs to effectively address concerns over privacy and security. While the majority agree (35%) or strongly agree (27%), others are neutral (19%) or disagree (DA 10% + SD 6%) with this statement.
- **D5: Increasing state control over individuals:** A significant number of respondents (SA 31% + AG 40%) are concerned about the potential for CBDCs to increase state control over individuals, indicating apprehensions about government authority.

The results reveal different levels of concern and recognition of potential threats associated with CBDCs. While there is agreement on some aspects, such as centralization and concerns over state control, there are divergent views on others, including the disruption of traditional banking systems and building public trust. These findings highlight the complexity of discussions surrounding the adoption and implementation of CBDCs, with respondents expressing a range of opinions on the potential threats.

The table also presents survey responses to a set of statements **on the ways CBDCs can potentially affect the banking industry**. Respondents were asked to indicate their level of agreement with each statement, with options ranging from "Strongly agree" to "Strongly disagree," along with an "I do not know" option. Here is an interpretation of the findings:

- **E1: Decreased demand for traditional bank deposits:** Respondents hold mixed views on whether CBDCs will lead to decreased demand for traditional bank deposits. While there are concerns expressed (SA 19% + AG 42%), a significant number are neutral (22%) or disagree (DA 12% + SD 2%) with this potential effect.
- **E2: Increased competition among banks:** A majority of respondents (SA 15% + AG 51%) anticipate that CBDCs will lead to increased competition among banks, suggesting the perception that CBDCs will alter the competitive landscape.
- **E3: New business opportunities for banks:** Most respondents (SA 22% + AG 54%) believe that CBDCs will create new business opportunities for banks, indicating an optimistic outlook on the potential benefits for the banking industry.
- **E4: Greater financial stability:** Respondents' opinions vary regarding whether CBDCs will contribute to greater financial stability. While there is a significant number who are neutral (39%), some respondents agree (SA 11% + AG 28%) or disagree (DA 13% + SD 6%) with this potential effect, and many respondents remain neutral (37%).
- **E5: Enhanced regulatory oversight**: A majority of respondents (SA 21% + AG 46%) believe that CBDCs will lead to enhanced regulatory oversight, indicating the perception that regulatory authorities will play a more active role.

So, the survey results highlight diverse opinions on the potential impacts of CBDCs on the banking industry. While there is almost a consensus on some aspects, such as increased competition and new business opportunities, there are differing views on others, including the impact on traditional bank deposits and financial stability. These findings emphasize the complex and multifaceted nature of discussions surrounding CBDCs and their effects on the banking sector, with respondents expressing a range of perspectives on potential outcomes.

Finally, the participants were asked about **the international collaboration and coordination required for developing and implementing CBDCs in OIC countries**.

- **F1: Fostering technical development and standards**: A majority of respondents (SA 45% + AG 43%) believe that fostering technical development and standards is essential for developing and implementing CBDCs in OIC countries, indicating a consensus on the importance of technical aspects.
- **F2: Improving regulatory and legal framework:** Most respondents (SA 43% + AG 48%) emphasize the need for improving the regulatory and legal framework for CBDCs in OIC countries, highlighting the importance of a robust regulatory environment.

- **F3: Easing cross-border payments**: Respondents generally agree (SA 39% + AG 50%) that easing cross-border payments is a crucial aspect of international collaboration for CBDCs in OIC countries, reflecting the recognition of cross-border efficiency.
- **F4: Enhancing trust and transparency among countries**: Generally, there is an agreement (SA 30% + AG 46%) on the importance of enhancing trust and transparency among countries, while some respondents are neutral (16%) or express disagreement (DA 2% + SD 2%).
- **F5: Enhancing political and economic cooperation**: Many respondents tend to agree (SA 27% + AG 48%) on the need for enhancing political and economic cooperation for CBDCs in OIC countries, but there is some variability in opinions, with some respondents expressing neutrality (17%) or disagreement (DA 2% + SD 3%).
- **F6: Increasing bilateral trade and investments:** A majority of respondents (SA 29% + AG 49%) emphasize the importance of increasing bilateral trade and investments as part of international collaboration for CBDCs in OIC countries, indicating nearly a consensus on this aspect.

Hence, the survey results highlight a general consensus among respondents on the importance of international collaboration and coordination in various areas for the development and implementation of CBDCs in OIC countries. These areas include technical development and standards, regulatory and legal framework improvement, easing cross-border payments, enhancing trust and transparency, political and economic cooperation, and increasing bilateral trade and investments. While there are varying levels of agreement, these findings underscore the recognition of the multifaceted nature of international collaboration in the context of CBDCs.

In summary, the survey results reveal a mixed bag of opinions and perceptions regarding the potential of CBDCs. There is a general optimism about the potential benefits of CBDCs, such as increased financial inclusion, reduced transaction costs, and greater transparency and accountability. However, there are also concerns about the potential risks and challenges associated with CBDCs, such as complexity, security, privacy, and centralization. The survey also highlights the potential impact of CBDCs on the banking industry, with the possibility of decreased demand for traditional bank deposits and increased competition among banks.

CHAPTER V: CONCLUSION

This chapter provides practical policy recommendations for enhancing collaboration and cooperation among OIC member countries in developing CBDCs. They are presented in a step-by-step approach and designed as a roadmap, considering short-, medium-, and long-term structures. The recommendations are tailored to the level of financial sector development and digitalization in each OIC member country, and the rationale behind each of them is clearly explained to encourage the transfer of knowledge and experience among OIC member countries.

5.1. Concluding Remarks

The study reports that many countries around the world are exploring the possibility of implementing CBDCs, with some already in advanced stages of development or even having fully launched their own CBDCs. The study emphasizes that while there are potential benefits to using CBDCs, such as reducing costs in cross-border transactions and increasing financial inclusion, there are also important issues to address, including financial system stability and cybersecurity.

