T.R.

ISTANBUL SABAHATTIN ZAIM UNIVERSITY

GRADUATE SCHOOL OF EDUCATION

DEPARTMENT OF ISLAMIC ECONOMICS AND FINANCE

DIGITAL TRANSFORMATION IN THE WEST AND EAST: LESSONS FOR THE MUSLIM MAJORITY COUNTRIES

Ph.D. DISSERTATION

Shah FAHAD

Istanbul

January-2025

T.R.

ISTANBUL SABAHATTIN ZAIM UNIVERSITY

GRADUATE EDUCATION INSTITUTE

DEPARTMENT OF ISLAMIC ECONOMICS AND FINANCE

DIGITAL TRANSFORMATION IN THE WEST AND EAST: LESSONS FOR THE MUSLIM MAJORITY COUNTRIES

Ph.D. DISSERTATION

Shah FAHAD

Supervisor

Prof. Dr. Mehmet BULUT

Istanbul

January-2025

This study has been approved in partial fulfillment of the requirements for Ph.D. Degree in Islamic Economics and Finance.

Supervisor Prof. Dr. Mehmet BULUT

Member of jury Prof. Dr. Turan EROL

Member of jury Prof. Dr. Metin Toprak

Member of the Jury Dr. Waqar Badshah

Member of the Jury Dr. Ozan Maraşlı

Approval by

Prof. Dr. Erhan İÇENER

Director, Graduate Education Institute

DECLARATION OF SCIENTIFIC ETHICS AND ORIGINALITY

This is to certify that this PhD thesis titled “Digital transformation in the West and East: Lessons for the Muslim majority countries” is my own work and I have acted according to scientific ethics and academic rules while producing it. I have collected and used all information and data according to scientific ethics and guidelines on thesis writing of Sabahattin Zaim University. I have fully referenced, in both the text and bibliography, all direct and indirect quotations and all sources I have used in this work.

Shah Fahad

ACKNOWLEDGEMENT

I am privileged to have the chance to work with Prof. Dr. Mehmet Bulut as my thesis supervisor. Undoubtedly, working with him was an amazing and beautiful experience. I have gained priceless insights, information, and experiences from my PhD path that go beyond the classroom. For this reason, I would want to sincerely thank my supervisor for his patience, guidance, oversight, and helpfulness.

Furthermore, I would like to express my sincere gratitude to my respected jury members, Prof. Dr. Turan EROL, Prof. Dr. Metin Toprak, Dr. Waqar Badshah, Dr. Ozan Maraşlı and Prof. Dr. YÜCEL Ensari, for their exceptional assistance in sharing knowledge, enhancing my understanding of my doctoral dissertation, and helping me to sharpen my research direction.

In addition, I am grateful to my friends, subject-matter industry experts, and well-wishers who have offered me a dynamic academic atmosphere and unwavering support during my Ph.D. journey. Their friendship, support, and wisdom have all been really helpful in keeping me inspired and on task.

Most importantly, I want to convey my profound gratitude and appreciation to my beloved family members who has supported me wholeheartedly and endured me during my PhD journey.

Lastly, I want to sincerely thank Almighty Allah for all of His favors and for giving me the bravery, tenacity, and endurance I needed to finish my doctorate.

Shah Fahad

ABSTRACT

DIGITAL TRANSFORMATION IN THE WEST AND EAST: LESSONS FOR THE MUSLIM MAJORITY COUNTRIES

Shah FAHAD

Ph.D. Dissertation, Islamic Economics and Finance

Supervisor: Prof. Dr. Mehmet BULUT

January-2025 – 177 + xvii Pages

In recent years, the global financial landscape has undergone a radical shift due to the adoption of digital technologies such as blockchain, artificial intelligence (AI), and central bank digital currencies (CBDCs). This digital transformation is reshaping how financial institutions operate, interacting with customers, and comply with regulatory requirements, particularly in the West and East. While developed economies have largely embraced these technologies to foster innovation and improve efficiency, many Muslim-majority countries face unique challenges in adopting digital transformation within the framework of Islamic finance, which emphasizes Shariah compliance, ethical banking, and financial inclusion.

This dissertation provides a comparative analysis of digital transformation in Western and Eastern financial systems and explores its implications for Islamic financial institutions. The study examines how advanced digital technologies can enhance operational efficiency, regulatory compliance, and customer experience in Islamic banking while remaining aligned with the principles of Islamic law. By evaluating successful digital initiatives in countries like the United States, China, and the Gulf Cooperation Council (GCC) nations, this study highlights the opportunities and challenges Muslim-majority countries face in leveraging digital innovations.

Key findings reveal that while digital transformation presents immense potential for improving financial inclusion, promoting sustainability, and reducing costs, it also raises concerns related to infrastructure readiness, regulatory harmonization, and skilled workforce development. This dissertation offers recommendations for Muslim-majority countries to successfully control these challenges and implement digital

technologies in ways that respect Islamic ethical frameworks, contributing to a more inclusive and resilient financial system.

Keywords: Digital transformation, Islamic finance, blockchain, AI, CBDCs, Shariah compliance, financial inclusion, Muslim-majority countries, fintech innovation.

ÖZET

BATI VE DOĞU'DA DİJİTAL DÖNÜŞÜM: MÜSLÜMAN ÇOĞUNLUKLU ÜLKELER İÇİN DERSLER

Shah FAHAD

Doktora Tezi, İslam Ekonomisi ve Finansı

Danışman: Prof. Dr. Mehmet BULUT

Ocak, 2025-177 + xvii sayfa

Son yıllarda, blok zinciri, yapay zeka (AI) ve merkez bankası dijital para birimleri (CBDC'ler) gibi dijital teknolojilerin benimsenmesi nedeniyle küresel finans manzarası kökten bir değişime uğradı. Bu dijital dönüşüm, özellikle Batı ve Doğu'da finans kuruluşlarının nasıl faaliyet gösterdiğini, müşterilerle nasıl etkileşim kurduğunu ve düzenleyici gerekliliklere nasıl uyduğunu yeniden şekillendiriyor. Gelişmiş ekonomiler, inovasyonu teşvik etmek ve verimliliği artırmak için bu teknolojileri büyük ölçüde benimserken, birçok Müslüman çoğunluklu ülke, Şeriat uyumluluğunu, etik bankacılığı ve finansal katılımı vurgulayan İslami finans çerçevesinde dijital dönüşümü benimsemede benzersiz zorluklarla karşı karşıyadır. Bu tez, Batı ve Doğu finans sistemlerindeki dijital dönüşümün karşılaştırmalı bir analizini sunar ve İslami finans kuruluşları için etkilerini araştırır. Çalışma, gelişmiş dijital teknolojilerin İslami bankacılıkta operasyonel verimliliği, düzenleyici uyumluluğu ve müşteri deneyimini İslami hukuk ilkeleriyle uyumlu kalırken nasıl artırabileceğini inceliyor. Amerika Birleşik Devletleri, Çin ve Körfez İşbirliği Konseyi (GCC) ülkeleri gibi ülkelerdeki başarılı dijital girişimleri değerlendirerek, bu çalışma Müslüman çoğunluklu ülkelerin dijital yeniliklerden yararlanmada karşılaştıkları fırsatları ve zorlukları vurguluyor. Temel bulgular, dijital dönüşümün finansal katılımı iyileştirme, sürdürülebilirliği teşvik etme ve maliyetleri düşürme konusunda muazzam bir potansiyel sunarken, aynı zamanda altyapı hazırlığı, düzenleyici uyumlaştırma ve kalifiye işgücü geliştirmeyle ilgili endişeleri de gündeme getirdiğini ortaya koyuyor. Bu tez, Müslüman çoğunluklu ülkelerin bu zorlukları başarıyla kontrol altına almaları ve daha kapsayıcı ve dayanıklı bir finansal sisteme katkıda bulunarak İslami etik çerçevelere saygılı bir şekilde dijital teknolojileri uygulamaları için öneriler sunuyor. Anahtar kelimeler: Dijital dönüşüm,

İslami finans, blok zinciri, yapay zeka, CBDC'ler, Şeriat uyumluluğu, finansal katılım, Müslüman çoğunluklu ülkeler, fintech inovasyonu.

Anahtar kalimeler: Dijital dönüşüm, İslami finans, blockchain, yapay zeka, CBDC'ler, Şeriat uyumluluğu, finansal katılım, Müslüman çoğunluklu ülkeler, fintech inovasyonu.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

1.1. Digital Transformation and Islamic Finance

Digital transformation (DT) is how companies should use technology, personnel, and processes to radically enhance business performance. So, this is a comprehensive paradigm change that becomes very important to corporations who would like to move ahead and have to stay in a rapidly changing digital market. Digital transformation at its core is described as strategic adoption and use of digital technologies into every facet of a business, which results in significant alternations to the way businesses operate, how they interact with their customers, and the competitive landscapes. A closer look at digital transformation indicates its complex and far-reaching impact across organizational dimensions. The more agile and innovative platform-based approaches of reshaping the business model include, for example, the platform business model and digital products that cater to the current market demand. These will also operationalize processes automatically through tasks, improve data analytics, and workflows. This will be in general to improve efficiency and reduce costs. On their part, customer engagement, in the wake of digital transformation, is about the tightening of their strategies through personalized marketing, better online customer experiences, and the improvement of service delivery that together reinforce customer satisfaction and loyalty.

The Islamic financial sector is undergoing a notable digital transformation due to several technological innovations. This change is essential for operational efficiency, enhancing customer experience, and sustaining a competitive edge. Islamic banks are increasingly adopting digital transformation to remain competitive, improve operational efficiency, and boost customer satisfaction. The COVID-19 pandemic has significantly accelerated these digital initiatives across Islamic financial institutions. Desky and Maulina (2022), highlight that banks such as Bank Syariah Indonesia (BSI), BCA Syariah, and Bank Aceh have been proactive in integrating digital technologies. These institutions understand that digital transformation is essential for enhancing their market position and catering to customers' growing preference for digital banking

services. Examples of these advancements include the implementation of mobile banking, digital wallets, and biometric authentication systems to elevate service delivery and operational effectiveness.

1.1.1. Importance

It goes without saying that digital transformation is, in essence, the reimagining of how to run a business within the context of a digital era. This process is transformative, breaking away from the norm of business practices towards innovative, fluid models which take advantage of data optimization in decision-making processes and create new value. A literature review by Gebayew et al. (2018), elaborated that digital transformation drastically changes the performance metrics and engagement strategies of businesses. The research brings to the fore the necessity for companies to change their business strategies according to the idiosyncrasies of the digital environment in such a way that it significantly improves operational efficiencies and customer satisfaction. The change here is not only the adoption of new technologies but rather an entire transformation of the culture and organizational processes so as to fully exploit the benefits from digital innovations. The business integrates digital tools and techniques that allow a more flexible, data-driven approach towards meeting customer demands and competitive pressures in the marketplace (Gebayew et al., 2018).

The impact of digital transformation on the operational efficiency and competitive advantage of Islamic banks is significant. Adopting digital transformation greatly improves both operational efficiency and competitive standing (Raymond et al., 2023). By incorporating digital technologies, Islamic banks can optimize their operations, lower costs, and provide more tailored and efficient services to their clients. This shift involves not only the adoption of new technologies but also a fundamental reassessment of business processes and organizational frameworks to foster ongoing innovation and improvement. Furthermore, digital platforms enhance financial inclusion by making banking services more accessible to underserved communities, aligning with the core Islamic finance values of promoting social justice and economic equity (Kanwal et al., 2023).

The approach to digital transformation among Islamic banks varies significantly across different regions, influenced by unique regulatory landscapes and market dynamics. For instance, the Saudi Arabian banking sector exhibits a distinct method in

comparison to both developed and emerging Islamic countries. A comparative analysis reveals that while Saudi Arabia and Malaysia have both advanced considerably in adopting digital technologies, their regulatory environments differ, particularly concerning Shariah compliance and the adoption of innovations. In a similar vein, the Turkish financial sector has actively pursued the digitalization of its banking services, prioritizing the enhancement of customer experience and strengthening cyber security to meet the increasing demand for digital financial solutions (Taka & Bayarçelik, 2023)

Digital transformation is reshaping the Islamic financial sector, leading to notable gains in operational efficiency, customer satisfaction, and competitive positioning. Despite ongoing challenges related to regulatory compliance, digital infrastructure, and the availability of skilled human resources, the advantages of integrating advanced financial technologies are clear. Islamic banks must continue to innovate and evolve in response to the rapidly shifting digital landscape to maintain their commitment to financial inclusion and economic development, all while upholding Shariah principles. Effectively implementing digital transformation strategies will not only bolster the resilience and efficiency of Islamic financial institutions but also secure their long-term sustainability within the global financial system.

1.1.2. Strategic Implications and Business Model Innovation

Digital transformation holds significant, deep strategic implications for organizations. This is the adoption of new technologies but changes the mindset and culture of an organization to fully embrace and, most importantly, exploit digital innovations. Pousttchi et al. (2019) explore how the emerging digital transformation will redefine three base dimensions of a business: redefined will be value creation, value proposition, and customer interaction. This underlines that with the help of digital technologies, firms are in a position to come up with innovative mechanisms both in value creation and delivery, hence enhancing their competitiveness within a digitalized environment (Pousttchi et al., 2019). Moreover, Gong & Ribière, (2021) elaborated on the problem of unclear conceptualization of digital transformation as its use in business has a very varied nature and is, in a way, sometimes considered ambiguous. This has suggested pushing for a single definition highlighting the critical impact of digital technologies on business strategies. This clarity is of utmost relevance, not only to the strengthening of theoretical understanding but also within the practical applications in

the realm of digital transformation. The proposed concept would underline how digital technologies have the potential to become transformational in the conduct of business; i.e., business operations, customer interaction, and basis of competitive advantage of strategic thinking and operational execution (Gong & Ribière, 2021).

1.1.3. Operational Processes and Organizational Culture

The diffusion of digital technologies brings a deep change to operational processes within organizations. It supports an effective increase in operational efficiency, the development of agility, and an incentive to spur innovation. But digital transformation goes much further than simply adopting new technologies. It is basically an invitation to an extensive reorganization of the workflow, data management practice, and even the whole organizational milieu so that everything is done in a manner supportive of digital development. Value realization in digital transformation largely requires the building of a digital culture in line with strategic objectives. A change in culture should focus on learning and adaptability, so that employees and the management remain well-equipped with the competences needed for quick responses towards the emerging new technologies. Such a culture would not be developed on the basis of the tangible parts of digital integration but instead on the long-term vision of the organization. He makes sure the digitalization of technologies adopted was contributing positively to the overall business strategy and had a competitive advantage sustained in a dynamically changing digital landscape (Deep, 2023).

1.1.4. Impacts on Environmental Sustainability and Economic Growth

Digital transformation thus goes beyond the internal mechanisms of business operations but plays a major role in advancing the course of environmental sustainability. According to Feroz et al. (2021), advanced digital technologies, such as artificial intelligence (AI) and big data analytics, will come into play in the context of exploiting the Internet of Things (IoT) to harness AI, which might in turn be useful for a whole lot of tasks in managing the environment. These technologies are used strategically to enhance pollution control, sustainable production practices, and waste management. For instance, it entails the use of AI and big data analytics in the effective analysis and management of big data, whereby improved, sustainable information for business practices and decision-making processes would be acquired, leading to less wastage and improved utilization of resources. These are possible with the integration

of IoT devices that help in monitoring and control of the environmental conditions in real-time, which basically means businesses can gain more specific control of their impact and resource consumption. This strategic use of digital tools helps the organization to provide value for their corporate social responsibility, at the same time supporting the sustainability goals through reducing the ecological footprints and enhancing the outcomes of the environment. Such enhancements are very critical for businesses to make sure that they remain competent in a dynamically growing market, where first and foremost, sustainability becomes a strategic necessity and, at the same time, value-enhancing selling factor. Such integration of digital technologies into environmental management practice underlies a very important paradigm shift toward more sustainable business models that will highly value ecological efficiency and eco-innovation. The findings of Feroz et al. (2021) articulate that their positive focus on the deep and transformative impact of digital technologies underscores the dual benefits modern strategies bring to the enterprise environment with respect to operational efficiency and sustainability profiles (Feroz et al., 2021). The approach would, therefore, underpin notjsonpe the viability of businesses only in the long-term but also the broader social benefits that come along with economically sustainable growth.