To each of the stakeholders' perspectives and, thus needs. Points to be addressed should include a comprehensive strategy for transition at the national level, the public awareness, technological capacity, technical and physical infrastructure so that even at the household level user-friendliness (i.e. downloadable apps in smartphones etc.) along with the security assurances. Higher demand for digitally enabling devices such as phones, computers and else would also be needed especially governments' involvement in mitigating the costs in lower-income countries.

The privacy concerns along with the security of the total system should be met by the central banks, in particular when cross-border transactions take place. Banking supervisory institutions and other financial/capital market regulatory institutions must also collaborate with central banks. Inter-governmental sharing of biometric information might become another sensitive issue in that regard.

As a result, this study seeks to guide for fostering collaboration among the central banks of OIC member countries and aims to provide comprehensive insights into the challenges and opportunities presented by CBDCs. It offers policy recommendations to facilitate increased

cooperation among these countries and serve as a valuable resource for policymakers and international organizations.

5.2. Detailed Policy Recommendations

Developing and implementing CBDCs is a complex process that involves various stakeholders and considerations. Depending on the stage of CBDC development, the countries are recommended to develop the following steps:

NO.	ACTION	DESCRIPTION
#1	**Define Objectives and Use Cases**	• Determine the primary objectives for introducing a CBDC, such as enhancing payment systems, financial inclusion, reducing cash usage, or improving monetary policy transmission. • Identify specific use cases for the CBDC, such as retail payments, wholesale settlements, cross-border transactions, or government disbursements. • This will help to inform the design and development of the CBDC, as well as the necessary infrastructure and support systems.
#2	**Legal Framework and Regulatory Compliance**	• Review and update relevant legal frameworks and regulations to accommodate the issuance and usage of CBDCs. • Ensure compliance with existing financial regulations, anti-money laundering (AML), and know-your-customer (KYC) requirements.
#3	**Select Technology Stack**	• Choose the appropriate technology stack for the CBDC, considering factors like blockchain, distributed ledger technology (DLT), or centralized databases. • Decide on the consensus mechanism, data privacy features, and smart contract capabilities if applicable.
#4	**Design and Development**	• Collaborate with technology partners or in-house teams to design the CBDC infrastructure, including digital wallets, transaction processing, and security measures. • Develop and test the CBDC's core features, ensuring scalability, security, and interoperability.
#5	**Monetary Policy Integration**	• Define how the CBDC will interact with monetary policy tools and objectives, such as interest rates, money supply, and inflation targeting. • Determine the rules and mechanisms for issuing, redeeming, and controlling the supply of CBDCs.

#6	**Security and Privacy Measures**	• Implement robust security measures to protect the CBDC against cyber threats and hacking attempts. • Ensure user data privacy and compliance with data protection regulations.
#7	**Distribution and Access**	• Establish channels for distributing CBDCs to the public, including partnerships with financial institutions or direct issuance to individuals. • Develop user-friendly digital wallets or mobile apps for accessing and managing CBDCs.
#8	**User Education and Awareness**	• Launch educational campaigns to inform the public, businesses, and financial institutions about CBDC usage, benefits, and security best practices.
#9	**Testing and Pilots**	• Conduct comprehensive testing, including performance, security, and usability testing. • Launch pilot programs in specific regions or industries to gather feedback and address potential issues.
#10	**Regulatory Approvals**	• Seek regulatory approvals and clearances from relevant authorities before the official launch.
#11	**Launch and Rollout**	• Officially launch the CBDC for public use, ensuring that the necessary infrastructure and support systems are in place.
#12	**Monitoring and Maintenance**	• Continuously monitor the CBDC's performance, security, and adoption rates. • Regularly update and maintain the technology stack to address emerging challenges and opportunities.
#13	**Feedback and Improvement**	• Gather feedback from users, financial institutions, and other stakeholders to identify areas for improvement. • Iteratively enhance the CBDC based on user experiences and changing needs.
#14	**Cross-Border Integration**	• Explore opportunities for cross-border transactions and international interoperability of the CBDC with other countries' digital currencies.
#15	**Regulatory Oversight**	• Maintain ongoing regulatory oversight to ensure compliance with evolving financial and legal standards.
#16	**International Collaboration**	• Collaborate with other central banks and international organizations to establish standards and protocols for cross-border CBDC usage.

Action 1: Defining the Objectives and Use Cases

- **Enhancing Payment Systems**: One of the primary objectives for introducing a CBDC is to enhance the efficiency and security of payment systems. By clearly defining this objective, a country aims to streamline payment processes, reduce transaction costs, and offer faster and more convenient payment options for individuals and businesses.
- **Financial Inclusion**: Another crucial objective may be to improve financial inclusion, ensuring that underserved and unbanked populations have access to digital financial services. Identifying this goal helps policymakers design CBDCs that are accessible to a broader range of people, potentially reducing disparities in financial access.
- **Reducing Cash Usage**: Governments may seek to reduce the reliance on physical cash to combat issues such as tax evasion and the informal economy. By specifying this objective, they can develop strategies and incentives to encourage the adoption of CBDCs as a digital alternative to cash.
- **Improving Monetary Policy Transmission**: CBDCs can also be designed to enhance the effectiveness of monetary policy tools. Defining this objective helps central banks create CBDCs that align with their monetary policy goals and can be used as a tool for influencing interest rates and money supply.
- **Specific Use Cases**: Identifying use cases, such as retail payments, wholesale settlements, cross-border transactions, or government disbursements, is essential to tailor the CBDC's features and functionalities. Different use cases may require varying degrees of scalability, security, and interoperability.

***Rationale**: Start with a clear vision and objectives. What do you want to achieve with your CBDC? Do you want to improve financial inclusion, reduce the cost of remittances, or make it easier for businesses to make payments? Once you have a clear understanding of your goals, you can start to develop a CBDC that is tailored to meet your needs.*

Clearly defining objectives and use cases is critical because it lays the foundation for the entire CBDC project. Without a clear understanding of what the CBDC aims to achieve and how it will be used, it is challenging to make informed decisions about its design, technical requirements, and supporting infrastructure. Additionally, having well-defined objectives helps communicate the benefits of CBDC adoption to the public and relevant stakeholders, fostering support and collaboration.

Action 2: Ensuring the Legal Framework and Regulatory Compliance

- **Reviewing and Updating Legal Frameworks**: Developing and implementing a CBDC often necessitates changes to existing legal frameworks and regulations. This step ensures that the legal environment is conducive to CBDC issuance and usage. For example, it may involve updating laws related to central bank operations, payment systems, and digital currencies.
- **Compliance with Financial Regulations**: Compliance with existing financial regulations, including AML/CFT and know-your-customer (KYC) requirements, is crucial to maintain the integrity and security of the financial system. CBDCs must adhere to these regulations to prevent illicit activities and protect user identities.

***Rationale*:** *Develop a comprehensive regulatory framework that addresses legal, financial, and security aspects, ensuring compliance with existing laws and regulations. CBDCs will need to be regulated in order to ensure that they are used in a safe and responsible manner. It is important to build a strong regulatory framework that considers the unique features of CBDCs.*

The legal framework and regulatory compliance steps are essential for several reasons:

- ***Legal Clarity:*** *It provides legal clarity and certainty to all stakeholders involved in CBDC transactions, including financial institutions, businesses, and individuals. This clarity encourages trust and confidence in using CBDCs.*
- ***Risk Mitigation****: Compliance with AML/CFT and KYC requirements helps mitigate the risk of financial crimes, such as money laundering and terrorist financing, associated with CBDC transactions.*
- ***Consumer Protection****: Regulatory compliance safeguards consumer interests by ensuring that CBDC transactions are conducted in a secure and transparent manner, protecting users from fraud and abuse.*
- ***Central Bank's Role****: It defines the central bank's role and responsibilities in issuing and managing CBDCs, ensuring that the central bank operates within its legal mandate.*

Action 3: Technology Stack Selection

- **Choosing the Appropriate Technology Stack:** Selecting the right technology stack is a critical decision. It involves choosing the underlying technology that will power the CBDC infrastructure. Factors to consider include whether to use blockchain technology, DLT, or centralized databases.

The performance and scalability of the CBDC system will depend on the correctly chosen technology stack.

- **Consensus Mechanism:** Decide on the consensus mechanism that will validate and confirm transactions on the CBDC network. Common consensus mechanisms include Proof of Authority, Proof of Work (PoW), Proof of Stake (PoS), and others. Probably, Proof of Authority may be the most relevant for CBDC. The choice of consensus mechanism impacts factors like transaction speed, energy efficiency, and security.
- **Data Privacy Features:** Determine the level of data privacy and confidentiality required for CBDC transactions. Depending on the use cases and regulatory requirements, CBDC systems may incorporate privacy features, such as confidential transactions or zero-knowledge proofs.
- **Smart Contract Capabilities:** If applicable to the CBDC design, decide whether to include smart contract functionality. Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller directly written into code. They can automate various processes and transactions and significantly reduce bureaucratic costs in the field of public and government services.

Rationale: *Implement secure and scalable technology, such as blockchain, to ensure the integrity, privacy, and efficiency of CBDC transactions. The choice of technology stack is pivotal as it influences the CBDC's technical capabilities, security, and efficiency. Whether to use blockchain or another technology depends on factors like the desired level of decentralization and the specific use cases of the CBDC*.

Action 4: Design and Development

- **Collaboration with Technology Partners**: Collaborate with technology partners or in-house development teams to design the CBDC infrastructure. This includes defining the architecture, protocols, and interfaces needed for the CBDC system to function effectively.
- **Development and Testing**: Develop and rigorously test the CBDC's core features. This involves creating digital wallets for users, establishing transaction processing systems, and implementing robust security measures. Testing ensures that the CBDC system is scalable to handle a large number of transactions, secure to protect user assets, and interoperable with existing payment systems.

Rationale: *Create intuitive and user-friendly interfaces for CBDC wallets and applications to encourage adoption among a wide range of users.*

This phase is where the technical aspects of the CBDC are brought to life. Collaboration with technology experts ensures that the CBDC infrastructure is robust, user-friendly, and secure. Rigorous testing is essential to identify and resolve any technical issues before the CBDC's launch.

Build CBDC systems that are adaptable to future technological advancements and changing economic conditions.

Action 5: Ensuring Monetary Policy Integration

- **Define Interaction with Monetary Policy**: Determine how the CBDC will interact with the central bank's monetary policy tools and objectives. This step is crucial for aligning CBDC issuance and management with broader economic goals. It includes decisions on how CBDCs will be used to influence interest rates, money supply, and inflation targeting.
- **Issuance and Control Rules**: Establish clear rules and mechanisms for issuing, redeeming, and controlling the supply of CBDCs. These rules help maintain the stability and integrity of the CBDC system. For instance, limits on CBDC issuance may be set to prevent inflationary pressures.

Rationale: *Conduct thorough economic impact assessments to understand the potential effects of CBDC introduction on monetary policy, financial stability, and the broader economy.*

Integrating CBDCs with monetary policy is fundamental for central banks. It allows them to achieve their economic objectives while leveraging the benefits of digital currency. Clear issuance and control rules are necessary to maintain stability and public trust in the CBDC.

Action 6: Ensuring Security and Privacy Measures

- **Robust Security Measures**: Implement robust security measures to safeguard the CBDC against cyber threats and hacking attempts. This includes encryption, secure key management, multi-signature features and multi-factor authentication to protect both the CBDC system and user assets. When using smart contract technology, additional security functions could also be available, such as blocking suspicious transactions, blacklisting, etc.
- **User Data Privacy**: Ensure user data privacy and compliance with data protection regulations. CBDC transactions should adhere to privacy standards, and user information must be securely handled to protect individuals' sensitive data.

Rationale: *Implement strong security measures to protect user data and transactions, balancing privacy with regulatory requirements.*

Security is paramount in the world of digital currencies. Robust security measures protect the CBDC system from threats, bolster user confidence, and prevent unauthorized access to funds. Compliance with data protection regulations is essential to respect user privacy.