Economically, digital transformation is one of the factors that are very much necessary for GDP growth due to the high-tech contribution that is part and parcel of modern economic development. The relationship that exists between the current digital revolution and the changing global economy gives fundamental changes within most of the economic sectors. High-tech solutions are also adopted in leading high-tech industries that provoke the direct growth but at the same time infiltrate through the whole economic system, thus fomenting broader economic development. The strategic attention to the high-tech industry in some policy frameworks, such as the Europe 2020 strategy of the European Union, would be the best example. This strategy identifies the central importance of the industry to propel smart, sustainable, and inclusive growth. Moreover, digital transformation brought about mainly by public and private ICT investments has a positive impact on major economic indicators, including GDP. This is an important accelerator of the economy; that is why the investment is seen as such throughout Europe in their competition to keep up with the USA, China, India, and other global technology powers. In this manner, the strategy for the high-tech

industry with digital transformation is a wide way not only to boost the economic growth but also a basic part of contemporary economic planning and development. In this way, it ensures the resilience and competitiveness of the economies in the global market, which has become ever-increasingly digital (Mićić, 2017).

1.1.5. Introduction to Digital Transformation in Islamic Finance

Digital transformation in Islamic finance is the inclusion of strategic digital technologies in institutions of Islamic finance. This is necessitated by increased demands for service delivery, improved operational efficiency, and, indeed, compliance with Sharia principles that prohibit interests accruing from customers' monies and regard very importantly ethical investments. The transformational process comprises innovative technologies like blockchain, artificial intelligence (AI), and digital banking platforms. In this, it refers to the technologies that bring about innovativeness of financial products and services at par with Islamic law. Research has proven that, in Indonesia and Jordan, digital transformation in the Islamic banking sectors is done basically for the key purposes of improved competitiveness, customer satisfaction, and operational smoothness. Which included mobile technologies, digital wallets, biometrics authentication, and application programming interfaces (Desky & Maulina, 2022; Raymond et al., 2023). Furthermore, the sustainability of a competitive edge in the present market scenario and the realization of financial inclusion among the underserved Muslim population are critical impetuses necessitating digitalization within the Islamic finance domain (Aziz, 2022). Digital transformation in Islamic finance, therefore, if implemented with success, will serve not only the modern-day business needs but will be of tremendous value in bringing the sector at par with the leading global trends of financial digitization.

1.1.6. Enhancement of Operational Efficiency and Competitiveness

Most importantly, the role of digital transformation in Islamic finance substantially improves operational efficiency and, in a better manner, competitiveness. Most of the researchers analyze that in the implementation of strategy for digital transformation, Islamic banks have improved their operational efficiency and, in turn, have grown their competitive advantage in the market. An example is a study on Islamic banking carried out in Jordan, which underscores the fact that digital transformation contributes to higher operational efficiency and subsequently boosts the level of competition,

therefore increasing the competitive edge. Under such circumstances, the competitiveness of the organization increases as it switches to improved digital tools, which not only bring higher order to the operations but also do so at a reduced cost and improved customer service standards (Raymond et al., 2023). This line of argument is supported by Indonesian Islamic bank research, which shows that digital initiatives, including mobile wallets and biometric authentication, increase customers' satisfaction and improve competitive positioning by mitigating operational bottlenecks in service delivery (Desky & Maulina, 2022). This is important in a setting of Islamic banks, as they strive to respond to the two-pronged difficulties presented by institutions dealing with conventional finances and those that compete with it in the realm of Islamic.

1.1.7. Challenges in Implementing Digital Technologies

Despite the advancements, there lie some major challenges in front of the Islamic finance sector for the adoption of digital technology. Many Islamic financial institutions are held back by infrastructural constraints and a shortage of qualified personnel who would use digital technologies competently and be in a position to understand the principles of Islamic finance. Research focusing on Islamic banks in Indonesia further underscores these challenges. Hence, Islamic banks in Indonesia after the COVID-19 crisis, like many other businesses, commonly fall between having insufficient digital infrastructure and a technically qualified workforce. These challenges significantly hinder the holistic implementation and scaling up of digital solutions in Islamic banking, which are strategic enablers to realize long-term sustainability and growth (Desky & Maulina, 2022). These challenges underscore not only the very critical need for making a requisite investment in technological infrastructure and human capital but rather point to investments required to be made in order to reap full benefits from the digital transformation of the Islamic financial sector.

1.1.8. Innovation and Sustainability in Islamic Finance

Digitalization in Islamic finance, thus, underscores innovativeness and sustainability as part of the broader economic goal. It, therefore, empowers institutions of Islamic finance to push key goals such as poverty alleviation, equal wealth distribution, sustainable development, and transversal goals within Shariah, promoting justice and

social welfare. This is where fintech and blockchain technologies become pivotal, serving as the catalysts for enhanced accessibility of financial services. The latest developments using technology help in reaching the underserved populations, hence fostering inclusive economic growth. Research has identified that digitalization is the tool for Islamic finance to tap into Sustainable Development Goals (SDGs), hence being the best means of implementing societal benefit and economic stability (M. Hassan et al., 2020; Sahabuddin et al., 2019). These developments indicate a transformational shift toward more ethically aligned and technologically empowered financial practices that hold great importance for the long-term sustainability and resilience of Islamic financial systems.

1.1.9. Blockchain and Financial Technologies

It is worth mentioning that the peculiarity of the application of the blockchain in Islamic finance is much due to the features and abilities of this technology, which ideally fit the aspirations of Islamic finance toward means of conducting transparent and secured financial transactions. This helps in bringing down the level of risks associated with dealings by providing a secured and immutable ledger. Hence, this increases the trust level between stakeholders. And it enables further development of new shariah-compliant financial products such as smart contracts and tradable Islamic Bonds (sukuk) that can be traded in an efficient and transparent way. Thus, the adoption of blockchain can revolutionize the operations' landscape in Islamic finance into a more robust and adaptive one with respect to the demands of the modern financial ecosystem (Kamdzhalov, 2020).

1.1.10. Regulatory and Sharia Compliance

There are several challenges around how to transverse the regulatory landscape and ensure the Shariah compliance. Here, such financial institutions have to make sure that their digital innovations adhere to Islamic legal tenets, a process that will require them to put in huge effort to create new regulatory frameworks and Sharia governance structures. This becomes even more pressing with the growth of Islamic finance, as regulators and Islamic scholars must work together to clearly lay down the guidelines and standards that should govern the use of digital technologies without contravening Sharia principles. This is important to maintain the integrity and credibility of Islamic finance in a very dynamic digital world (Aliqulova, 2023).

1.2. The Statement of the Problem

The landscape of present financial systems is witnessing a sea change due to the incorporation of innovative technologies, such as blockchain, which is enabling the issuance of CBDCs. This digitalization trend literally poses a huge challenge to Islamic majority countries. In all such countries, financial transactions are supposed to be executed following Sharia law. These principles dictate compliance with Islamic financial laws, which explicitly proscribe interest (riba) and encourage risk-sharing mechanisms to be integral in maintaining ethical and economic harmonization within Islamic societies.

It would involve more than just a technological upgrade. The transformation of such a process must successfully be navigated through a highly complex matrix of regulatory, ethical, and economic challenges. Muslim-majority countries, therefore, are at crossroads of searching for mechanisms through which they can harness the benefits of digital financial technologies for enhancing financial inclusion and facilitating economic development but, at the same time, ensure that these technologies remain within the compliance of Islamic jurisprudence.

These considerations thus underline one of the key missing voids within scholarly research in terms of how these nations can reconcile the rapid adoption of digital financial technologies with the immutable tenets of Islamic finance. This study aims to explore this difficult balance that Muslim-majority countries need to establish, which will align the emerging digital financial landscape with full Shariah compliance. The study would critically analyze the potential pathways through which CBDCs can be designed and implemented to contribute to a more equitable and stable financial system that spans global technological advancements while at the same time speaking to the foundational ethical standards of Islam. This study sought to provide deep insights and, to a great extent, practical solutions that may guide the policymakers and financial regulators of these countries.

1.3. The Rationale of the Study

The financial landscape is fast changing due to digitalization and the rise of Central Bank Digital Currencies (CBDCs). This fast-changing landscape represents the very critical point of confluence between technology, regulatory frameworks, and cultural

adherence to Islamic financial principles. The logic behind this study is motivated by a number of critical observations:

1. There is an opportunity to have financial innovations such as CBDCs designed within the prism of Shariah, the guiding framework of economic activities in Muslim majority countries. This alignment should not prescript regulation but be a cultural imperative that ensures wide patronage and sustainability of such financial innovations within these societies.
2. The rapid pace at which the technological revolution of digital finance is coming onto the scene is fast and therefore offers opportunities but at the same time poses challenges. The blockchain does provide an advanced form of transparency and security, but application in existing financial systems would need to be cautiously appraised with a sufficient level of Shariah compliance.
3. CBDCs may significantly enhance financial inclusion, and since providing easier access to financial services for the underserved is a critical objective of Islamic finance, it makes an inevitable choice. This study will explore how such a digital currency (CBDC) is designed in a manner that enhances greater financial inclusion and access to better services at a cheaper cost, hence being in conformity with the wider objectives of Islamic finance, which is founded in promoting socioeconomic justice and the equitable distribution of wealth.
4. The complexity of the regulatory landscape applicable to digital currencies and how they fully comply with Islamic law in the study. It will discuss the ethical considerations that come together with deploying such technologies, like privacy and security, while the environmental impact of digital transactions is under constant consideration within Islamic ethics.
5. The approach of different Muslim majority countries towards CBDC implementation would allow the study, in outlining the best practices and finding common challenges. Such a comparative perspective will present insights that can be used for the global repercussions of digital transformation in Islamic banking and finance, which will offer a guide to policymakers and the financial regulatory framework.

Situated at the critical incorporation of technology, finance, and religion, this study aims to produce a roadmap for how Islamic finance, in particular, can evolve in the

digital age while retaining the moral and doctrinal imperatives at its core. This research will make a great contribution to academic and practical understanding of digital transformation in Islamic finance, having pertinent implications with respect to financial stability, regulatory framework, and equitable distribution of the fruits of economic development.

1.4. Research Objectives

1. Analyze the impact of cryptocurrencies, FinTech, and blockchain on traditional financial systems in developed countries.
2. Examine the role of CBDCs in enhancing financial inclusion and monetary policy in Muslim-majority countries.
3. Investigate the regulatory frameworks required for the successful adoption of FinTech and blockchain technologies.
4. Assess the opportunities for emerging economies to leverage financial technologies for economic growth and inclusion.
5. Explore how blockchain can improve transparency, efficiency, and risk management in trade finance, in Muslim-majority countries.

1.5. Research Questions

1. How have cryptocurrencies, FinTech, and blockchain transformed financial systems in developed countries?
2. How can CBDCs promote financial inclusion in Muslim countries?
3. What regulatory frameworks are needed for FinTech and blockchain adoption?
4. How can emerging economies use financial technologies for growth and inclusion?
5. How can blockchain improve trade finance in Muslim countries?

1.6. Research Hypotheses

H1: Cryptocurrencies and blockchain improve financial efficiency and security.

H2: CBDCs enhance financial inclusion in Muslim countries despite regulatory challenges.

H3: Effective regulations balance innovation and stability in FinTech adoption.

H4: Emerging economies benefit from adopting new financial technologies.

H5: Blockchain enhances transparency and reduces risks in trade finance.

CHAPTER II

LITERATURE REVIEW AND METHODOLOGY

2.1. Digital Transformation

The digital transformation of the banking sector has accelerated with the development and implementation of Central Bank Digital Currency (CBDC). CBDC, a digital form of a nation's fiat currency issued and managed by central banks, provides a secure, modernized payment solution in today's increasingly digital economy. This innovation is designed to enhance financial inclusion, reduce reliance on physical cash, and offer a safer means of conducting transactions. The adoption of CBDC also has significant implications for financial stability, central bank balance sheets, and reserve markets. However, careful consideration is required regarding its integration into existing financial systems, especially concerning its impact on monetary policy and asset structures. Advances in blockchain technology and the rise of private digital currencies, such as cryptocurrencies, have driven the interest in CBDC. While it offers programmability, traceability, and improved security, balancing privacy concerns with regulatory compliance is a central challenge in its design and deployment (Allen et al., 2022).

Blockchain technology, a core component of CBDC infrastructure, supports decentralized and secure platforms for transaction management. It enables real-time transaction verification, comprehensive auditing, and privacy-preserving capabilities. Blockchain-based platforms like Corda and Hyperledger Fabric are frequently employed in CBDC projects, particularly in permissioned systems designed to ensure privacy. However, the integration of blockchain into CBDCs also introduces technical challenges, including ensuring system security, achieving programmability, and defending against potential cyberattacks. These technical aspects are critical to ensuring the successful implementation of CBDCs in the modern financial landscape (Y. R. Wang et al., 2022).

The economic and financial implications of CBDCs extend beyond banking, as they reshape risk management and market behavior. The uncertainty surrounding CBDC adoption influences financial risk aversion and has the potential to decentralize the global financial system. Additionally, CBDCs are playing a transformative role in

sectors such as supply chain management, where they enhance transparency and security through smart contract integration. However, the complexity of integrating CBDCs into existing economic structures, combined with their potential volatility, presents challenges that require careful management (Dunbar, 2023).

Cross-border transactions represent another area of significant potential for CBDCs. Various models, such as domestic platforms and international corridor networks, are being explored to facilitate cross-border CBDC transfers. Projects like Project Jura are pioneering efforts in creating global infrastructure for CBDC settlements, focusing on both technical and macroeconomic factors. Establishing common technical standards and aligning legal and regulatory frameworks are essential to realizing cross-border CBDC interoperability, ensuring seamless international transactions. Public acceptance of CBDCs is crucial for their success in the banking sector's digital transformation. While the public generally views CBDCs positively due to their potential for convenience, security, and financial inclusion, privacy concerns remain. Governments and central banks need to address these concerns through transparent communication, pilot programs, and strong regulatory frameworks to build public trust in CBDCs. Engaging with the public and ensuring the alignment of CBDCs with societal needs will be key to their successful implementation (Ding et al., 2022).

Beyond traditional banking, CBDCs offer transformative potential in various industries. They are increasingly being adopted in supply chain operations, smart contracts, and industrial ecosystems, driving efficiency and transparency. The programmability of CBDCs is particularly valuable in green finance, where it can provide traceability and control over sustainable project funding. As digital currencies continue to evolve, their role in fostering sustainability and innovation across various sectors becomes increasingly important (Inozemtsev et al., 2022).

Nevertheless, CBDCs face certain security challenges, particularly in offline payment scenarios. Trusted Execution Environment (TEE) technology has been proposed as a solution to enhance the security of CBDC-based transactions, addressing issues like double spending and verification. Insights from other digital currencies, such as cryptocurrencies, are helping shape the security requirements for CBDCs, ensuring that they offer a secure and accessible alternative to traditional cash (Mukesh et al., 2023).

The introduction of CBDCs is part of a broader digital transformation in banking, offering both opportunities and challenges. The convergence of digital currencies, blockchain innovations, and tokenization is driving significant changes in financial systems. Central banks are actively exploring the creation of digital fiat currencies, with the anticipated adoption of retail CBDCs marking a pivotal milestone in the evolution of digital payments. Additionally, the development of cross-border CBDC systems is an area of active research, with efforts focused on building the infrastructure necessary for seamless international currency exchanges. This shift is a key component of the ongoing digital transformation in the global banking sector, revolutionizing how transactions are conducted and how financial systems operate in the digital age.

2.2. Value-Based Intermediation and Islamic Finance

2.2.1. VBI Overview

Bank Negara Malaysia (BNM) has initiated efforts to promote Value-Based Intermediation (VBI) among Islamic Banking Institutions (IBIs). This initiative aligns with the 2030 Agenda for Sustainable Development, which includes 17 Sustainable Development Goals (SDGs) aimed at global harmony and wealth creation for current and future populations. The implementation of VBI in Malaysia, as noted by Dhesi (2022), is a timely step in fulfilling the United Nations' 2030 Agenda. The concept of VBI, introduced by BNM and VBI Communities of Practice (CoPs), focuses on adopting Shariah-relevant practices. Yousufzai et al. (2021) stated that traditional methods and products are being replaced by new technology. There will be numerous risks and problems associated with the digital revolution. The two main risks linked with digital transactions are cyber security and Shariah non-compliance. According to Shariah law, the subject matter of the novel technology-based transaction must exist physically and be Halal. These practices are intended to yield positive and sustainable impacts on the economy, community, and environment, ensuring sustainable returns and long-term interests for shareholders.

In 2018, BNM issued a paper titled "Value-based intermediation: Strengthening the roles and impact of Islamic finance" (BNM, 2018). This document outlines proposed implementation approaches and strategies to enhance VBI for the strategic direction of IBIs. It establishes six strategic directions to improve the Islamic finance ecosystem in Malaysia. VBI is built on four foundational principles: Best Conduct, Good Self-

governance, Entrepreneurial Mindset, and Community Empowerment. Tan Sri Zarinah Anwar, the former Chairman of the Securities Commission, emphasized the need for a mindset change among IBI directors and senior management to achieve these values (The Edge Markets, 2009). IBIs are making initial efforts to build resilience towards sustainable Islamic finance in Malaysia, aiming to support entrepreneurs and promote sustainable business practices, particularly for SMEs. According to Yousufzai et al. (2021), a good governance and corporate digital strategy, ESG can enable organization smoothly transformed its products and services offerings.