Action 7: Establishing Distribution Channels and Providing Financial Inclusion

- **Establish Distribution Channels:** Set up channels for distributing CBDCs to the public. This may involve partnerships with financial institutions (e.g., banks) that can offer CBDC services to their customers. Alternatively, CBDCs may be issued directly to individuals.
- **User-Friendly Digital Wallets**: Develop user-friendly digital wallets or mobile apps that allow individuals to access and manage their CBDC holdings conveniently. These wallets should be intuitive and secure to encourage adoption.
- **Cross-chain integration with public blockchain solutions**. It makes sense to develop cross-chain bridges between CBDC and public blockchain systems to increase the spread of CBDC and thereby increase the liquidity of the national currency pegged to the CBDC.

Rationale*: Design CBDCs to promote financial inclusion by offering access to unbanked and underbanked populations.*

Establishing distribution channels and user-friendly wallets ensures that CBDCs are accessible to the public. Collaboration with financial institutions can extend the reach of CBDC services, making them widely available.

Action 8: User Education and Public Awareness

- **Educational Campaigns**: Launch educational campaigns to inform the public, businesses, and financial institutions about CBDC usage, benefits, and security best practices. These campaigns aim to raise awareness and build trust in the CBDC system.

Rationale: *CBDCs are a new and unfamiliar technology for many people. It is important to communicate effectively with the public about CBDCs and how they will work. Educate the public about their benefits, risks, and how to use them securely. This will help to build trust and acceptance of CBDCs.*

Educational campaigns are vital to inform users and stakeholders about the benefits of CBDCs, how to use them securely, and what precautions to take. They contribute to the successful adoption of CBDCs.

Action 9: Testing and Piloting

- **Comprehensive Testing**: Conduct comprehensive testing of the CBDC system. This includes performance testing to ensure it can handle the expected transaction volume, security testing to identify and address vulnerabilities, and usability testing to assess the user experience.
- **Pilot Programs**: Consider launching pilot programs in specific regions or industries to gather real-world feedback. Pilots help identify any operational challenges or issues that may arise when CBDCs are used on a larger scale. Feedback from pilot participants can inform necessary adjustments.

Rationale: *CBDCs are new and complex technologies. It is important to conduct thorough research and testing before launching a CBDC. This will help to identify and mitigate any potential risks.*

Comprehensive testing and pilot programs help identify and address any technical or operational issues early in the development process. This proactive approach improves the overall functionality and reliability of the CBDC system.

Action 10: Obtaining Regulatory Approvals

- **Seek Regulatory Approvals**: Before the official launch of the CBDC, seek regulatory approvals and clearances from relevant authorities. This step ensures that the CBDC complies with legal and regulatory frameworks, including financial regulations and consumer protection laws.

Rationale: *Seeking regulatory approvals ensures that the CBDC operates within the legal framework, preventing potential regulatory hurdles or legal challenges after launch.*

Action 11: Official Launch and Rollout

- **Official Launch**: This step involves the official launch of the CBDC for public use. It marks the culmination of the development and testing phases. At this stage, it is crucial to ensure that the necessary infrastructure and support systems are fully operational and ready to handle the increased volume of transactions.

Rationale: *Consider a gradual rollout of CBDCs to test their functionality, gather user feedback, and make necessary adjustments.*

The official launch of the CBDC marks a critical milestone, but it must be executed seamlessly to build trust among users and stakeholders. Ensuring that all necessary infrastructure and support systems are in place minimizes disruptions during the transition.

Action 12: Continuous Monitoring and Maintenance

- **Continuous Monitoring**: After the CBDC's launch, it is essential to continuously monitor its performance, security, and adoption rates. Monitoring helps detect any issues or anomalies promptly, ensuring a smooth user experience and maintaining system integrity.
- **Regular Updates**: Technology evolves rapidly, and the CBDC's technology stack must stay up-to-date. Regularly update and maintain the technology stack to address emerging challenges and opportunities, including security improvements and system enhancements.

Rationale: *Focus on improving payment systems by reducing transaction costs, settlement times, and friction in the payment process.*

Continuous monitoring and regular maintenance are essential to uphold the CBDC's performance and security standards. By proactively addressing issues and adapting to evolving threats, the CBDC remains reliable and secure for users.

Action 13: Feedback and Improvement

- **Gathering Stakeholder Feedback**: Collect feedback from various stakeholders, including users, financial institutions, businesses, and regulatory authorities. These insights provide valuable information on the CBDC's strengths and weaknesses.
- **Iterative Enhancement**: Use the feedback received to continuously enhance the CBDC. This process involves making improvements and adjustments based on user experiences and changing needs. It ensures that the CBDC remains responsive to evolving financial and technological landscapes.

Rationale*: Involve stakeholders early and often. CBDCs will have a significant impact on the financial system. It is important to involve key stakeholders, such as banks, financial institutions, technology providers, businesses, and consumers, early in the development process to ensure smooth integration and acceptance of CBDCs.*

Gathering feedback and iteratively improving the CBDC based on user experiences is essential for its long-term success. Adapting to changing needs and addressing user concerns enhances the CBDC's adoption and utility in the financial ecosystem.

Action 14: Cross-Border Integration

- **Explore Cross-Border Opportunities**: Consider opportunities for cross-border transactions and international interoperability of the CBDC with other countries' digital currencies. This step involves engaging in discussions and negotiations with foreign counterparts to enable seamless cross-border transactions using the CBDC.

Rationale*: Explore possibilities for cross-border CBDC transactions and establish agreements with other countries to facilitate international use. Ensure CBDC systems can interact with existing payment systems, promoting seamless transactions and cross-border compatibility.*

Exploring cross-border opportunities and interoperability is crucial for enhancing the utility of CBDCs on a global scale. It facilitates international trade, remittances, and financial transactions, promoting economic cooperation between countries.

Action 15: Regulatory Oversight

- **Maintain Regulatory Oversight**: Continue to exercise regulatory oversight to ensure that the CBDC remains compliant with evolving financial and legal standards. Regulatory requirements can change over time, and it is essential to adapt the CBDC's operations and policies accordingly.