VBI adoption has progressively improved CoPs' business practices. This improvement is evident through impact-based disclosure, comprehensive measurement, impact-based assessment, constructive collaboration, and inclusive governance (BNM, 2018). The approach provides more business opportunities beyond traditional philanthropy, creating sustainable economic value for businesses and stakeholders (Msamula et al., 2018). Impactful programs aligned with organizations' preferences and interests are crucial for creating sustainable outcomes (Costa & Pesci, 2022; Epstein & McFarlan, 2011). Miller (2015) and Tate and Bals (2018) believe that impactful outcomes generate value, leading to improved organizational and economic performance. Therefore, enhanced values in SMEs are a key indicator of CoPs' VBI performance success and a marker of public confidence in performance improvement.

2.2.2. Automation and Cybersecurity

Financial institutions are increasingly turning to automation as a strategic solution to enhance their operational efficiency and competitiveness. This trend involves automating a significant portion of business processes, which can lead to substantial improvements in performance and customer service. However, the transition from traditional, legacy systems to more advanced technological platforms is a complex. It often requires the development of new skills among employees and changes in staffing, presenting a considerable challenge to these institutions. Adapting to these new systems is essential for financial institutions to stay relevant and efficient in a rapidly evolving digital financial landscape.

Digital transformation in intermediary services leverages artificial intelligence, machine learning, and advanced analytics to derive insights from data, identifying patterns, trends, and customer preferences. This enables personalized services,

enhancing customer satisfaction. User-friendly digital platforms like chatbots, web portals, and mobile apps improve service accessibility. Efficient feedback collection through digital media allows ongoing service improvement and market adaptation. Collaborations with startups and fintech firms foster value-added services and technological advancements. Additionally, predictive analytics and Regulatory Technology (RegTech) solutions are employed to manage transactional risk and ensure compliance with evolving standards and laws (Yousufzai et al., 2021).

In addition to the challenges of system transition, cybersecurity emerges as a paramount concern in the age of digital finance. Financial institutions are increasingly relying on machine learning to bolster their defences against cyber threats and financial fraud. Machine learning algorithms are adept at identifying and preventing fraudulent activities by analysing transaction patterns and detecting anomalies at a scale beyond human capability. A notable example of this is Danske Bank, successfully integrated machine learning into their fraud detection systems. This integration significantly reduced false positives and improved the detection of legitimate fraud cases, exemplifying the transformative impact of advanced technologies in the financial sector. This shift towards embracing machine learning and other sophisticated tools underscores the sector's commitment to enhancing security and operational efficiency in a digital-first era. (FinTech Magazine, 2024a).

2.2.3. Adoption of AI and Mobile Payments

Artificial intelligence is changing the financial services industry by automating processes, enhancing decision-making, and improving customer experiences. Öztürk and Kula (2021) examine AI adoption in Turkish banks, showcasing its implementation across various banking functions to boost service delivery and operational efficiency. Their study finds that AI not only reduces costs but also simplifies user interactions, forecasting significant future benefits for banks. Similarly, Ghandour (2021) discusses both the opportunities and challenges of AI in banking. Opportunities include the provision of personalized services, automation of processes, enhanced security, and improved customer satisfaction. However, challenges such as job displacement, privacy issues, and the need for high-quality data present considerable obstacles that need to be addressed. Kumar and Gupta (2023) investigate the impact of AI on customer relationships within the Indian banking sector,

highlighting how AI technologies can greatly enhance customer satisfaction by delivering seamless banking experiences.

The year 2024 is witnessing the continued transformation of financial services through the integration of Artificial Intelligence (AI). AI is not only streamlining customer experiences but also enabling a new level of hyper-personalization in financial services. This technology is being applied in various domains within the sector, from detecting irregularities in accounting practices to facilitating automated trading systems. AI's ability to analyse vast amounts of data at unprecedented speeds allows for more accurate and efficient operations, making it a crucial tool in modern finance. Additionally, AI's role in enhancing customer service is notable; it offers more personalized and efficient customer interactions, improves risk assessment accuracy, and boosts overall operational efficiency.

Another significant development in the financial sector is the growth of mobile payments, largely driven by the increasing adoption of FinTech products among younger generations, particularly Millennials and Gen Z. This shift is enhancing the overall customer experience by providing more convenience and accessibility. The rise in digital wallet usage is a testament to this trend, facilitating seamless mobile cashless payments. These advancements in mobile payment technologies are not just a matter of convenience; they represent a broader shift in consumer behaviour towards digital solutions in financial transactions. The combination of AI and mobile payment technologies is creating a more dynamic, efficient, and user-friendly financial landscape, meeting the evolving demands of a digitally savvy customer base (FinTech Magazine, 2024b).

The rise of mobile banking has revolutionized consumer engagement with financial services, offering unprecedented convenience and accessibility. Dawood et al. (2022) did a comprehensive literature review on mobile perceived trust (MPT) and its role in mediating the intention and adoption of FinTech innovations. Their research highlights the critical role of trust in mobile technology, especially in addressing geographical and temporal challenges that consumers face. Indriasari et al. (2021) explore the integration of design thinking, agile software development, and co-creation principles in driving innovation within digital banking. Additionally, Dananjayan et al. (2023) offer a historical overview of technological adoption in the Indian banking industry,

tracing its evolution from early computerization to the current focus on mobile banking and AI.

The integration of AI and mobile banking marks a major transformation in the financial sector, leading to more efficient, secure, and customer-focused services. Although these technologies bring considerable advantages, they also present challenges that require careful strategic planning and a focus on gaining user acceptance.

2.2.4 Digital Strategy and Market Performance

The impact of a well-defined digital strategy on market performance in financial institutions is becoming increasingly evident. Research conducted by Boston Consulting Group highlights the varied levels of digital maturity among financial institutions, categorizing them into different archetypes. Among these, Frontrunners and Advanced Strategists, who are characterized by their advanced digital capabilities and strategic approaches to digitalization, consistently show superior market performance compared to their peers. This correlation underscores the significance of not only adopting digital technologies but also having a comprehensive digital strategy in place (Scardovi, 2017).

The success of these leading institutions can be attributed to their holistic approach to digital transformation. This involves not just the integration of cutting-edge technologies but also fostering a digital culture within the organization. A clear digital strategy acts as a roadmap, guiding institutions in aligning their technological investments with business objectives and customer needs. It also emphasizes the importance of organizational agility and continuous innovation, enabling institutions to adapt quickly to market changes and emerging opportunities. Thus, the key takeaway from this research is that for financial institutions to thrive in an increasingly digitalized market, it is crucial to develop and implement a robust digital strategy that goes beyond technology adoption and permeates the entire organizational culture (Scardovi, 2017).

2.2.5. Economic Impact of Digital Transformation

The economic impact of digital transformation on large corporations is substantial, as emphasized in a 2023 report by Deloitte. This report reveals that if Fortune 500 companies effectively implement the right mix of digital transformation initiatives, they could potentially unlock up to US$1.25 trillion in additional market capitalization.

This significant figure highlights the immense value that digital transformation can bring to major businesses, not just in terms of operational efficiency or customer experience, but also in measurable financial growth (Deloitte, 2023).

The key to unlocking this value lies in the alignment of digital strategy with actionable steps and appropriate technology. It's not just about adopting new technologies; it's about integrating these technologies into the core strategy and operations of the organization in a way that amplifies business value. Additionally, the ability of an organization to adapt to digital changes is crucial. This involves being agile and responsive to the evolving digital landscape, which includes keeping up with emerging technologies, adapting to new consumer behaviors, and navigating the changing competitive environment. The Deloitte report underscores that digital transformation is a complex but essential for large corporations looking to increase their market value and stay competitive in the rapidly evolving digital economy (Deloitte, 2023).

2.2.6. Impact on Customer Engagement and Satisfaction

Digital transformation is crucial in enhancing customer experience and building loyalty. Felix and Rembulan (2023) highlight essential factors such as user-friendliness, product quality, loyalty programs, exclusive deals, responsive customer service, and special incentives as key contributors to a positive customer experience. These elements not only boost customer engagement but also strengthen loyalty, which in turn drives business growth. Likewise, the adoption of digital technologies in customer relationship management enables businesses to better understand and respond to evolving customer behaviors and expectations, thereby improving overall customer relationships (Hahn, 2019).

Enhancing customer satisfaction through the development of dynamic capabilities via digital transformation is essential. De Miguel et al., (2022) show that companies in the automotive industry can significantly improve customer satisfaction by utilizing dynamic capabilities such as sensing, seizing, and innovation. These capabilities allow businesses to effectively identify customer needs, swiftly address issues, and deliver products and services that anticipate future demands. The positive impact of dynamic capabilities on customer satisfaction highlights the critical role of continuous innovation and adaptability in today’s digital era.

For small and medium-sized enterprises (SMEs), adopting digital transformation through online-to-offline (O2O) platforms plays a vital role in boosting customer engagement. Shin et al., (2022) explore how digitalization efforts by SMEs, such as offering diverse information, being responsive to customers, and effectively utilizing platform functionalities, positively impact customer engagement. The use of O2O platforms enables SMEs to compete more effectively in the digital marketplace, thereby enhancing customer engagement and improving service delivery. In the financial services industry, digital transformation is essential for enhancing customer experience and gaining a competitive edge. Masoud and Basahel (2023) emphasize that combining digital transformation with IT innovation and a strong focus on customer experience leads to significant improvements in firm performance. Financial institutions that prioritize digital customer interactions and innovations are better equipped to meet customer expectations and build long-term loyalty.

Digital transformation significantly influences customer engagement and satisfaction by elevating the customer experience, building loyalty, and helping businesses adapt to changing customer demands. By utilizing digital technologies and dynamic capabilities, companies can foster positive customer interactions, enhance service delivery, and gain competitive advantages across various sectors.

2.2.7 Digital Transformation's Impact on Operations

Digital transformation has become essential for organizations seeking to improve operational efficiency. By leveraging advanced digital technologies like automation, AI, the Internet of Things (IoT), and cloud computing, businesses can streamline their processes, lower costs, and greatly enhance productivity.

2.2.7.1.Process Automation

Digital transformation often starts with the automation of operational processes, which is crucial for enhancing efficiency. Morvan and Mayer (2006), stress that achieving efficient operational transformation requires a blend of advanced process automation, business flexibility, and high-quality customer service. This strategy not only lowers operational costs but also enhances service quality. Similarly, Ponea (2020) highlights that the ongoing evolution of operational processes through automation is vital for meeting growing customer demands and handling complex products or services. Automation enables companies to streamline operations, minimize manual errors, and

improve overall efficiency by aligning all departments and processes with the organization’s strategic objectives.

2.2.7.2.Productivity Enhancement

Rohmah and Komarudin (2023) explore the pivotal role that digital transformation plays in business operations management. Their study demonstrates how the adoption of digital technologies such as IoT, AI, cognitive computing, advanced robotics, cloud technologies, blockchain, and big data analytics has revolutionized the way companies plan, organize, manage, and oversee the production of goods and services. This digital shift allows companies to adapt swiftly to market changes, boost productivity, and maintain a competitive edge. For example, the integration of a Manufacturing Execution System (MES) with Enterprise Resource Planning (ERP) software in a tire production facility resulted in a 15% increase in efficiency and notable energy savings (Temel et al., 2023). This case study underscores the potential of digital technologies to enhance operational performance and sustainability.

2.2.7.3.Frameworks for Successful Digital Transformation

The success of digital transformation efforts often depends on the creation of strong frameworks that integrate technological advancements with the organization's culture and processes. Moreira and Ferreira (2023), contend that digital transformation is fundamentally about cultural change rather than simply adopting new technologies. Their study on offshore oil platforms reveals that establishing a well-defined digital process stream, identifying core digital pillars, and fostering a digital culture are essential for maintaining and expanding the use of digital tools. This strategy led to the successful deployment of over 200 digital solutions, delivering significant value with minimal capital investment. Similarly, Haron (2021) underscores the importance of incorporating project management and change management teams to facilitate smooth digital transformation. This comprehensive approach addresses the human elements of change, which often present the greatest challenges to successful digital initiatives.

2.2.7.4.Sector-Specific Impacts

The effects of digital transformation vary widely across different industries. In Indonesia's oil palm plantation sector, Kembaren (2022) discovered that the integration of ERP systems, coupled with organizational trust, transformational leadership, and

mobility strategies, led to significant improvements in operational performance. This finding illustrates how customized digital solutions can effectively address industry-specific challenges and boost efficiency. Similarly, in the financial management field, Ayuandiani et al., (2023) emphasize that digital transformation not only strengthens data security but also enhances operational efficiency by improving data management and streamlining financial processes.

2.2.7.5.Challenges and Considerations

While digital transformation offers numerous advantages, it also presents several challenges. Heavin and Power (2018) identify seven key obstacles that can impede successful digital transformation, including technological readiness, resistance to change, and the necessity for a systematic approach. These challenges underscore the need for a strategic and carefully planned approach to digital transformation. Ramesh (2021) adds that the high failure rate of digital transformation efforts often stems from a lack of vision, insufficient management, and misalignment with organizational culture. To overcome these hurdles, organizations must prioritize continuous improvement, engage stakeholders, and develop digital skills among their workforce.

Nonetheless, digital transformation remains a powerful driver of operational efficiency, enabling process automation, increased productivity, and enhanced competitiveness. Its success hinges on the strategic adoption of technology, cultural shifts, and the implementation of robust frameworks aligned with organizational objectives. By addressing the challenges and capitalizing on the opportunities provided by digital transformation, businesses can achieve sustainable efficiency improvements and foster long-term growth. The studies reviewed collectively highlight the transformative power of digital technologies and the critical importance of a holistic approach to digital transformation.

2.2.8 Value Based Intermediation (VBI)

Value-based Intermediation (VBI), initially conceptualized to rejuvenate growth in Islamic banking, has evolved to represent a broader movement towards sustainable banking practices. This approach emphasizes not just financial returns, but also the social and environmental impact of banking activities. Despite its potential to transform the banking sector into a more ethically and environmentally conscious industry, VBI has not gained widespread popularity globally. This limited adoption can

be attributed in part to resistance within the financial industry, including a certain degree of complacency among bank executives who may be hesitant to depart from traditional banking models.

The implementation of VBI varies across different regions and institutions. Some regulatory authorities are taking a more proactive stance, advocating for the integration of VBI principles into mainstream financial practices. This advocacy is aimed at encouraging banks to consider the broader impact of their operations and investment decisions. The adoption of VBI could potentially open up new streams of investment and attract clients who are increasingly conscious of the ethical and environmental implications of their financial choices. However, as Gulzhan and Musaeva (2020) noted, the overall market impact of VBI might be somewhat constrained by the current market share of Islamic banks. While Islamic banking is significant in certain regions, it still represents a relatively small fraction of the global banking sector. Consequently, while VBI has the potential to drive change towards more sustainable banking practices, its impact at the global level may be limited, at least in the short term.

As we progress into 2024, these trends and challenges will shape the landscape of digital transformation in the financial industry, particularly in the context of value-based intermediation. The focus will likely remain on leveraging advanced technologies like AI and machine learning while aligning these technological advancements with comprehensive digital strategies to ensure sustainable growth and value creation.

2.3. Digital Transformation and Islamic Finance

2.3.1. Adapting Digital Initiatives to Islamic Financial Principles

Islamic banks are increasingly adopting digital technologies to boost operational efficiency and enhance customer satisfaction while remaining compliant with Shariah principles. Desky and Maulina (2022) observe that Islamic banks in Indonesia, such as Bank Syariah Indonesia (BSI), are utilizing digital wallets, biometric authentication, and APIs to enhance their competitiveness and improve service delivery. These digital transformations are meticulously aligned with Shariah principles to ensure full compliance. Additionally, financial technologies like blockchain and AI are instrumental in advancing digital services within Islamic banks. Ali (2023) explains how Islamic banks are leveraging FinTech to improve mobile banking, online services,

and electronic payments, all while adhering to Islamic values. These technologies streamline financial processes, increase efficiency, and ensure that all services are in line with Islamic finance principles.