  Rationale: *Regulatory compliance is an ongoing responsibility. Financial and legal standards can change due to evolving technologies and emerging risks. Maintaining regulatory oversight ensures that the CBDC operates within the boundaries of the law and remains secure for users.*

Action 16: International Collaboration

- **International Collaboration**: Collaborate with other central banks and international organizations to establish standards and protocols for cross-border CBDC usage. This collaboration helps create a harmonized framework for cross-border transactions and ensures that CBDCs from different countries can work together effectively.

Rationale*: Collaboration with other central banks and international organizations such as the IMF or BIS for experience, insight and best practice sharing is essential to create a standardized*

and interconnected ecosystem for CBDCs. International standards and protocols promote trust and interoperability, allowing CBDCs to function seamlessly across borders.

The development and implementation of a CBDC are significant undertakings that require careful planning, collaboration, and continuous monitoring to ensure a successful launch and sustained adoption. Each action should involve input and coordination among central banks, financial institutions, technology partners, and regulatory authorities.

Thus, depending on the stage of CBDC development, the OIC member countries should focus on actions that are more relevant to them:

Stage 1: Research. It is highly important at this stage to set the foundational goals and objectives for the CBDC (*Action 1*). Also, countries should start considering the legal and regulatory implications (*Action 2*) of CBDC issuance. This involves understanding the changes needed in existing legal frameworks and regulations to accommodate CBDCs.

Stage 2: Development. Selecting the robust technology is crucial during the development stage as it directly impacts the technical infrastructure of the CBDC (*Action 3*). Also, collaboration with technology partners and the development and testing of core features (*Action 4*) and defining how the CBDC will interact with monetary policy tools are essential steps in CBDC development (*Action 5*). Legal framework and regulatory compliance (*Action 2*) continue to be relevant as countries should work on updating and adapting their legal and regulatory frameworks to align with the development of the CBDC.

Stage 3: Piloting. Introducing robust security measures and ensuring user data privacy become particularly important as the CBDC moves to the piloting stage (*Action 6*). Moreover, establishing distribution channels and user-friendly wallets becomes crucial as the CBDC is tested with a broader user base (*Action 7*). Comprehensive testing and pilot programs are the hallmark of the piloting stage, helping to identify and address issues before full-scale deployment (*Action 9*). Also, gathering feedback and iteratively enhancing the CBDC based on user experiences are vital (*Action 13*). In the piloting stage, it is important to educate users and stakeholders (*Action 8*) about the CBDC's usage, benefits, and security. Pilot programs are an ideal opportunity to gather user feedback and ensure users are aware of how to use the CBDC securely.

Stage 4: Launch. Seeking regulatory approvals (*Action 10*) is essential before the official launch of the CBDC (*Action 11*) which ensures that infrastructure and support systems are in

place. Next, continuous monitoring and regular updates are essential once the CBDC is in operation (*Action 12*). In its turn, exploring cross-border opportunities becomes more relevant as the CBDC becomes established and seeks international integration (*Action 14*). Consequently, maintaining regulatory oversight is an ongoing responsibility once the CBDC is operational (*Action 15*), and collaboration with other central banks and international organizations becomes more critical as the CBDC seeks to integrate internationally (*Action 16*). *Action 2* remains critical post-launch, as regulatory oversight (*Action 15*) and maintaining compliance with evolving financial and legal standards are ongoing responsibilities. User education and awareness (*Action 8*) remain relevant in this stage to ensure that the broader public, businesses, and financial institutions continue to be informed about CBDC usage and security best practices.

By aligning their actions with the corresponding stage of CBDC development, OIC member countries can efficiently progress through the development process and maximize the success of their CBDC initiatives.

5.3. Policy Formulation Guidelines

The guidelines of policy recommendations for the development and implementation of CBDCs include:

1. *Use well-tested protocols with provable security guarantees:* It is critical to utilize proven consensus protocols and cryptographic primitives to ensure robust cybersecurity protections.
2. *Leverage existing risk management frameworks and regulations*: Policy-makers and regulators should assess which areas of the CBDC ecosystem are covered by current laws and regulations and determine if novel statutes or technical frameworks are necessary for adequate protection.
3. *Conduct extensive testing and security audits:* Governments should have full access to and oversee security testing and audits for all CBDC implementation instances. Open-source code bases can facilitate more participation in the security testing process.
4. *Establish clear accountability rules and policies*: The overall framework governing CBDCs should define accountability for errors, breaches, and their consequences. For CBDCs using distributed ledger technology, accountability requirements among validators on the blockchain should be clearly established.

5. *Promote interoperability*: CBDCs should be designed to be interoperable with relevant financial infrastructure to increase the resiliency of existing financial systems. International coordination on regulation and standard setting is crucial for global interoperability.
6. *Streamline and deconflict regulations*: Policy-makers and regulators should assess existing regulations and determine if any overlap or unnecessarily complicate CBDC implementation. Streamlining and deconflicting regulations can provide adequate protection.
7. *Balance privacy and compliance*: System designs should aim to achieve reasonable levels of payment privacy for users while enabling regulatory authorities to enforce compliance rules. Recent research advancements indicate that privacy and compliance can coexist.

These policy recommendations aim to ensure robust cybersecurity protections, accountability, interoperability, and a balance between privacy and compliance in CBDC implementations.

5.4. Policy Recommendations for the OIC Countries based on the findings of the Case Studies

The policy recommendations based on the findings of the Case Studies have overlapping themes. Here's a breakdown:

5.4.1. Common Policy Recommendations:

1. Develop/Harmonize a CBDC Framework

- Promote a uniform standard for CBDC issuance.
- Collaborate with international initiatives like BIS.
- Draw insights from successful CBDC implementations like the Digital Rupiah in Indonesia.
- Infrastructure and Technical Development

2. Prioritize digital infrastructure investment, ensuring high-speed internet access and reliable mobile networks.

- Establish a specialized technical team or high-level team to create a comprehensive framework for CBDC.
- Regulatory Framework and Cybersecurity

3. Craft a specific regulatory architecture for cross-border CBDC transactions.

- Focus on cybersecurity measures, including sharing details on cyber threats and emphasizing cybersecurity education.
- Introduce robust measures to protect digital assets and user data associated with CBDCs.
- Cross-Border Collaboration and Integration

4. Prioritize cross-border integration of blockchain infrastructure.

- Encourage cross-border collaboration and establish systems like OIC currency-conversion projects.
- Create forums or platforms to facilitate knowledge sharing and collaboration.

5. Promote Financial Ecosystem Development

- Encourage fintech ecosystem development, supporting fintech startups and innovation hubs.
- Boost digital literacy initiatives and focus on cultivating local expertise.

6. Focus on Trade and Monetary Implications

- Adopt or promote CBDC designs that support streamlined cross-border trade.
- Consider monetary policy implications and the potential impacts on financial stability and exchange rate regimes.

5.4.2. Additional Recommendations:

Incorporate Dispute Management Mechanisms

- Integrate automated dispute resolution mechanisms.
- Use smart contract protocols on the blockchain to manage disputes.

Prioritize Sharīʿah-Compliance in CBDC Design

- Ensure designs address prohibitions in Islamic finance.
- Use experiences like eNaira to align CBDCs with rules on ribā and gharar.

Sustainability in CBDC Design

- Prioritize green technology to reduce carbon emissions and energy consumption during CBDC development.

By grouping similar themes together, it is evident that there are recurring focuses on infrastructure, regulation, cross-border collaboration, fintech ecosystem development, and trade across the different sets of recommendations provided.

5.5. Overall Policy Recommendations for the OIC Countries on CBDCs

POLICY ADVICE 1: Establishing a Project Management/Steering Committee and Identifying the Objectives and Use Cases for CBDCs in Consultation with a Wide Range of Relevant Stakeholders (government bodies, financial institutions, universities, think tanks, civil society organizations etc.) to Build a Digital Ecosystem that is interoperable

with Existing Payment System(s), Increase Financial Inclusion and Improve Monetary Policy Transmission

Rationale / Explanation:

It is crucial to have a robust Project Management/Steering Committee comprising of members with diverse expertise that will continuously provide executive support and to ensure the project meets its goals and objectives. The Committee will provide and develop Central Bank digital Currencies (CBDCs) with a clear vision and objectives adapted to meet the needs, which is what to be achieved with CBDC, e.g. improving financial inclusion or making it easier for businesses to pay. Clearly defining objectives and use cases (such as retail payments, wholesale settlements, cross-border transactions, or government disbursements) is critical because it lays the foundation for the entire CBDC projects. Without a clear understanding of what the CBDC aims to achieve and how it will be used, it is challenging to make informed decisions about its design, technical requirements, and supporting infrastructure. Additionally, having well-defined objectives helps communicate the benefits of CBDC adoption to the public and relevant stakeholders, fostering support and collaboration.

POLICY ADVICE 2: Developing Legal Framework and Regulatory Compliance / Regulatory Approval and Oversight for Ensuring Legal Clarity, Risk Management, Consumer Protection and Central Bank's Role

Rationale / Explanation:

It is crucial to develop a comprehensive and robust legal and regulatory framework that addresses legal, financial, and security aspects and the specific characteristics of CBDCs, ensuring compliance with existing laws and regulations. The legal framework and regulatory compliance steps are essential in terms of legal clarity, risk mitigation, consumer protection and Central Bank's role. Seeking regulatory approval within a well-defined framework ensures that the CBDC operates within the legal framework, preventing potential regulatory hurdles or legal challenges after launch. Regulatory compliance however is an ongoing responsibility. Financial and legal standards can change due to evolving technologies and emerging risks. Maintaining regulatory oversight ensures that the CBDC operates within the boundaries of the law and remains secure for users. Such a perspective should meet shari'ah compliance criteria and promote the role of Islamic finance hubs/centers among the OIC member states as well.

POLICY ADVICE 3: Setting-up a Dedicated Task Force including Central Bank Specialists to Identify the Right Technology Stack for the CBDCs (i.e. for providing security, efficiency, scalability, interoperability etc.)

Rationale / Explanation:

It is necessary to implement emerging technologies such as the AI, which ensure the integrity, confidentiality, interoperability, scalability and efficiency of CBDC transactions. The choice of the appropriate Technology stack for the CBDC, considering factors such as distributed ledger

technology (DLT), distributed databases or centralized databases, is crucial as it affects the CBDC's technical capabilities, security, and efficiency. Whether to use block chain or another technology depends on factors like the desired level of decentralization or distributedness along with the specific use cases of the CBDC. Therefore, it might be pertinent to establish a dedicated task force consisting of qualified experts to elaborate on the subject.

POLICY ADVICE 4: Designing and Developing of CBDCs with Extensive Testing and Pilot Studies by Central Banks in Consultation with Technology Experts and Relevant Stakeholders

Rationale / Explanation:

It is important to create CBDC systems that are adaptable to future technological developments and changing economic conditions. Collaboration with technology experts ensures that the CBDC infrastructure is robust, user-friendly, secure, and resilient. Furthermore, creating intuitive and friendly interfaces for CBDC wallets and applications will encourage adoption among a wide range of users. Rigorous testing is essential to identify and resolve any technical issues before the CBDC's launch. Comprehensive testing and pilot programs help identify and address any technical or operational issues early in the development process. This proactive approach improves the overall functionality and reliability of the CBDC system.

POLICY ADVICE 5: Developing Policies/Strategies/Programs for Ensuring Security and Privacy in order to Protect User Data and Transactions, and to Balance Privacy and Legal Requirements

Rationale / Explanation:

It is crucial to implement strong security measures to protect user data and transactions, and to balance privacy and legal requirements. Security is paramount in the world of digital currencies. Robust security measures protect the CBDC system from threats such as cyber threats and hacking attempts, bolster user confidence, and prevent unauthorized access to funds. Compliance with data protection regulations is essential to respect user privacy.