The adoption of digital technologies in Islamic finance presents both challenges and risks that require careful management. Alsaghir (2023) underscores the need for effective risk mitigation strategies in digital transformation to uphold Shariah compliance. The inherent uncertainty, or gharar, in practices like cryptocurrencies and smart contracts necessitates additional regulation and thorough testing before they can be broadly adopted. Islamic financial institutions must establish robust risk management frameworks to address these issues and maximize the benefits of digital technologies. Digital transformation plays a key role in advancing financial inclusion within the Islamic finance sector. Aziz (2022) examines how Islamic digital banking, aligned with Maqasid al-Shariah (the objectives of Shariah), can help reduce poverty and enhance financial inclusion. The study highlights the necessity of community awareness and acceptance of Shariah-compliant digital banking for its successful implementation and widespread use. Islamic finance seeks to provide ethical and sustainable economic solutions and Sahabuddin et al., (2019) explore how digitalization and innovation contribute to sustainable development from an Islamic finance perspective. Emerging technologies like blockchain and bitcoin, though still developing, are viewed as tools to help achieve goals such as eliminating poverty, ending hunger, and promoting social well-being, which align with the broader objectives of Islamic finance.

2.3.2. Role of Central Banks in Islamic Countries

Central banks in Muslim majority countries are tasked with a dual mandate that extends well beyond the conventional scope of central banking. Firstly, these banks play a crucial role in formulating and implementing monetary policies that are in strict adherence to Shariah principles. Unlike traditional central banking systems, which primarily focus on economic stability and controlling inflation, Islamic central banks must ensure that their policies foster socio-economic justice. This objective is rooted in the Islamic economic ethos, which emphasizes equitable wealth distribution and prohibits Interest (Riba). By regulating banking activities, these central banks ensure that financial practices do not lead to disproportionate wealth accumulation in the hands of a few, thus promoting a more balanced and inclusive economic growth. Their

involvement in the economy is not limited to monetary stability but extends to ensuring that financial activities contribute positively to societal welfare and do not contradict Islamic moral and ethical standards.

In addition to their regulatory role, central banks in these countries are also seen as pioneers of innovation within the Islamic financial system. They are envisioned as autonomous institutions that harmonize their conventional banking functions with Shariah compliance, thus paving the way for a more resilient and ethical financial system. This involves a continuous process of reviewing and revising banking practices to align them with Islamic principles while also embracing technological advancements and innovative financial products. For example, the introduction and regulation of Islamic fintech solutions demonstrate their commitment to modernizing the financial sector without compromising religious directives. These banks are not only guardians of financial stability but also catalysts for change, encouraging the development of Shariah-compliant financial instruments and services. This dual role of ensuring compliance and fostering innovation positions these central banks as key players in the global Islamic finance industry, contributing significantly to its growth and integration into the mainstream financial world (Anwer et al., 2020).

2.3.3. Recent Initiatives and Trends

In recent decade, there has been a noticeable shift towards digital transformation in the Islamic finance sector across various Muslim majority countries, reflecting a global trend in financial services. This shift is characterized by the integration of digital technology into all aspects of Islamic banking and finance, which is significantly altering how these services are delivered and consumed. For instance, in Saudi Arabia, the introduction of Shariah-compliant digital platforms and investment funds marks a significant step in this direction. These platforms offer a range of Islamic financial products and services, accessible online, thus expanding the reach and convenience for consumers adhering to Islamic financial principles (IFN News, 2023).

Similarly, Malaysia, a leading nation in Islamic finance, has witnessed significant initiatives by its central bank, Bank Negara Malaysia, in issuing a substantial volume of Islamic financial facilities. This move demonstrates the country's commitment to expanding and modernizing its Islamic finance sector. By leveraging digital technologies, Bank Negara Malaysia aims to enhance the efficiency and effectiveness

of monetary policy implementation, while also increasing accessibility to Islamic financial services for a broader segment of the population. These digital initiatives are critical in ensuring that Islamic banking remains competitive and relevant in an increasingly digital world. They not only provide a platform for increased participation in Shariah-compliant financial markets but also pave the way for more innovative, efficient, and inclusive financial solutions that align with Islamic principles (IFN News, 2023).

These trends reflect a broader recognition within the Islamic finance industry of the need to adapt to a rapidly evolving digital landscape. By embracing digital transformation, these countries are not only enhancing their financial services but are also setting a precedent for other nations in the integration of technology and finance in adherence to Islamic principles.

2.3.4. Challenges and Regulatory Approaches

The introduction of Value-Based Intermediation (VBI) in Islamic finance brings forward notable challenges, particularly concerning the potential increase in operational costs. This increase is attributed to the need for Islamic banks to develop new systems and processes that adhere to VBI's focus on social and environmental impacts. Implementing these changes requires substantial investment in areas such as technology, employee training, and compliance mechanisms. These additional expenses raise concerns about the competitive standing of Islamic banks, especially in markets where they compete with conventional financial institutions that are not bound by similar ethical obligations. Another significant challenge is the complexity of integrating VBI principles into existing Islamic banking frameworks. Given that Islamic banks already operate under the distinct Shariah principles, the incorporation of VBI mandates further complicates product design, risk assessment, and investment strategies. This not only adds to operational complexities but also necessitates a deeper level of expertise from bank personnel and a greater understanding from customers (Gulzhan Musaeva, 2020).

In response to these challenges, regulators like Bank Negara Malaysia advocate for a balanced regulatory approach. They emphasize the importance of sustainable banking as a critical aspect of risk management, arguing that a focus on long-term societal and environmental impacts leads to more sustainable financial practices. This approach

aligns with the ethos of Islamic banking, which inherently values societal contributions and environmental stewardship alongside financial profitability. The regulatory strategy involves a blend of recognizing individual bank circumstances and enforcing proactive measures for incorporating social and environmental criteria into banking operations. This might include a phased implementation strategy for VBI principles, tailored guidelines for product development, and potential incentives for banks that successfully integrate these principles. Additionally, regulators play a pivotal role in fostering a supportive ecosystem for VBI by encouraging collaboration, knowledge sharing, and training among banks. Such collaborative efforts enable banks to exchange best practices, jointly tackle common challenges, and develop innovative solutions that align with VBI objectives. Ultimately, while the transition to VBI presents certain hurdles, a well-structured regulatory framework can effectively address these challenges, guiding Islamic banks towards a more sustainable, socially responsible banking future (Gulzhan Musaeva, 2020).

2.4. Qualitative Approach

The qualitative methods deployed in this study for exploring digital transformation in Islamic finance leverage an extensive literature review combined with in-depth case study analyses. The literature review critically examines scholarly articles, reports, and publications, focusing on the integration of Value-Based Intermediation (VBI) with digital technologies. This methodological choice allows for a broad yet detailed understanding of the theoretical and practical aspects of digital transformation within the Islamic banking sector.

The theoretical frameworks guiding this qualitative inquiry are rooted in the constructivist paradigm, which posits that knowledge is constructed through interactions within specific social and cultural contexts (Lewis, 2015). This paradigm is especially relevant to the study of Islamic finance, where financial practices are deeply intertwined with religious principles and cultural norms.

The method of conducting a thorough literature review serves to build a foundational understanding of how digital technologies are being adopted and adapted in Islamic financial institutions. It involves synthesizing a wide range of materials to construct a comprehensive view of current practices and theoretical underpinnings (Sharon B, 2009). This process is indicative of the constructivist approach, as it recognizes the

complexities and nuances of how digital transformation is conceptualized and implemented in diverse Islamic banking contexts.

The application of case studies, such as the analysis of blockchain technology at Dubai Islamic Bank, provides practical insights into the specific challenges and achievements of digital transformation in the sector. Case studies are a hallmark of constructivist methodology because they allow for an in-depth exploration of how individual Islamic banks interpret and navigate the integration of digital technologies within the regulatory and ethical frameworks of Shariah compliance (Stake, 2005). This method underscores the constructed nature of technological adoption, shaped by the unique socio-economic and cultural landscapes of Islamic finance.

The critical examination of data throughout the research process aligns with constructivist ideals by emphasizing the importance of source reliability and acknowledging potential biases. This approach ensures that the findings are reflective of a balanced synthesis of theoretical perspectives and practical implementations, contributing to a robust and insightful exploration of digital transformation in Islamic banking and finance (Kathy Charmaz, 2014).

This research employs a qualitative approach to comprehensively investigate the transformative potential of Central Bank Digital Currencies (CBDCs) for payment settlements. The study endeavors to understand the implications and challenges associated with the adoption of CBDCs in various economies, with a particular focus on Muslim-majority countries. The methodology is designed to gather insights from experts and stakeholders by utilizing structured questionnaires as the primary data collection method. The qualitative research approach is chosen for its suitability in exploring the ‘how’ and ‘why questions related to the research objectives (Sekaran & Bougie, 1993). Qualitative research allows for a detailed investigation into the perspectives and experiences of key stakeholders.

Structured questionnaires serve as the primary data source. Key stakeholders, including experts, policymakers, and industry professionals with direct involvement in CBDC projects, as well as end-users where applicable, are selected as participants. Participants are selected based on their expertise, experience, qualifications, and their alignment with the objectives of this study. This selection is guided by the specific criteria mentioned in the SGF (Ayedh & Echchabi, 2015). The responses obtained from

the structured questionnaires are compiled and organized for analysis. Thematic analysis is applied manually to identify recurring patterns, themes, and critical insights within the questionnaire responses. This analysis is guided by the research questions and objectives.

All participants are assured of the strict confidentiality of their information and identity. No personal details will be made public. Informed consent is sought from all participants, clearly explaining the purpose and nature of the research. The research findings are presented in a structured manner, organized according to the research questions. The presentation of findings adheres to the outcomes of the thematic analysis. The implications of the findings for the field of CBDCs and payment settlements are discussed. Relevant literature and prior research are referenced to support the findings. The methodology section serves to enhance the validity and reliability of the information collected.

2.5. Quantitative Approach

The quantitative methods utilized in this study are focused on analyzing financial metrics affecting Central Bank Digital Currencies (CBDCs) through a systematic literature review (SLR). This methodological approach is critical for identifying trends, patterns, and correlations across a significant corpus of scholarly articles, employing statistical models to analyze the data comprehensively.

The strategic utilization of the Scopus database, noted for its extensive coverage of academic literature, facilitated the initial compilation of a diverse array of documents related to CBDCs. The selection process involved applying inclusion and exclusion criteria such as language and relevance, narrowing down to 169 English-language articles from various document types. This meticulous filtering process ensures that the data used in the quantitative analysis are directly relevant and of high quality, enhancing the study's overall reliability. The manual review of abstracts added a qualitative touch to the screening process, ensuring that each article was specifically relevant to CBDCs, which is critical for the focused application of quantitative analysis tools later in the study.

The study employs R, Biblioshiny, and Excel for data analysis, which are pivotal in organizing and analyzing the data. R is particularly advantageous for statistical computation and creating advanced graphs, which is essential for the quantitative

assessment of financial metrics in CBDC research. Biblioshiny offers a user-friendly interface for bibliometric analysis, helping to visualize data trends and publication metrics, while Excel supports data organization and basic statistical functions, acting as a preliminary tool before more complex analyses in R. These tools collectively provide a robust framework for the quantitative analysis of CBDCs, facilitating the exploration of complex datasets and the derivation of meaningful insights from the structured literature data.

The study begins by providing an introduction that establishes the context of digital transformation within Islamic financial institutions. After the introduction, a comprehensive literature review explores existing research on relevant technologies and their applications in the financial sector. The following sections outline the methodology and data collection techniques used to gather the necessary information. The central part of the study presents an in-depth comparative case study analysis, showcasing how Islamic banks are integrating digital technologies into their operations. The study's findings are then discussed to assess the effectiveness of these digital transformation efforts. The study concludes by summarizing the research outcomes, discussing their implications for the field, and offering recommendations for future digital transformation initiatives in Islamic finance.

CHAPTER III

DIGITAL TRANSFORMATION OF THE VALUE-BASED INTERMEDIATION

3.1. Blockchain

Blockchain is transforming traditional practices. It simplifies access to capital, making it easier, cheaper, and faster. The technology is pivotal in facilitating peer-to-peer trading, streamlining settlement and clearing processes, and reducing costs and counterparty risks. This innovation extends to enhancing auditing and compliance. Additionally, blockchain supports emerging financial tools such as crypto staking and invoice factoring, and it plays a crucial role in the tokenization of real-world assets. This tokenization process allows for fractionalized ownership of assets, thereby enabling easier selling, trading, or using them as collateral for loans. In the context of Islamic finance, blockchain's compliance with Sharia law could open up new opportunities for financial inclusivity and ethical investing, although this area is still under exploration and development (Baker, 2021; CONSENSYS, 2024; Daley, 2021).

3.2. Artificial Intelligence (AI) and Machine Learning (ML)

Artificial Intelligence (AI) and Machine Learning (ML) are significantly transforming various sectors, including the financial industry, particularly in areas like credit scoring, fraud detection, and customer service automation. These technologies are crucial for analyzing vast datasets, enabling more accurate predictions, and automating decision-making processes. In credit scoring, AI and ML are increasingly being used for dynamic scoring, allowing lenders to make more accurate decisions by adapting quickly to environmental changes. Traditional credit scoring methods often rely on static variables and historical data, which may not fully account for the complexities of the modern financial ecosystem. AI/ML models, by contrast, can analyze a broader range of data, including non-traditional sources like social media interactions, mobile payments, and online purchase histories. This expanded data use helps in generating more accurate and fair credit scores (Dash et al., 2021; Team, 2023).

However, the implementation of AI and ML in credit scoring also comes with challenges, such as potential biases in the data used for training the algorithms.

Lenders must be aware of these biases and take steps to mitigate any resulting discrimination in their lending decisions. Additionally, the complexity of AI and ML algorithms can make it difficult for lenders to explain their credit scoring models and lending decisions to borrowers, which is a crucial aspect of responsible lending practices (White, 2023).

3.3. Digital Wallets and Contactless Payments

The emergence of digital wallets and contactless payments has been pivotal in reducing reliance on physical cash. These technologies are increasingly favored for both in-store and online transactions. They offer convenience and speed, which is particularly appealing in today's fast-paced world. However, it's important to note that digital wallets haven't entirely replaced traditional card usage, especially in regions like the U.S. where card usage has a long history. Digital wallets do present a potential shift in the balance of power within the financial industry, from banking to payments. The role of traditional credit card providers is evolving as digital wallets can process payments directly from linked bank accounts. This change is accompanied by concerns and opportunities regarding data ownership and customer information within the digital wallet ecosystem. Despite the advantages, a significant portion of consumers either remain unaware of or uninterested in contactless payments, citing value, security, and availability concerns. This presents a challenge for merchants and card issuers in effectively communicating the value of these digital solutions (Anan et al., 2021; Groenfeldt, 2021).

3.4. COVID – 19 Impact

The COVID-19 pandemic accelerated the digitalization of payments. The demand for high-value denominations increased, indicating a shift in consumer behavior towards cash hoarding as a precautionary measure. This trend was influenced by factors like potential disruptions to payment infrastructures or potential bank closures. The pandemic also led to a marked increase in cash holdings for transactional and precautionary reasons. Interestingly, while the use of cash as a means of payment declined, its demand as a store of value rose significantly. In response, many central banks are exploring the potential for retail central bank digital currencies (CBDCs) that would provide the same protection as cash, allowing consumers to make payments without carrying physical banknotes and coins. The adoption of retail CBDCs could

potentially alter the use of cash in its physical form, both as a means of payment and as a store of value (Kosse & Szemere, 2021).

3.5. Dubai Islamic Bank's Adoption of Blockchain Technology

Dubai Islamic Bank (DIB) made a significant stride by joining the UAE Trade Connect (UTC), a revolutionary blockchain platform (DIB, 2022). This collaboration, involving Etisalat Digital, key UAE banks, and Avanza Innovations, signifies a major leap in integrating cutting-edge technologies within Islamic finance. UTC's foundation on cloud-native solutions, distributed ledger technology, and artificial intelligence represents a convergence of reliability, security, and innovation. This move not only enhances DIB's operational efficiency and transactional security but also exemplifies how Islamic banks can embrace digital advancements while adhering to Shariah principles. The initiative sets a precedent in the financial sector, demonstrating how strategic adoption of modern technologies can propel Islamic banking into a new era of digitalization and efficiency, making DIB a forerunner in this transformative journey.

Dubai Islamic Bank's (DIB) alliance with the UAE Trade Connect (UTC) platform has led to significant advancements and has profound implications in various aspects of Islamic finance:

3.5.1. Enhanced Security and Efficiency

Through blockchain technology, DIB significantly bolstered the security, transparency, and efficiency of its financial operations. Blockchain's inherent characteristics, such as immutability and decentralized ledger, ensure that every transaction is recorded securely and transparently. This technology has allowed DIB to reduce potential fraud risks, streamline transaction processes, and offer a more robust and reliable banking experience to its customers (DIB, 2022).