POLICY ADVICE 6: Facilitating the Access of the Public to the CBDCs through User-Friendly Distribution Channels in Collaboration with Financial Institutions

Rationale / Explanation:

Establishing necessary distribution channels and user-friendly wallets ensures that CBDCs are accessible to the public. Collaboration with financial institutions where is needed and/or relevant, can extend the reach of CBDC services, making them widely available.

POLICY ADVICE 7: Enhancing monetary transmission mechanism, Improving Monetary Policy Effectiveness and Financial Stability through the CBDCs

Rationale / Explanation:

Integrating CBDCs with monetary policy is fundamental for central banks. It allows them to achieve their economic objectives such as price stability while leveraging the benefits of digital currency. Certain governance rules are necessary to maintain trust and stability in the CBDCs as many of the ongoing projects consider the CBDCs as complementary to cash. Digitalization of goods and services and the related economic activity may enable monitoring prices instantly, thus lead to better assessment of the impacts of monetary policies.

POLICY ADVICE 8: Developing a Comprehensive Public Relations and Communication Strategy (i.e. Mobile Applications) to Enhance User Capacities and Raise Awareness about CBDC Usage, Benefits, and Security

Rationale / Explanation:

CBDCs are a new and unfamiliar technology for many people. It is important to communicate effectively with the public about CBDCs and how they will work. Increasing financial literacy on the CBDCs is therefore a must, given the potentially widespread usage such digital platforms and interfaces. Awareness campaigns and educational programs are vital to inform the public, businesses, universities and financial institutions etc. about the benefits of CBDCs, how to use them safely, best security practices and what precautions to take. These campaigns aim to raise awareness and build trust in the CBDC system, contributing to the successful adoption of CBDCs.

POLICY ADVICE 9: Developing/Improving Sound Monitoring and Maintenance Mechanisms for Gathering Insights about the CBDC's Performance

Rationale / Explanation:

The official launch of the CBDC marks a critical milestone, but it should be executed seamlessly to build trust among users and stakeholders. Ensuring that all necessary infrastructure and support systems are in place minimizes disruptions during the transition. On the other hand, continuous monitoring and regular maintenance are essential to uphold the CBDC's performance and security standards. **In this context, gathering feedback and iteratively improving CBDC based on user experiences are crucial to its long-term success. By adapting to changing needs and addressing user concerns, in addition to increasing the adoption and utility of CBDC in the financial ecosystem, CBDC remains reliable and secure for users.**

POLICY ADVICE 10: Promoting Cross-Border CBDC Utilization by Enhancing International Cooperation between Central Banks and International Organizations through Standards and Protocols

Rationale / Explanation:

Exploring cross-border opportunities and interoperability by entering into agreements with other countries to facilitate international use is crucial for enhancing the utility of CBDCs on a global scale. It facilitates international trade, remittances, and financial transactions, promoting economic cooperation between countries. International standards and protocols promote trust and interoperability, allowing CBDCs to function seamlessly across borders. Cross-border CBDC integration should also be weighed against the potential destabilizing effects of increased volume of cross border capital flows as well as the potential for a CBDC of home country to displace another one if used extensively in a host country.

Collaboration with other central banks and international organizations is essential to create a standardized and interconnected ecosystem for CBDCs. The OIC-COMCEC Central Banks Forum provides a regular platform for the relevant authorities of the Member Countries. Therefore, this forum in cooperation with relevant OIC institutions such as SESRIC or SMIIC when needed, might be utilized for the realization of this recommendation. SESRIC's training programs on central banking to enhance capacity building in terms of human resources with respect to CBCDs should also be utilized effectively.

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APPENDIX

Table 7: Ranking of OIC countries based on IFDI of year 2020

Market	OIC	Group	2020	2019	2018	2017	2016	2015
Malaysia	**Yes**	**Asian**	**1**	**1**	**1**	**1**	**1**	**1**
Indonesia	Yes	Asian	**2**	2	4	10	10	10
Saudi Arabia	Yes	Arab	**3**	5	5	5	5	5
Bahrain	Yes	Arab	**4**	3	2	2	2	2
United Arab Emirates	Yes	Arab	**5**	4	3	3	3	3
Jordan	Yes	Arab	**6**	6	6	6	8	8
Pakistan	Yes	Asian	**7**	7	7	4	6	6
Kuwait	Yes	Arab	**8**	9	8	8	7	7
Oman	**Yes**	**Arab**	**9**	**8**	**9**	**7**	**4**	**4**
Maldives	Yes	Asian	**10**	12	12	12	12	12
Qatar	Yes	Arab	**11**	10	11	11	9	9
Brunei	Yes	Asian	**12**	11	10	9	14	14
Nigeria	Yes	African	**13**	13	14	14	26	26
Bangladesh	Yes	Asian	**14**	16	13	13	16	16
Turkey	**Yes**	**Asian**	**15**	**18**	**16**	**20**	**25**	**25**
Iran	Yes	Asian	**17**	17	18	16	19	19
Palestine	Yes	Arab	**18**	23	22	21	15	15
Tunisia	Yes	Arab	**19**	22	20	24	17	17
Syria	Yes	Arab	**20**	15	24	32	21	21
Iraq	Yes	Arab	**22**	25	26	29	49	49
Kazakhstan	Yes	Asian	**24**	21	21	22	31	31
Morocco	**Yes**	**Arab**	**29**	**26**	**28**	**25**	**30**	**30**
Gambia	Yes	African	**30**	32	31	34	32	32
Yemen	Yes	Arab	**34**	35	34	35	24	24
Egypt	Yes	Arab	**35**	27	27	26	23	23
Algeria	Yes	Arab	**36**	41	46	48	47	47
Djibouti	Yes	Arab	**37**	38	38	31	33	33
Kyrgyzstan	Yes	Asian	**38**	39	41	37	43	43
Uganda	Yes	African	**41**	48	94	45	63	63
Somalia	Yes	Arab	**42**	36	35	41	42	42
Tajikistan	Yes	Asian	**46**	44	45	40	48	48
Mauritania	Yes	Arab	**47**	45	48	50	37	37
Uzbekistan	Yes	Asian	**49**	54	55	76	102	102
Senegal	Yes	African	**54**	50	49	55	44	44
Suriname	Yes	Asian*	**55**	51	59	71	88	88