3.5.2. Balancing Innovation with Shariah Compliance

DIB's participation in UTC is emblematic of how Islamic financial institutions can successfully integrate technological innovation while strictly adhering to Shariah principles. This balance is crucial in Islamic banking, where maintaining ethical and religious compliance is as important as embracing modern technological solutions. DIB's approach serves as a blueprint for other Islamic banks looking to modernize their services without compromising their religious mandates (DIB, 2022).

3.5.3. Promoting Industry Collaboration

The collaboration in developing UTC, which involves not only DIB but other leading UAE banks and the Central Bank of the UAE, highlights the critical role of collective efforts and regulatory support in the realm of digital transformation. This partnership exemplifies how collaboration can lead to more significant, industry-wide advancements, setting new standards for how Islamic financial institutions can work together towards common technological goals (DIB, 2022).

3.5.4. Societal Impact

DIBs involvement in UTC goes beyond mere technological progression. It aligns with broader societal objectives, contributing to the financial stability and overall economic growth of the UAE. By enhancing the efficiency and security of financial transactions, DIB plays a pivotal role in bolstering the confidence of both customers and investors in the Islamic banking sector, thus fostering a more stable and prosperous economic environment (DIB, 2022).

3.6. A Way Forward for Muslim Majority Countries

The digital transformation of Value-Based Intermediation (VBI) offers a promising path forward for central banks in Muslim majority countries, aligning the unique principles of Islamic finance with broader global sustainability objectives. By integrating digital technologies into the framework of VBI, these banks can enhance the efficiency, accessibility, and impact of their financial services, while remaining true to Shariah principles. This digital shift is not just a matter of technological advancement; it represents a fundamental alignment of Islamic finance with the evolving demands of the global economy and the growing emphasis on sustainable practices. It paves the way for creating financial systems that are not only economically robust but also socially responsible and environmentally conscious. The integration of digital tools in Islamic finance can streamline processes, broaden access to financial services, and introduce innovative Shariah-compliant products that meet the needs of a diverse and growing customer base.

Looking ahead, the central banks in these regions are poised to play a crucial role in shaping a financial sector that balances ethical values with modern financial practices. By championing digital initiatives, these institutions can ensure that Islamic finance remains relevant and competitive in the global market. This involves not only adopting

new technologies but also fostering an environment that encourages innovation within the framework of Islamic finance. The goal is to create a dynamic, inclusive, and sustainable financial sector that contributes to the overall economic growth and development of Muslim majority countries. Such a sector would not only meet the financial needs of its customers but also address broader societal challenges, aligning financial activities with the ethical and moral values that underpin Islamic finance. In essence, the digital transformation of VBI marks a strategic move towards a future where Islamic finance continues to evolve, innovate, and lead in the global pursuit of sustainable and equitable economic development.

The success of Dubai Islamic Bank (DIB) in integrating with the UAE Trade Connect (UTC) blockchain platform offers a valuable blueprint for other Islamic financial institutions in Muslim majority countries seeking to embark on a similar digital transformation journey.

3.6.1. Adoption of Advanced Technologies

Like DIB (2022), Islamic banks should actively explore and integrate cutting-edge technologies such as blockchain to revolutionize their transactional processes. The adoption of blockchain technology, known for its enhanced security, transparency, and efficiency, can transform traditional banking operations. This would involve not only adopting the technology itself but also investing in the necessary infrastructure and training to fully leverage its capabilities. The goal is to create a more secure and efficient banking environment, reducing the risk of fraud and errors while speeding up transaction times.

3.6.2. Adherence to Ethical and Shariah Principles

Banks must ensure that their digital transformation strategies align seamlessly with Islamic ethical and moral values. This adherence involves not just complying with the technical aspects of Shariah law but also embracing its spirit, ensuring that all digital initiatives promote fairness, transparency, and social welfare. This approach requires a thorough understanding of Shariah principles and a commitment to embedding these values in all technological advancements and banking practices.

3.6.3. Collaborative and Regulatory Support

Emulating DIB's approach, Islamic financial institutions should foster collaboration both within the industry and with regulatory bodies. This collaboration can take

various forms, including partnerships with technology providers, joint ventures with other banks, and active engagement with regulators to ensure that digital innovations receive the necessary support and guidance. The objective is to create an ecosystem where innovation thrives within the bounds of regulatory requirements and where regulatory frameworks evolve to support and encourage digital innovation in Islamic finance.

3.6.4. Addressing Broader Economic and Social Goals

The digital transformation strategy should extend beyond the bank's immediate operational needs to address key societal and economic challenges. This approach entails leveraging digital technologies to enhance financial inclusion, support economic development, and contribute to the overall welfare of society. By mirroring DIB's commitment to the UAE's economy, Islamic banks can use digital transformation not only as a tool for business growth but also as a means to play a more significant role in the economic and social development of their respective countries.

In implementing this framework, Islamic financial institutions can look to DIB's journey with UTC as a model for how to successfully navigate the challenges and opportunities presented by digital transformation. This path involves a careful balance of technological innovation, adherence to Islamic principles, collaborative efforts, and a commitment to broader societal objectives. Through this approach, Islamic banks can not only modernize their operations but also reinforce their role as pivotal contributors to the economic and social fabric of their communities.

CHAPTER IV

DIGITAL TRANSFORMATION AND CBDCS INNOVATIONS FOR PAYMENT SETTLEMENTS

4.1. CBDC and Innovative Payment System

The concept of Central Bank Digital Currency (CBDC) has been gaining quite a bit of attention in the financial world. It is a digital representation of a country's regular old fiat currency, but with a twist, it is the central bank that is in charge of minting and overseeing this virtual cash. The whole idea behind CBDCs is to offer a modern and safe way of making payments in our increasingly digital and tech-driven world. These digital currencies aim to bring more people into the financial fold, ensuring that everyone, regardless of their economic status, can participate in the financial system. And, as an added bonus, it might just help reduce our reliance on physical cash, which can be a bit of a hassle to carry around and can pose certain health risks in some situations. CBDCs are not just about keeping up with the times, they are also about making money more accessible and safer for everyone (Allen et al., 2022).

Lee et al. (2023) explored that CBDC implementation holds the potential to augment financial stability and enhance the security of policy operations, thereby contributing to a more stable and secure policy environment. CBDC also bears implications for the reserve market and the composition of the central bank's balance sheet, potentially influencing the structure of short-term assets held by the private sector. The adoption of CBDC must be approached with meticulous consideration of the demand for and its interaction with the existing financial systems, as it holds the potential to impact reserve markets, central bank balance sheets, and the concept of seigniorage. According to Sethaput and Innet (2023), CBDC represents an active research area for central banks globally, with countries like the United States and China delving into CBDC projects. The implementation of CBDC can leverage blockchain or Distributed Ledger technology (DLT), offering a foundation for secure and efficient peer-to-peer transactions. This growing interest in CBDC is fueled by the rise of private digital currencies, including cryptocurrencies and stable coins, as well as the accelerated adoption of digital payments, particularly in the context of the COVID-19 pandemic. CBDC's potential advantages encompass attributes such as high-security issuance,

systemwide auditability, programmability, and enhanced traceability for Anti-Money Laundering. However, it is imperative that the design and implementation of CBDC strike a delicate balance between data privacy and regulatory compliance, as its utilization may impinge upon the privacy traditionally associated with physical paper currency. Additionally, the successful realization of CBDC projects necessitates comprehensive consultation with representatives of the populace to ensure alignment with the needs and preferences of society.

4.1.1. Technical Aspects and Blockchain Applications

The application of blockchain technology within CBDC systems brings forth a myriad of features and functionalities, crucial for the modern financial landscape. These features encompass real-time transaction verification, comprehensive supervision, privacy-preserving transactions, and verifiable audits. To ensure the integrity of records and the precision of audits, the CBDC system leverages blockchain technology and implements Pederson Commitment (Y. R. Wang et al., 2022).

CBDC deployment embraces the potential use of blockchain or Distributed Ledger Technology (DLT) for the seamless execution and settlement of peer-to-peer transactions. Various technical solutions have been adopted in CBDC projects, with notable platforms like Corda, Ethereum Enterprise, Hyperledger Fabric, and Quorum being at the forefront of implementation. There is a clear preference in this domain for private or permissioned DLT platforms, with Corda being a popular option. This preference is mostly motivated by privacy concerns. Retail CBDC initiatives have demonstrated a wider range of technical solutions. They include Corda, a hybrid system that can be connected with DLT platform, and the Bitt digital currency management system. The intricacy of CBDC implementation raises a number of technical issues that must be addressed. Among these are ensuring high-security issuance, establishing systemwide auditability, improving programmability, striking a delicate balance between privacy compliance and regulatory requirements, delineating technical roles for intermediaries, and fortifying CBDC systems against potential denial of service attacks (Sethaput & Innet, 2023). The successful application of blockchain technology into CBDCs relies on addressing these multifaceted technical aspects and challenges.

4.1.2. Economic and Financial Implications

The hedging behaviour of participants in the currency futures market holds substantial value in shedding light on the uncertainty surrounding CBDCs and their influence on the financial system. This hedging factor exhibits a statistically significant impact on financial market risk aversion and various measures of uncertainty. CBDC-related uncertainty emerges as a potent transmitter of risk within the financial system, underscoring the pivotal role of the hedging factor, which can exert a direct influence on risk aversion. Furthermore, CBDC uncertainty exerts a net positive effect on financial markets, in conjunction with other influential factors such as information transmission from the bond market and the banking sector. The burgeoning body of literature concerning "Attention Indexes" emphasizes the paramount role of public attention in shaping shifts within financial markets, with specific reference to the CBDC attention index, which gauges market reactions to central bank announcements. It is important to recognize that changes in one market, as exemplified by the crypto markets, can reverberate across other financial domains, including the spot exchange market (Dunbar, 2023).

H. Wang and Gao (2023) stated, CBDC represents a transformative force with the potential to introduce heightened intricacies and currency competition into the international financial system. The emerging CBDC network is poised to take shape in a decentralized and uncoordinated fashion, a characteristic that may not foster harmonization in CBDC regulation. Instead, the dispersion of CBDC networks is expected to yield policy diffusion effects, as states adopt an instrumental approach, potentially recalibrating the power dynamics among different financial actors. Consequently, the CBDC network could steer the international financial system towards greater decentralization, marking a pivotal shift.

CBDC has the potential to enhance business operations transparency by facilitating direct electronic payments, a capability that can prove invaluable in applications related to supply chain management. However, application of CBDC in supply chain processes introduces a new dimension of complexity, primarily due to the inherent volatility and fluctuation in the value of CBDC. Furthermore, the application of smart contracts into the supply chain, coupled with the incorporation of digital currencies like CBDC, holds the potential to significantly bolster cybersecurity and streamline operations. This combination enables the automatic execution of physical operations

within the supply chain, further optimizing efficiency and reducing operational risks, thereby underscoring the transformative impact of CBDC in supply chain management (Ding et al., 2022).

4.1.3. Cross-Border Settlement and Interoperability

Diverse models are currently under construction for cross-border CBDC platforms, encompassing domestic platforms, corridor network platforms, and third-party platforms. One notable initiative in this domain is Project Jura, a collaborative effort involving public and private entities such as Banque de France, Swiss National Bank, Bank for International Settlements, commercial banks, and law firms, with the shared goal of establishing a cross-border digital platform for CBDC transfers. The development of cross-border payment infrastructure using CBDCs is being comprehensively examined from practical and macro-financial perspectives, including infrastructure creation, the potential growth of cross-border capital flows, risks related to financial stability and currency substitution, and the configuration of a reserve currency and its supportive mechanisms. This evolving landscape underscores the importance of continuous research and analysis in cross-border CBDC settlements (Inozemtsev et al., 2022).

Themistocleous et al. (2023) states CBDCs hold the transformative potential to facilitate secure, efficient, and cost-effective cross-border and cross-currency payments within the global financial system. Realizing CBDC cross-border interoperability, however, necessitates the establishment of common technical standards alongside aligned legal, regulatory, and supervisory frameworks. The Bank of International Settlements (BIS) has put forth a compelling proposition for multi-CBDC arrangements, offering a mechanism for the seamless interoperation of CBDCs across national borders. The BIS outlines three distinct models for CBDC cross-border interoperability, each tailored to accommodate varying degrees of harmonization, encompassing rulebook and governance alignment, participation criteria, and technical infrastructure. In the current landscape, numerous CBDC cross-border interoperability projects have emerged on a global scale, including initiatives like Aber, Dunbar, Helvetia, HSBC, Jasper-Ubin, Jura, MAS, mBridge, and Prosperus, showcasing the active pursuit of enhanced cross-border payment capabilities.

4.1.4. Public Acceptance and Social Factors

Public acceptance and social factors hold paramount importance in shaping the design and implementation of CBDCs. A fundamental determinant of a CBDC's viability lies in its acceptance by the public, and in cases like the CBDC Wholesale, where access is constrained, the effectiveness in mitigating criminal activities such as money laundering is significantly heightened. This, however, underscores the delicate balance between the imperatives of enhancing financial security and maintaining individual privacy. An inherent challenge is that regulatory responses to socially undesirable phenomena, like money laundering, tend to be more reactive than proactive, potentially perpetuating a cycle of innovation among those seeking greater financial privacy and those engaged in illicit financial activities. The potential for money laundering under a CBDC regime hinges on the precise design and features of the CBDC, with different CBDC types offering varying levels of control and susceptibility to circumvention by money launderers (Dupuis et al., 2022).

Public sentiment surrounding the adoption of CBDC is generally favourable, with convenience, security, potential for financial inclusion, and reduced transaction costs being key factors contributing to this positive reception. A positive outlook on CBDC can provide a competitive edge on the global stage, positioning the country as a leader in the digital currency domain. Nonetheless, the global perspective on CBDC exhibits a mix of neutral and positive attitudes, with concerns about privacy and security contributing to a more neutral stance. To ensure the successful implementation of CBDC worldwide, it is crucial to address these concerns and build public trust through clear communication, collaboration with stakeholders, pilot programs, competition resolution, and robust legal and regulatory frameworks. Research efforts aim to gain deeper insights into public sentiment regarding CBDC by employing sentiment analysis techniques, natural language processing, and machine learning algorithms to analyse data and inform the development and deployment of CBDC initiatives (Mukesh et al., 2023).

The sentiment of the public regarding CBDC exhibits an overall upward trajectory, with specific countries witnessing significant enhancements in public sentiment during the year 2022. A prominent aspect of public discourse centers on CBDC's potential to facilitate cross-border transactions, with discussions often revolving around the feasibility of forming multi-CBDC agreements among central banks to unlock this

capability. It is worth noting that the level of public discourse and opinions about CBDC, particularly on social media platforms such as Facebook, serves as a valuable resource for governments as they formulate and execute CBDC strategies. Crucially, the decision of governments to implement CBDC is heavily influenced by the prevailing public attitude, the adoption of decentralized finance (DeFi) within their respective jurisdictions, and the broader framework of monetary policy settings. Additionally, demographic characteristics, including wealth disparity and technological knowledge, contribute to the government's acceptance of CBDC (Ngo et al., 2023).

4.1.5. Use Cases and Applications

CBDCs offer a transformative potential as they can serve as a viable replacement for traditional currencies, possessing the status of legal tender, thereby enabling seamless transactions and payments within the broader financial system. Furthermore, their utility extends to supply chain trade scenarios, where they can be adopted within private blockchain networks to facilitate transactions while automatically reporting them to government agencies and external entities. Moreover, CBDCs find applicability in financial settlement processes within industrial-financial ecosystems and supply chains, offering organizations a means to efficiently close their financial transactions. These versatile digital currencies can also be integrated into smart contracts to control and automate processes across diverse domains, including the physical realm, Industrial Internet of Things (IIoT), and blockchain applications. In the context of over-the-counter derivatives, CBDCs empower industrial stakeholders to effectively manage counterparty risks, match bids, and execute physical settlements. However, the multifaceted applications of CBDCs have the potential to profoundly transform and enhance the existing economic landscapes by providing a secure and efficient means to conduct transactions and financial settlements across diverse industries and supply chains (Franko et al., 2022).

The incorporation of blockchain technology and the utilization of big data tools within CBDC elevate its functionality, enabling advanced traceability and meticulous tracking of transactional information flow. This integration further ensures transparency and accountability in transactions, a critical element in green finance. Moreover, CBDC's integration of smart contracts enhances transaction security and grants a level of control that is crucial for the oversight and management of green

projects, adding yet another layer of assurance. CBDC's programmable and compliant features equip it with significant potential to foster the development of green finance. These attributes provide a versatile platform for the facilitation of green projects and contribute to the sustainability objectives of the financial ecosystem (Q. Yang et al., 2023).

According to Kim et al. (2023), the innovative applications of CBDC in payment systems offer a promising avenue for the tourism industry, facilitating the seamless use of digital currencies by travelers to pay for various tourism products and services. This transition to CBDC payments can introduce enhanced convenience and efficiency, benefiting both tourists and businesses alike. However, it's essential to acknowledge the various perceived risks associated with CBDC payments, encompassing financial, performance, privacy, psychological, and time-related concerns, as these can significantly influence attitudes towards CBDC payment adoption. Several factors, such as consumer innovativeness, prior experiences with digital currencies, structural assurance, and the influence of media narratives, can act as moderators, shaping the relationship between these perceived risks and one's attitude towards CBDC payments. In particular, prior experience with digital currencies, including holding cryptocurrencies or virtual currency, can exert a notable influence on attitudes towards CBDC payment. Individuals with previous experience in this domain tend to be more acquainted with the use of digital currencies, potentially mitigating the adverse effects of perceived risks on their attitudes towards CBDC payments. Likewise, the influence of media narratives plays a crucial role in moderating the connection between perceived risks and attitudes towards CBDC payment. Nonetheless, it's worth noting that there exists a dearth of empirical studies that delve into the specific moderating role played by media encouragement in this context.

4.1.6. Security and Technical Features

According to a review study by Chu et al. (2022), CBDC emerges as a potential remedy for the inherent deficiencies observed in electronic financial systems, encompassing issues like exorbitant charges, security vulnerabilities, and financial exclusion. Its overarching objective is to attain universality and accessibility, akin to physical cash, transcending the constraints of time and place, making it widely available. To further expand the reach and accessibility of CBDC, there are active endeavours to develop offline payment functionalities. Nonetheless, given the inherent characteristics of

electronic financial systems, CBDC faces vulnerabilities in offline scenarios, susceptible to malicious behaviours during events like blackouts and system shutdowns. In pursuit of bolstering the implementation of CBDC's offline payment functionality, it is pivotal to give due consideration to security prerequisites such as averting double spending, ensuring verifiability, and preserving anonymity. The integration of Trusted Execution Environment (TEE) technology stands out as a prospective solution to enhance the security of CBDC-based payment mechanisms. Furthermore, insights garnered from the study of other digital currencies, like e-cash and cryptocurrencies, have been instrumental in comprehending and shaping the security requirements for CBDC, collectively contributing to the ongoing evolution of digital currency ecosystems. In essence, CBDC's development underscores a comprehensive effort to address the shortcomings of electronic financial systems and provide a secure and accessible alternative to traditional currencies.

4.1.7. Innovation and Emerging Trends

CBDCs introduce a groundbreaking shift in the global landscape of digital currencies and traditional cash, offering a distinct set of advantages and disadvantages that set them apart from other digital currencies and traditional cash. These unique attributes present opportunities and challenges that require meticulous consideration by policy and decision-makers. In the contemporary financial environment, marked by global exchange rate volatility, high inflation, sluggish growth, trade disputes, and recurring currency crises in emerging economies following the post-Bretton Woods era, central banks are engaged in substantive discussions surrounding the issuance of their own CBDCs. The concept of CBDC is inherently associated with central banks, as underscored by references to influential entities like the Bank for International Settlements (BIS) and central banks such as the Federal Reserve (Fed), the Bundesbank, and the Riksbank. Interestingly, within the Twitter sphere, this association appears unidirectional. Furthermore, U.S.-based money transfer platform Ripple has emerged as a significant focal point for discussions related to CBDCs on social media. The parallel drawn between CBDCs and Ripple is notable, as both share similarities concerning centralization aspects. These developments underscore the dynamic and evolving landscape of CBDCs and their influence on the global financial system (Ozturkcan et al., 2022).

The convergence of cryptocurrencies, FinTech innovations, and the concept of tokenization has fostered a highly fertile landscape for financial innovation and transformation. Central banks have been actively exploring the establishment of sovereign frameworks for digital fiat currencies, with the forthcoming introduction of consumer retail payments facilitated through CBDCs being anticipated as a pivotal milestone in the realm of digital payments. CBDCs can assume two distinct forms: account-based, where users hold a current account with the central bank, or token-based, where the CBDC takes the form of a digital unit stored within a physical device, enhancing the spectrum of choices for users and institutions. Ongoing research and development endeavors are dedicated to unraveling the intricate interplay between the Machine-to-Machine (M2M) economy, the adoption of retail CBDCs, and the regulatory questions that inevitably arise in this evolving landscape, where digital transactions are becoming increasingly complex. Another notable area of interest revolves around the cross-border dimensions of CBDCs, involving the development and assessment of arrangements for multiple CBDC bridges. These endeavors aim to create an infrastructure that fosters international collaboration and the seamless exchange of digital currencies across borders, further propelling the evolution of the digital financial ecosystem (Pocher & Zichichi, 2022).

However, the rise of CBDCs within the broader context of digital finance signifies a pivotal moment in the financial industry's progression, as innovations and research initiatives continue to shape the future of digital payments and international financial cooperation.

4.2. Research Questions

Q1. How have cryptocurrencies, Fintech, and Defi-Blockchain transformed the traditional financial system in developed countries such as the US, China, Japan, and Europe? What are the implications of these changes for financial stability, security, and regulation?

Q2. How can Central Bank Digital Currencies (CBDCs) be leveraged to promote financial inclusion and enhance monetary policy in Muslim countries? What are the challenges and opportunities associated with adopting and integrating CBDCs in these economies?

Q3. What are the legal and regulatory frameworks required to develop and deploy cryptocurrencies, Fintech, and Defi-Blockchain technologies? What are the potential implications of regulatory approaches on innovation, consumer protection, and financial stability?

Q4. How can emerging economies, particularly Muslim countries, adopt and integrate new financial technologies to enhance financial inclusion and promote economic growth? What are the key factors that determine the success of these efforts, and what are the lessons that can be learned from the experiences of developed countries?

Q5. How can blockchain technology enhance supply chain and trade finance in Muslim countries? What challenges and opportunities are associated with adopting and integrating blockchain technology in these economies?

4.3. Impact of Cryptocurrencies, Fintech, and DeFi in Developed Countries

Respondent notes, *"It will change the pattern of the financial industry and would require new regulations and thinking."* This observation underscores the transformative effect of cryptocurrencies and blockchain technology on the traditional financial sector. These innovations have indeed altered the landscape in developed countries.

The respondent further states, *"I see no link of digital currency and financial inclusion. Unless Muslim countries respect the faith of their citizens and offer Shariah-compliant services, we may not achieve good progress."* This highlights a critical issue in Muslim-majority countries: the lack of Shariah-compliant financial services. While cryptocurrencies have reshaped finance, the translation of these changes into financial inclusion may be hindered in regions where traditional financial services are not aligned with the faith of the population.

Regarding regulatory aspects, Respondent emphasizes, *"You need both legal frameworks and good regulations to provide legal cover and avoid any harm to the general public."* This highlights the importance of creating a supportive legal and regulatory environment to ensure the security and integrity of financial systems during this transformation.

The respondent concludes, *"Overall, if the solutions are simple and not exploitative, then they are expected to work."* This suggests that straightforward and equitable

solutions are key to the success of innovations in the financial sector, aligning with the study's focus on how these innovations impact payment settlements.

According to a respondent, *"Firstly, they need to allow room for experiments and a sandbox-type approach so the technology can be tested. Secondly, existing big players need to be motivated to develop and experiment."*

The respondent suggested that this could be achieved by providing space for experiments and adopting a sandbox-type approach where new technologies could be tested without immediate regulatory constraints. Additionally, the respondent believed that established industry leaders should be incentivized to engage in development and experimentation to drive progress.

A respondent also stated, *"Overall, if the solutions are simple and not exploitative, then they are expected to work."* This respondent suggested that for technology solutions to be successful, they should be uncomplicated and should not exploit users or resources. This perspective implied that the key to success lay in designing technology that was user-friendly and ethical in its application.

4.3.1. Central Bank Digital Currencies (CBDCs) and Financial Inclusion in Muslim Countries

Respondent provides insight into the potential of Central Bank Digital Currencies (CBDCs) in Muslim countries, stating, *"CBDCs may improve financial inclusion and monetary policy by expanding financial inclusion through increased access to banking services, reducing costs, providing inclusive payment systems, and improving financial literacy."*

This highlights the promise of CBDCs in addressing financial inclusion challenges.

However, the respondent acknowledges the challenges: *"Cybersecurity, privacy, digital access inequities, and the transition from conventional to digital currencies are among these difficulties."* This highlights the importance of introducing CBDCs in Muslim-majority nations in a structured and regulated manner.

Respondent emphasizes the significance of regulatory frameworks and international collaboration in order to maximize the potential of CBDCs while addressing the accompanying issues. This is consistent with the study's emphasis on the legal and regulatory implications of financial innovations.

4.3.2. Legal and Regulatory Frameworks for Cryptocurrencies and Fintech

Respondent emphasizes the importance of clear legal and regulatory frameworks, stating, *"Legal and regulatory frameworks required to develop and deploy cryptocurrencies, Fintech, and DeFi-Blockchain technologies should begin with clear legal definitions and establishing regulatory authorities, licensing and registration requirements, consumer protection, data security, and privacy."*

This is consistent with the study's emphasis on determining the legal and regulatory ramifications of these developments.

The respondent points out that achieving a balance is crucial, as *"Excessive regulation may slow innovation, fair market competition, and investment, while poor supervision can leave customers susceptible to dangers and threaten the financial system."*

This emphasizes the significance of achieving the appropriate balance in regulation, which is critical to the study's analysis of regulatory techniques' ramifications.

4.3.3. Financial Inclusion and Economic Growth in Emerging Economies

The opportunity for rising economies, including Muslim-majority countries, to capitalize on financial advances is clear. Respondent observes that *"Emerging economies can promote financial inclusion and economic growth by adopting and integrating new financial technologies."*

This is in line with the study's emphasis on how emerging economies may adopt and integrate these technologies to boost financial inclusion and economic growth. The response underlines the need of public-private collaboration, creative legislation, and tailoring solutions to local circumstances. These elements are crucial for the development of financial innovations in emerging economies, emphasizing the lessons that may be derived from the experiences of industrialized countries, as the research intends to uncover.

The respondent pointed,

> *In emerging economies, including those with a Muslim majority, financial inclusion and economic growth can be enhanced through adaptive regulatory frameworks, improved digital payment infrastructure, financial literacy programs, collaboration between traditional institutions and Fintech*

startups, supportive infrastructure, and accommodations for Islamic finance principles.

Several initiatives for boosting financial inclusion and economic success in emerging economies, especially those with a Muslim majority, were suggested in the response. Respondents proposed adaptive regulatory frameworks, enhanced digital payment infrastructure, financial literacy programs, collaboration between traditional financial institutions and Fintech companies, supportive infrastructure, and accommodations for Islamic finance principles. This response underlines the significance of a multifaceted approach to tackling the particular challenges that emerging economies confront.

The respondent stated,

> *In emerging economies, the success of these factors depends on adaptable regulations, digital infrastructure, financial education, collaboration, cybersecurity, government support, and well-integrated institutional architecture. The importance of inclusive regulation, public-private partnerships, education, data protection, and international collaboration can be learned from the developed countries.*

The response emphasized the need of adaptive regulations, digital infrastructure, financial education, teamwork, cybersecurity, government aid, and well-integrated institutional architecture in the context of growing economies. Respondents emphasized the need of regulatory inclusion, forming public-private partnerships, investing in education, ensuring data security, and encouraging international collaboration. In addition, the responder highlighted the possible lessons that emerging economies may learn from affluent countries in terms of these traits. In order to foster growth and financial inclusion in developing economies, this solution highlights the necessity of learning from the experiences of more established economies.

4.3.4. Blockchain Technology and Supply Chain Finance in Muslim Countries

Blockchain technology offers potential benefits for supply chain and trade finance in Muslim-majority countries. Respondent emphasizes that, *"Blockchain technology might change Muslim supply chains and trade finance through transparency, security, and efficiency."*

This aligns with the study's focus on understanding how blockchain technology can enhance supply chain and trade finance in these economies.

The respondent acknowledges the challenges, stating, *"Obstacles include infrastructural investment, regulatory consistency, and overcoming change resistance."*

These challenges need to be addressed for blockchain technology to deliver on its promises, as highlighted in the study's focus on the challenges and opportunities associated with adopting and integrating blockchain technology.

The respondent stated,

> *Through blockchain technology, Muslim countries can enhance their supply chains and trade finance by improving transparency and traceability, reducing fraud. Smart contracts enable automation, simplify cross-border trade, and provide Shariah-compliant financing opportunities. Challenges include regulation uncertainty, education and awareness needs, infrastructure requirements, security concerns, and the development of blockchain expertise.*

The responses from the various stakeholders, on the other hand, provide vital insights into the influence of cryptocurrencies, fintech, DeFi, CBDCs, and blockchain technology on financial systems. These innovations have the potential to change the financial sector, but they also bring with them regulatory, cybersecurity, and cultural alignment issues. Achieving a balance between innovation and regulation, as well as learning from developed-country experiences, is critical for realizing the revolutionary potential of emerging technologies in the global financial landscape.

4.4. Pilot Projects of CBDCs in Different Countries

4.4.1. North America

The United States is one of the main economies that has yet to initiate a CBDC pilot project, but it is actively investigating and testing the potential advantages and hazards of a digital currency. The Federal Reserve has collaborated with MIT to create a fictitious CBDC platform, and it aims to deliver a discussion paper on the subject in mid-2022.Meanwhile, Canada has been researching the feasibility and design of a digital loonie since 2016, and has undertaken many tests and simulations with partners such as the Bank of England, the Singapore Monetary Authority, and JP Morgan. Canada has not yet chosen whether to issue a CBDC, but it has issued a backup plan for the eventual launch of a digital Loonie (Fuje et al., 2022).

4.4.2. South America

Several South American countries, including Brazil, Uruguay, Ecuador, and Venezuela, are also considering CBDC programs. Brazil is creating a digital real that will be connected with the country's existing rapid payment system, PIX, and open banking platform. Brazil intends to establish the CBDC by end of 2023. Uruguay was one of the first countries to test a CBDC, issuing and distributing digital pesos to chosen consumers via a mobile app in 2017-2018. Although the pilot was a success, Uruguay has not yet declared intentions to issue a CBDC on a broader basis. Ecuador introduced a digital currency in 2015, however it was phased down in 2018 owing to poor acceptance and technical concerns. Venezuela introduced a digital bolivar in 2018, but it was heavily condemned as a means of evading sanctions and inflating the currency.

4.4.3. China

China is one of the most advanced countries in terms of creating and deploying the CBDC, also known as the e-CNY or digital yuan. Since 2020, China has been undertaking large-scale e-CNY experiments in many locations and situations, involving millions of users and businesses. The e- CNY is intended to work with existing payment systems and platforms like Alipay and WeChat Pay. China intends to use the e-CNY for cross-border payments and international trade as well.

4.4.4. Japan

Another large economy, Japan, is currently exploring and experimenting with a CBDC known as the digital yen. Japan has established a three-phase CBDC trial program that was run until March 2023. The first phase focuses on putting the digital yen's essential operations and characteristics to the test, such as issuance, distribution, and redemption. The second phase will include more in-depth testing and simulations involving private-sector partners such as banks and payment service providers. The third step will include public input and feedback.

4.4.5. Europe

Europe is also investigating the feasibility and implications of launching a digital euro, which would supplement the eurozone’s existing cash and payment infrastructures. The European Central Bank (ECB) has begun an investigative phase for its CBDC project, which spanned until the middle of 2023. The inquiry phase looked at

technological design choices, user needs, policy goals, and the legal framework for a digital euro. During this phase, the ECB also conducted experiments and consultations with stakeholders and the general public. In addition to the ECB's effort, France, Sweden, the United Kingdom, Germany, Italy, and Spain have all performed their own CBDC pilots or tests.

4.4.6. India

India is one of the major growing nations contemplating the issuance of a CBDC, dubbed the digital rupee. India has conducted a CBDC pilot project by December 2021. The Reserve Bank of India (RBI) tested the issue and distribution of digital rupees to selected banks and financial organizations as part of the pilot project. The CBDC's influence on monetary policy, financial stability, inclusiveness, and innovation were also assessed in the pilot study. India's CBDC is currently in a pilot phase across the retail and wholesale segments. The central bank has set a target of one million transactions a day by the end of 2023 (Ohri & Dayal, 2023).