Comoros	Yes	Arab	**56**	57	56	58	50	50
Guinea	Yes	African	**60**	61	58	77	65	65
Cameroon	Yes	African	**64**	56	62	51	71	71
Guinea-Bissau	Yes	African	**70**	74	73	74	60	60
Guyana	Yes	Asian*	**71**	77	72	87	112	112
Azerbaijan	Yes	Asian	**72**	63	54	53	35	35
Gabon	Yes	African	**74**	76	75	81	64	64
Sierra Leone	Yes	African	**78**	81	76	80	67	67
Togo	Yes	African	**79**	83	80	91	61	61
Benin	Yes	African	**83**	80	81	88	52	52
Turkmenistan	Yes	Asian	**85**	89	60	99	92	92
Chad	Yes	African	**86**	85	82	89	69	69
Mali	Yes	African	**89**	94	87	92	70	70
Burkina Faso	Yes	African	**90**	93	79	78	72	72
Niger	Yes	African	**91**	95	84	82	66	66
Cote d'Ivoire	Yes	African	**95**	98	77	98	59	59
Mozambique	Yes	African	**97**	97	97	102	46	46

Notes: *The countries are ranked based on IFDI scores of year 2020. The IFDI score is a composite weighted index that measures the overall development and health of the Islamic finance industry. It draws on five indicators that are the main drivers of development in the industry: Quantitative Development, Knowledge, Governance, Corporate Social Responsibility, and Awareness.*

Table 8: Survey questions

Part 1. Background information

1. Please select your country of residence from the list below (indicate if non-OIC):
2. Please indicate your area of specialization (occupation):
3. To what extent are you familiar with the CBDCs?

A. Very Familiar
B. Familiar to some extent
C. Not familiar
D. None

Part 2. To what extent do you agree or disagree with the following statement?

4. CBDCs have the following potential strengths:

Survey Question	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	I Do not Know
Increased Financial Inclusion						

Reduced Transaction Costs						
Greater Control Over Monetary Policy						
Reduced Risk of Fraud and Counterfeiting						
Improved Security and Transparency						
Greater Speed and Efficiency						
Reduced Need for Intermediaries						

5. CBDCs have the following potential weaknesses:

Survey Question	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	I Do Not Know
Complexity in Implementation and Management						
Risk of Cyber Attacks and Hacking						
Privacy Concerns						
Risk of Financial Fraud and Money Laundering						
Over Dependence on Technology and Infrastructure						

6. CBDCs have the following potential opportunities:

Survey Question	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	I Do Not Know
Greater Transparency and Accountability in Financial Transactions						
More Effective Management of Monetary Policy						
Reducing the Risk of Bank Runs and Financial Crises						

Improving Access to Credit and Reducing Financial Exclusion						

7. CBDCs have the following potential threats:

Survey Question	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	I Do Not Know
Too Much Centralization						
Disruption of Traditional Banking Systems						
Building Trust and Acceptance Among the Public						
Addressing Concerns Over Privacy and Security						
Increasing State Control Over Individuals						

8. CBDCs can potentially affect the banking industry in various ways:

Survey Question	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	I Do Not Know
Decreased Demand for Traditional Bank Deposits						
Increased Competition Among Banks						
New Business Opportunities for Banks						
Greater Financial Stability						
Enhanced Regulatory Oversight						

9. Developing & implementing CBDCs in OIC countries require international collaboration and coordination in the following areas:

Collaboration Area	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	I Do Not Know

Fostering Technical Development and Standards						
Improving Regulatory and Legal Framework						
Easing Cross-Border Payments						
Enhancing Trust and Transparency Among Countries						
Enhancing Political and Economic Cooperation						
Increasing Bilateral Trade & Investments						

Table 9: Open-ended interview questions

Time of the interview: **Duration:** **Interviewer:** **Country/Region:**	**Position in the institution (interviewee):** **Age:** **Gender:** **Specialization:**
1.	What are the main advantages and benefits of implementing Central Bank Digital Currencies (CBDCs)? **Follow-up:** What do you believe are the key features of CBDCs that give them an advantage over traditional financial systems?
2.	What potential challenges, such as technical, operational, or financial issues, might arise from implementing CBDCs?
3.	How can CBDCs improve monetary policy, financial inclusion, economic growth, and innovation in the financial industry? **Follow-up:** How can they benefit unbanked and underbanked populations?
4.	What do you perceive as the primary risks or threats associated with the introduction of CBDCs, such as cybersecurity, privacy concerns, or monetary policy implications? **Follow-up 1:** How do you plan to ensure that the adoption of a CBDC does not result in a loss of confidence in traditional currencies, such as cash? **Follow-up 2:** What measures do you plan to put in place to ensure that the adoption of a CBDC does not adversely affect financial stability and monetary policy?
5.	In what ways can CBDCs improve cross-border transactions and facilitate international trade -especially among the OIC countries? **Follow-up:** What challenges might arise in this context?
6.	How do you foresee the impact of CBDCs on the existing commercial banking landscape? What challenges do you anticipate in this process? **Follow-up:** What policies do you

	plan to implement to ensure that the adoption of a CBDC does not create new systemic risks for the financial system?
7.	Can you discuss the importance of international collaboration and coordination - especially among the OIC countries- when it comes to CBDC development and deployment? **Follow-up:** How can countries work together to address common challenges?
8.	What regulatory framework is necessary for the successful implementation and management of CBDCs, and how can it be adapted to address the unique aspects of digital currencies? **Follow-up:** How can the adoption of CBDCs be transparent and accountable to the public?

Note: *The interview questions are subject to minor changes based on pilot study.*

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