4.4.7. Africa

Africa is another region that is exhibiting interest in and potential for CBDC adoption. Nigeria, Ghana, South Africa, Morocco, Kenya, Egypt, Tunisia, Senegal, Uganda, Rwanda, Tanzania, Ethiopia, and Zimbabwe are among the African nations investigating or piloting CBDCs. Increasing financial inclusion, lowering transaction costs, increasing payment efficiency and security, and tackling currency instability and inflation are some of the main reasons and problems for CBDCs in Africa.

4.4.8. Jamaica

The Digital Jamaican Dollar (DJMD) project in Jamaica aims to create a digital version of the Jamaican dollar that can be used for a variety of purposes, including facilitating financial inclusion, improving monetary policy effectiveness, and improving payment efficiency and security. The DJMD initiative has a two-tier design in which the central bank creates and manages the digital Jamaican dollar while approved financial institutions, such as banks and payment service providers, distribute and manage it to consumers. The DJMD project likewise employs a token-based architecture, with each digital Jamaican dollar represented by a unique cryptographic token that the central bank can validate. The DJMD project is intended to be interoperable with Jamaica's existing payment systems and platforms, such as Quisk and NCB Quisk Wallet. The

DJMD initiative also allows users to send digital Jamaican dollars to one another by scanning QR codes or utilizing NFC technology. In August 2021, Jamaica began its CBDC pilot project in collaboration with the Irish technology firm eCurrency Mint (Ohri & Dayal, 2023). The pilot project involved approved financial institutions testing the issue, distribution, and redemption of the DJMD. The pilot study also sought to assess the CBDC's influence on financial inclusion, monetary policy, and financial stability. The pilot project was successfully finished in December 2021 (Outlook Money Team, 2022).

4.4.9. South Korea

The Digital Korean Won (DKRW) project in South Korea aims to create a digital version of the Korean won that can be used for a variety of purposes, including improving payment convenience and efficiency, promoting financial sector innovation, and preparing for future changes in the payment environment. The DKRW initiative employs a two-tier design, with the central bank issuing and controlling digital Korean won and approved intermediaries, such as banks and payment platforms, distributing and managing digital Korean won to users. The DKRW initiative also employs an account-based design, in which each user has a distinct digital identity tied to their bank account or mobile phone number. The DKRW project is intended to be interoperable with South Korean payment systems and platforms such as Naver Pay and Kakao Pay. The DKRW initiative also allows users to send digital Korean won to one another by scanning QR codes or utilizing NFC technology. After completing a proof-of-concept phase in 2020, South Korea launched its CBDC pilot program in April 2021. There were three steps to the pilot program: development, testing, and implementation. The development stage was concerned with creating the DKRW's technological characteristics and functions, such as issue, circulation, and management. During the testing stage, numerous DKRW use cases and scenarios, including as offline payments, remittances, and micropayments, are simulated. The DKRW's legal and regulatory issues, as well as its interoperability with current systems, will be evaluated throughout the implementation stage (David Attlee, 2023).

4.4.10. France

The Digital Euro (DEUR) project in France intends to build a digital version of the euro that may be used for interbank transactions and settlements. The DEUR initiative

employs a two-tier design in which the central bank creates and manages the digital euro while approved financial institutions, including as banks and clearing houses, distribute and manage it to consumers. The DEUR project likewise employs a token-based architecture, with each digital euro represented by a unique cryptographic token that the central bank can validate. The DEUR project is intended to be interoperable with existing eurozone payment systems and platforms such as TARGET2 and TIPS. The DEUR project also offers cross-border payments, allowing users to send digital euros to countries that use the same currency or have CBDC systems that are compatible. Since 2020, France has been experimenting with a wholesale CBDC for interbank transactions and payments. France has successfully performed multiple tests with various partners, including banks, financial institutions, and blockchain platforms. France intends to investigate the possible benefits and drawbacks of utilizing a CBDC for eurozone cross-border payments and clearing activities.

One notable initiative in this domain is Project Jura, a collaborative effort involving public and private entities such as Banque de France, Swiss National Bank, Bank for International Settlements, commercial banks, and law firms, with the shared goal of establishing a cross-border digital platform for CBDC transfers. The development of cross-border payment infrastructure using CBDCs is being comprehensively examined from practical and macro-financial perspectives, including infrastructure creation, the potential growth of cross-border capital flows, risks related to financial stability and currency substitution, and the configuration of a reserve currency and its supportive mechanisms. This evolving landscape underscores the importance of continuous research and analysis in cross-border CBDC settlements (Inozemtsev et al., 2022).

The Bank of International Settlements (BIS) has put forth a compelling proposition for multi-CBDC arrangements, offering a mechanism for the seamless interoperation of CBDCs across national borders. The BIS outlines three distinct models for CBDC cross-border interoperability, each tailored to accommodate varying degrees of harmonization, encompassing rulebook and governance alignment, participation criteria, and technical infrastructure. In the current landscape, numerous CBDC cross-border interoperability projects have emerged on a global scale, including initiatives like Aber, Dunbar, Helvetia, HSBC, Jasper-Ubin, Jura, MAS, mBridge, and Prosperus, showcasing the active pursuit of enhanced cross-border payment capabilities.

CHAPTER V

CBDCs: A SYSTEMATIC LITERATURE REVIEW[1]

Central Bank Digital Currencies (CBDCs) are digital replicas of fiat currencies Issued by central banks. In recent years, CBDCs have become ever more important given the growing demand for digital payments, the existence of private digital currencies, and the necessity for payment infrastructure (Alonso-Robisco & Carbó, 2023). Though various central banks throughout the world are looking at the possibility of releasing CBDCs, several of them are in the early stages of study. For instance, while the European Central Bank is starting a public consultation on the future issuing of a digital euro, the People's Bank of China has been testing its digital yuan in many pilot projects. Additionally aggressively investigating and experimenting with CBDCs are the Federal Reserve, Bank of England, and Bank of Japan. (Maruo & Sugino, 2023a). Chiu et al. (2023a) state that CBDCs could boost financial inclusion and improve banking sector efficiency. Adoption of CBDCs raises major policy questions about monetary policy, financial stability, and privacy, Chiu et al. (2023a) have noted. Therefore, additional research and critical thinking are needed to fully understand the pros and cons of CBDCs and their importance in the world economy.

Knowledge on this subject is much sought after even if CBDCs are becoming more and more important and research on them is increasing. To comprehend the evolution of research dimensions and guide the investigations of this topic, a thorough literature evaluation is essential to find main research patterns applied. Few studies examining the study rise in this sector (Hoang et al., 2023a, 2023b; Themistocleous et al., 2023).

This paper primarily addresses world-wide research trends, new sources, nations and authors utilizing R, Biblioshiny, and Excel together with a thorough hand investigation of research techniques applied in CBDC literature. 169 papers were finished in this study utilizing Scopus database following extensive screening method as depicted in figure 1. Based on research techniques, the study arranged the material exposing 73 qualitative,18 mixed-methods and 78 quantitative studies. This methodological review

[1] This article is published authored by the student as part of the research conducted for this PhD thesis. (Fahad, S. and Bulut, M. 2024)

guarantees a thorough investigation of the CBDC terrain, therefore facilitating a later analysis and synthesis of results. This study aims to guide stakeholders, legislators, and academics on the changing research patterns and approaches applied in CBDC research by consolidating the body of knowledge already has been done.

The research started with a thoughtful introduction that sets the context and background on the topic. Then, a review of earlier research was done to evaluate areas for more investigation and current gaps. Carefully conducted data selection and screening guarantees the inclusion of pertinent studies. Driven by methodical ideas, the chosen approach let for a methodical and objective assessment of the chosen material. The acquired results from this SLR emphasize research trends, approaches, and possible future advancements, therefore offering insightful analysis of the present situation of CBDC research. The paper ends with a summary of the main lessons learned and a discussion of consequences for academics, legislators, and practitioners navigating the changing terrain of CBDCs.

5.1. Previous Studies

Few research was identified systematically exploring the literature on CBDCs and its ramifications to provide insights into many dimensions. These research, spanning 2013 to 2022, bibliometric and systematic review studies. Analyzing 293 papers from scholarly publications listed by the Scopus database, a recent Alrawashdeh (2023) paper provides a thorough evaluation spanning 2013 to 2022. The authors used a bibliometric citation analysis technique using tools to elucidate the conceptual framework and main aspects in literature on CBDCs. Hoang et al. (2023a) used text mining and systematic review techniques to assess 191 academic papers on CBDCs. The poll up with seven themes: CBDC's impact on monetary policy and financial stability, CBDC design and technologies, the central bank and CBDC. With these strategies, the authors try to address the close gaps and provide outlook research paths.

Bhaskar et al. (2022a) investigated publishing patterns in CBDCs since 2018 by means of bibliometric and content analysis of 174 papers obtained from Scopus. Along with stressing significant studies, conceptual frameworks, and current research trends, this paper also recognized influential works the authors underlined that order to grasp the structural consequences of CBDCs theoretical progress, contextual coverage, and methodological contributions are important. Underlining the poor knowledge of CBDCs and the need for more research, research outside of CBDCs' financial

justification should cover their effects on ethical issues, financial and price stability, monetary policy transmission (Elsayed and Nasir's 2022a) The expected deployment of CBDCs underscored the importance of addressing outstanding issues together with those of ethics, privacy, environmental and technological constraints.

Although these earlier investigations made great contributions, this SLR stood out in many respects. First, its inclusive and thorough screening system combined with the use of several documents guaranteed a whole picture of the state of the knowledge on CBDCs. Furthermore, this study went beyond conventional bibliometric techniques and included a broad spectrum of analytical instruments and techniques to provide a complex knowledge of the several aspects of CBDCs. Moreover, this SLR presented a full picture of the relevant studies, connections, influence, and global reach, so serving academics, professionals, and legislators interacting with the evolving scene of Central Bank Digital Currencies.

5.2. Data Selection and Screening

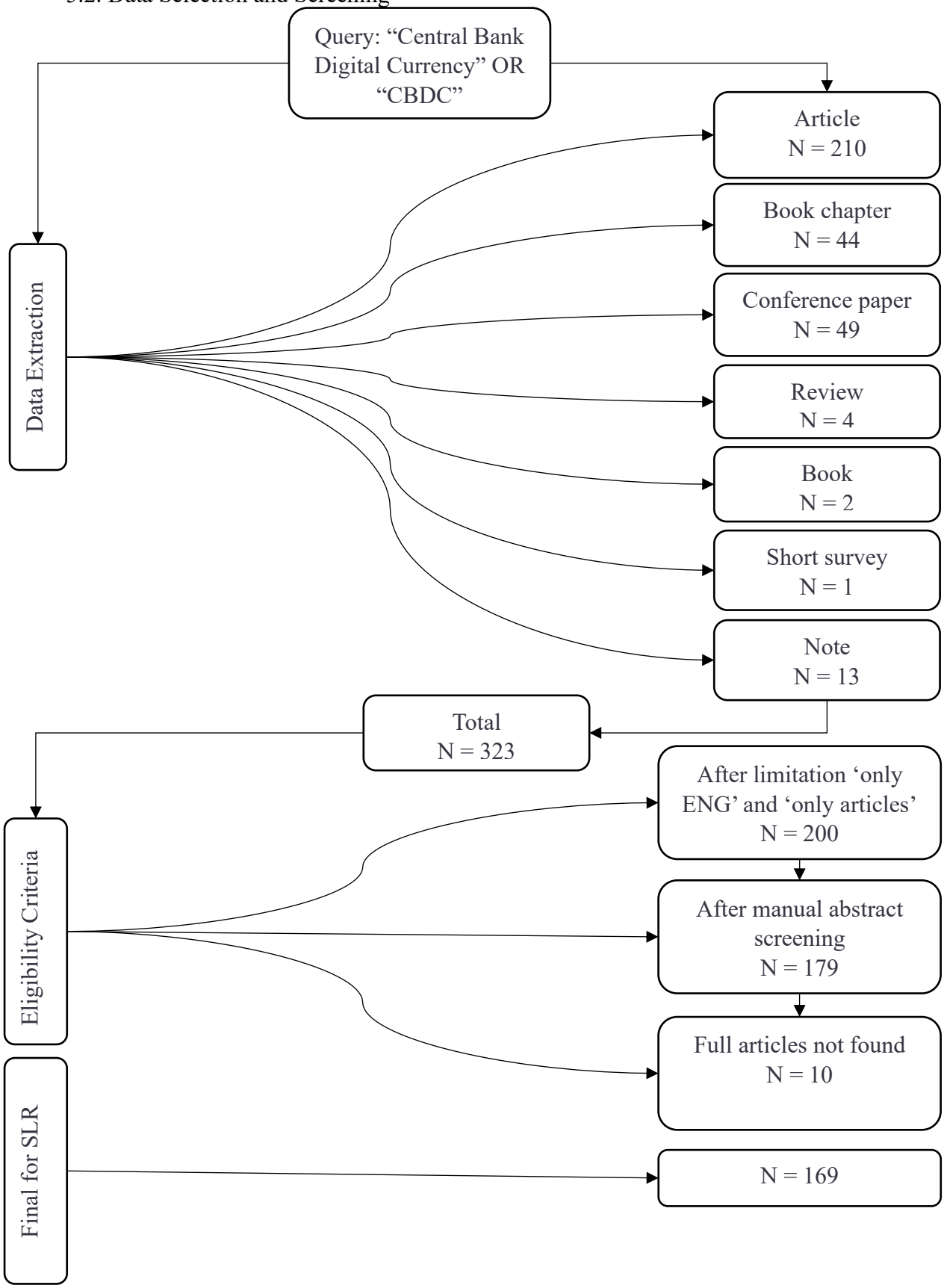


Figure 5.01: Data Selection

Figure 5.1 shows, using the Scopus database, the data extraction and screening procedure associated with the query "Central Bank Digital Currency," or "CBDC." Initial data collecting produced 323 items overall book chapters, articles, reviews, conference papers, , brief surveys and notes. Applying eligibility criteria, restricting the choice to English papers and removing non-articles, the count dropped to 200. Manual abstract review produced further screening via 179 papers. Ten complete articles were then absent, therefore producing a final set of 169 items for this SLR.

The search strategy employed involved the use of keywords “Central Bank Digital Currency” OR “CBDC” in the Scopus database. This database was chosen as the primary source for its comprehensive coverage of the articles.

Starting with an initial pool of 323 items covering a range of document the search method used inclusion and exclusion criteria helped to restrict the collection to only 200 English publications, therefore improving the choice. This choice to restrict the review to English publications was accompanied by the non-article document types being excluded. Further screening the papers by hand abstract review produced a final collection of 179 papers. Furthermore, ten articles vanished from the latter full-text retrieval stage, therefore providing a final corpus of 169 articles for the SLR. As shown in Figure 1, this incremental screening method guaranteed a rigorous selection depending on predefined criteria, so improving the dependability and relevance of the last batch.

Focusing on English papers was meant to preserve linguistic consistency and accessibility in line with the shared language of academic communication. Manual abstract review also gave the screening procedure a qualitative component that let one assess the relevance of the papers for the CBDC theme. The basis for the further stages of the SLR was the 169 found papers. R, Biblioshiny, and Excel were among the tools utilized in the analysis; these give a strong basis for data organization and analysis. Much research has also made advantage of these software’s including (Alrawashdeh, 2023; Bhaskar et al., 2022a, 2022b).

Acknowledging such constraints, it is important to observe during the retrieval procedure the lack of ten complete publications. One should take into account how these absent papers affect the general conclusions and analysis. Thus far, the method has developed a systematic and open approach to the literature review, therefore laying a strong basis for the later synthesis and interpretation of results. Furthermore, within

the chosen 169 papers, a subset was found depending on the methodologies used. Of these, 78 studies took a quantitative approach, using statistical techniques to examine data about CBDC. Another group of 78 research utilizing a qualitative approach concentrated on thorough investigation and interpretation of CBDC-related events. Moreover, 73 studies applied a mixed-methods strategy integrating qualitative and quantitative techniques for a whole grasp of CBDC dynamics.

These categorizations provide a view of the research landscape, highlighting the diversity of methodologies employed in the existing literature on CBDC. The inclusion of studies using quantitative, qualitative, and mixed-method approaches added depth and breadth to the SLR, allowing for a more comprehensive analysis.

5.3. Findings and Discussions

Illustrating from a wide range of sources 93 journals, books, and relevant references the dataset employed in the research project produces 169 documents overall. There is a significant increase in literature between the given period. Examining the document contents closely found 201 Keywords Plus (ID) and 424 Author's Keywords. The research was clearly cooperative, with 415 writers among other things. Especially noteworthy was the fact that forty-three authors had created single-authored papers, therefore showing individual intellectual output.

Indicating productive research into the environment, 46 single-authored articles having 2.67 average of co-authors per document were examined more closely. Notable 23.08% of these joint projects crossed national borders, therefore highlighting the global aspect of scientific activities. Within the dataset, document kinds are mostly comprised of 169 articles total. Examining document age found an average of 0.852, suggesting the quite recent character of the contained material. Moreover, the average of 8.669 references per document emphasized the impact of the research. Emphasizing the wide intellectual terrain covered in this research article, the references part of the dataset was large and included 7359 citations.

Figure 5.2 presents an overview of the annual production of studies. The figure showcases the evolution of research output over this period. Notably, the figure reveals a discernible surge in scholarly interest in CBDC, with the number of studies gradually increasing from 2019 onwards. In 2019, there were 5 studies, followed by 8 in 2020, and a substantial growth in 2021 with 25 studies. The upward trajectory continues in

2022, reaching 50 studies, and peaks in 2023 with a notable 81 studies. This progression underscores the growing significance of CBDC within the academic landscape, reflecting a heightened focus and exploration of this subject in recent years.

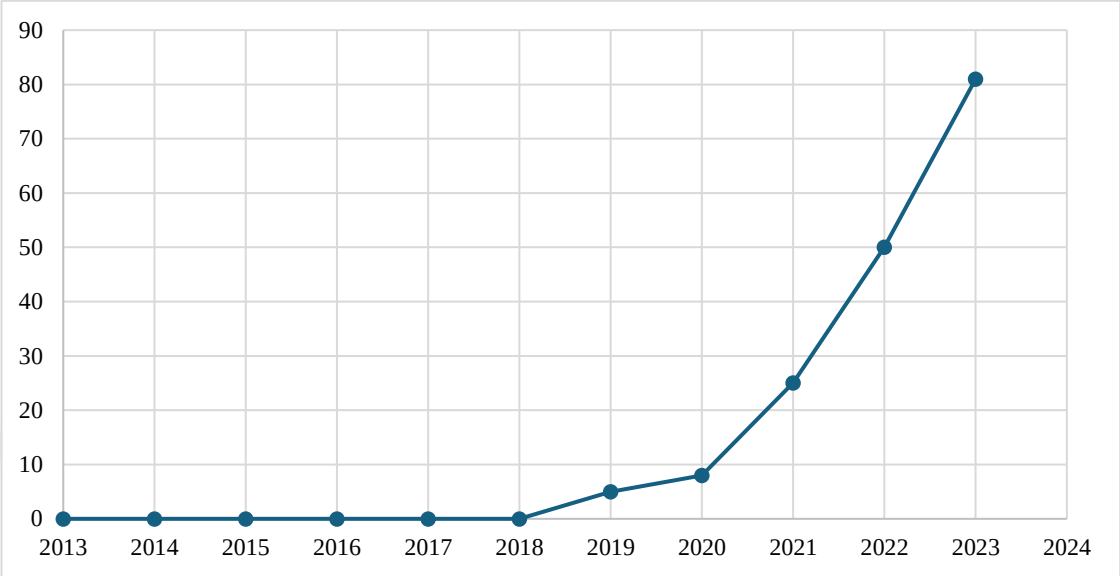


Figure 5.2: Yearly production of the studies

An idea of the most pertinent sources, as Figure 5.3 shows how studies are distributed among several publications. Particularly, with 11 research, the "Journal of Payments Strategy and Systems" becomes a prominent center; on the other hand, "Research in International Business and Finance" stands out with a significant 20 study contribution. With 6, 5, and 5 studies respectively. This number offers important new perspectives on the main scholarly publications shaping the debate on CBDC.

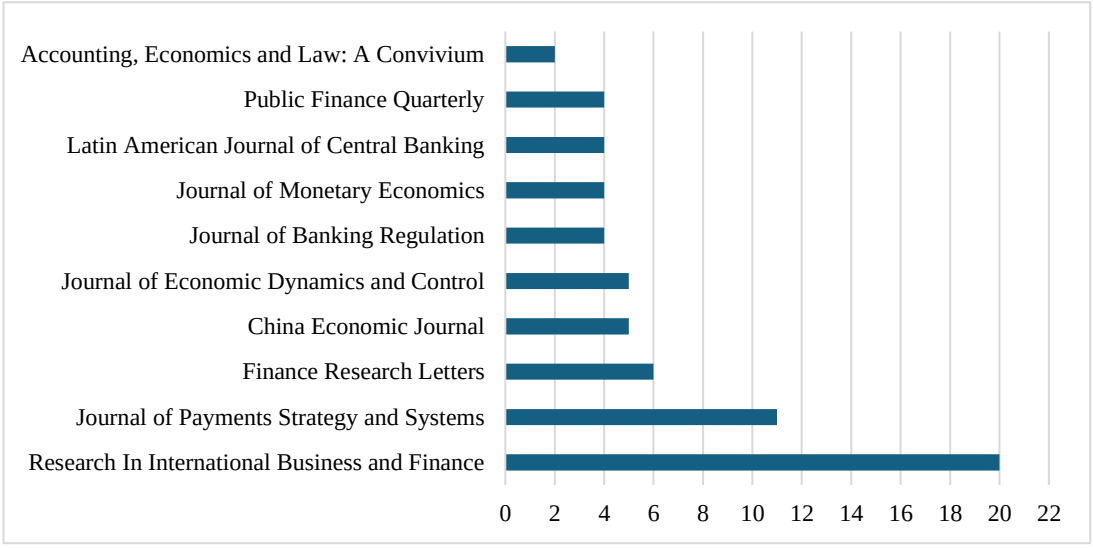


Figure 5.3: Most Relevant Sources

Table 5.1 lists the top 10 sources' impact measures. For every source the table shows the H-index, G-index, M-index, total citations (TC), number of publications (NP), and publication year (PY_start). Leading with an H-index of 8, G-index of 11, M-index of 4, 156 total citations, 20 articles, and a starting publication year of 2022 is "Research in International Business and Finance." Additional noteworthy references include "Journal of Banking Regulation," "Journal of Economic Dynamics and Control," "Journal of Monetary Economics," "Latin American Journal of Central Banking," "China Economic Journal," and "Finance Research Letters." This table offers a whole picture of the scholarly influence of various sources in the field of CBDC study. Table 5.2 lists, based on total citations, an overview of the most globally significant works. Leading with 69 overall citations, averaging 23.00 citations annually and a normalized total citation score of 3.77, "Assessing the Impact of Central Bank Digital Currency on Private Banks" Other significant publications include "Central bank digital currency: Central banking for all?," with 59 total references; "How does the fintech sector react to signals from central bank digital currencies," with 59 total references; "Designing central bank digital currencies," with 54 total references; "Fintech, Cryptocurrency, and CBDC: Financial Structural Transformation in China," with 52 total references. These records have attracted a lot of interest in the CBDC research scene and provide important new angles (Table 5.2).

Table 5.1: Source impact

Element	H_index	G_index	M_index	TC	NP	PY_start
Research In International Business and Finance	8	11	4	156	20	2022
China Economic Journal	5	5	1	124	5	2019
Finance Research Letters	3	6	1	77	6	2021
Journal of Banking Regulation	3	4	0.75	37	4	2020
Journal of Economic Dynamics and Control	3	5	1.5	116	5	2022
Journal of Monetary Economics	3	4	1.5	90	4	2022
Latin American Journal of Central Banking	3	4	1	30	4	2021
Buletin Ekonomi Moneter Dan Perbankan	2	2	0.5	11	2	2020
Digital Policy, Regulation and Governance	2	2	2	13	2	2023
Economic Inquiry	2	2	1	12	2	2022

Table 5.2: Most global cited documents

Paper	Total Citations	TC per Year	Normalized TC
Assessing the Impact of Central Bank Digital Currency on Private Banks	69	23.00	3.77
Central bank digital currency: Central banking for all?	59	19.67	3.22
How does the fintech sector react to signals from central bank digital currencies?	59	29.50	4.55
Designing central bank digital currencies	54	27.00	4.17
Fintech, Cryptocurrencies, and CBDC: Financial Structural Transformation in China	52	26.00	4.01
Central bank digital currency and monetary policy	51	25.50	3.94
The macroeconomics of central bank digital currencies	49	24.50	3.78
The Effects of Central Bank Digital Currencies News on Financial Markets	45	22.50	3.47
A Global Perspective on Central Bank Digital Currency	39	13.00	2.13
Blockchain and central bank digital currency	36	18.00	2.78

Impact metrics for top ten authors contributing to the literature are presented in table 5.3. The table includes the H-index, G-index, M-index, total citations (TC), number of publications (NP), and the starting publication year (PY_Start) for each author. Notable authors include Lucey Bm, Ozili Pk, and Wang Y, each with an H-index of 3 and G-index of 3, demonstrating a significant impact in the field. Wang Y stands out with 93 total citations and 4 publications starting from 2021. Other impactful authors include Alonso Sln, Arauz A, Davoodalhosseini Sm, Forradellas Rfr, Guesmi K, Han H, and Huang Z, each contributing substantially to CBDC research. This table provides valuable insights into the scholarly impact of individual authors in the CBDC literature.

Table 5.3: Authors' impact

Element	H_index	G_index	M_index	TC	NP	PY_Start
Lucey Bm	3	3	1.5	57	3	2022
Ozili Pk	3	3	1.5	20	3	2022
Wang Y	3	4	1	93	4	2021
Alonso Sln	2	2	0.5	51	2	2020
Arauz A	2	2	0.667	21	2	2021
Davoodalhosseini Sm	2	2	1	56	2	2022
Forradellas Rfr	2	2	0.5	51	2	2020
Guesmi K	2	2	1	11	2	2022
Han H	2	2	1	19	2	2022
Huang Z	2	3	1	95	3	2022

As shown in table 5.4, the production of literature by individual authors over time is presented. The table includes the author's name, frequency of publications (Freq), total citations (TC), citations per year (TC PY), and the publication year (Year). Davoodalhosseini Sm stands out in 2022 with one publication accumulating 51 total citations at a rate of 25.5 citations per year. Alonso Sln and Forradellas Rfr both contributed one publication in 2021, each with 32 total citations and an average of 10.667 citations per year. Arauz A has two publications in 2021 with a total of 21 citations and an average of 7 citations per year. Additionally, Fujiki H and Buckley Rp have made contributions in 2023, each with two publications, while Buckley Rp also had one publication in 2022. This table provides a comprehensive overview of the productivity and impact of individual authors in the CBDC literature over the years.

Table 5.4: Authors' Productions Overtime

Author	Freq	TC	TC PY	Year
Davoodalhosseini Sm	1	51	25.5	2022
Alonso Sln	1	32	10.667	2021
Forradellas Rfr	1	32	10.667	2021
Arauz A	2	21	7	2021
Alonso Sln	1	19	4.75	2020
Forradellas Rfr	1	19	4.75	2020
Davoodalhosseini Sm	1	5	5	2023
Buckley Rp	1	2	2	2023
Fujiki H	2	1	1	2023
FUJIKI H	2	1	1	2023
Buckley Rp	1	1	0.5	2022

Figure 5.4 depicts a co-occurrence network of abstracts related to Central Bank Digital Currency (CBDC). The red-colored nodes represent central themes such as "cbdc," "currency," "bank," "digital," "payment," "money," and "stability." The blue-colored nodes highlight associated concepts such as "cbdc market," "data technology," "authors," "adoption," "economic policy," and "potential." The connections between nodes illustrate the co-occurrence patterns of these terms within the abstracts, providing a visual representation of the interrelated concepts and topics in CBDC research. The figure offers a comprehensive view of the key themes and their associations within literature.

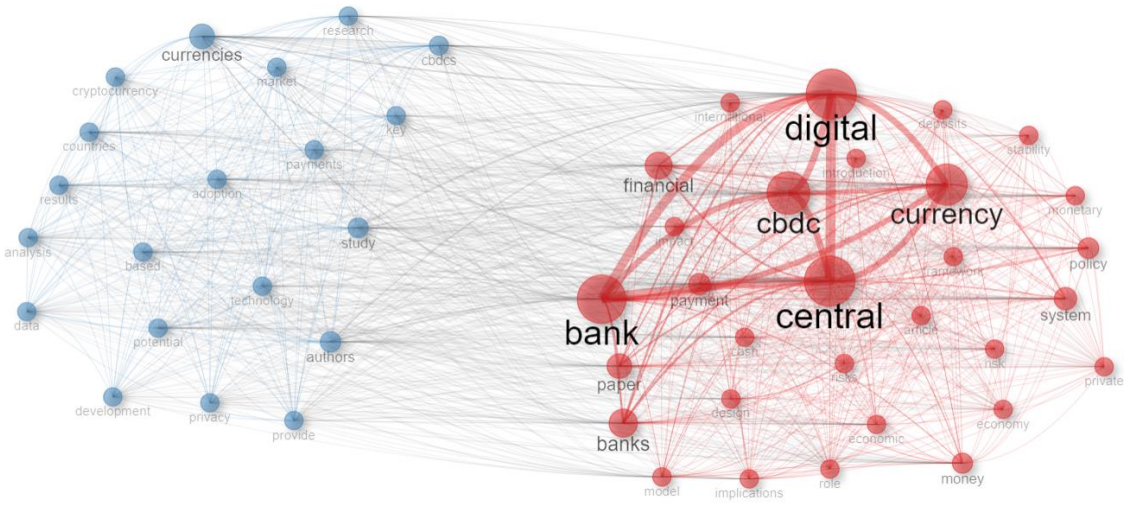


Figure 5.4: Co-Occurrence Network of Abstracts

Figure 5.5 illustrates a detailed thematic map of keywords' prominence within the landscape of CBDC research. The red-colored nodes emphasize pivotal terms that have emerged as central themes, including "Central bank," reflecting the overarching institutional context; "Central bank digital currency," highlighting the specific focus on digital forms of national currency issued by central banks; "electronic money," underscoring the broader digitalization of financial transactions; "blockchain," indicating the technological foundation often associated with CBDC implementations; and "economic and social effects," underscoring the comprehensive exploration of the broader impact of CBDC on both economic and societal dimensions. The nodes in red denote the high emergence and significance of these key terms, underscoring their critical roles in shaping the discourse on CBDC. This figure serves as a valuable tool for researchers and readers seeking to comprehend the complex web of ideas and their relationships within the CBDC.

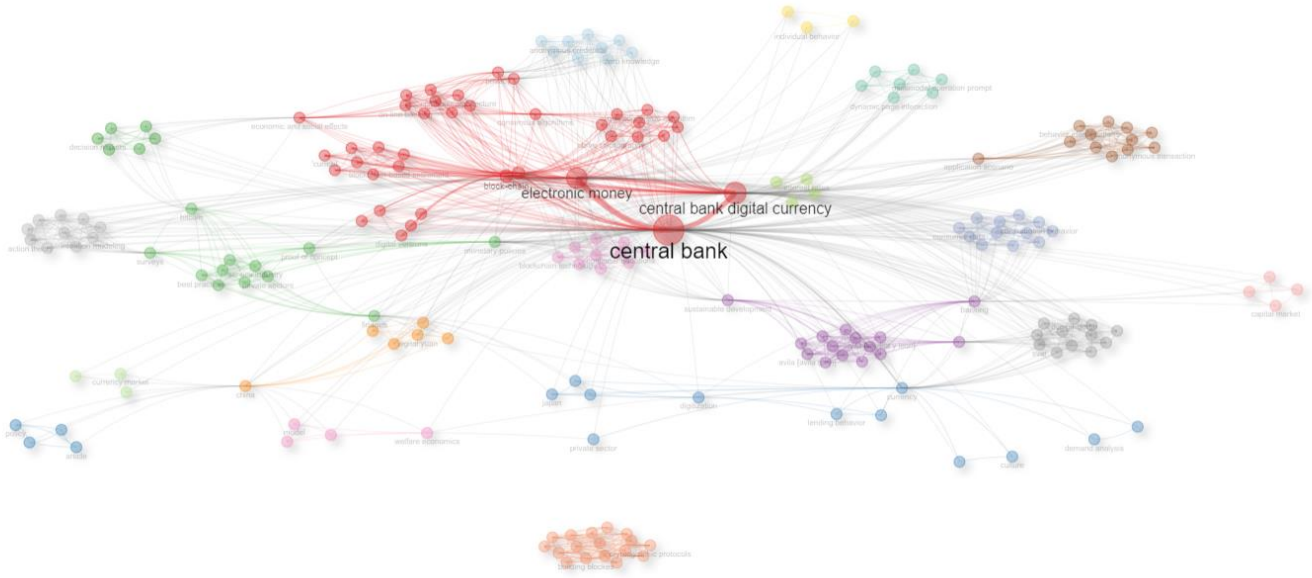


Figure 5.05: Thematic Map of Keywords' Plus

Figure 5.6 presents a global collaboration network. The varying colors of the countries help to symbolize distinct cooperation with major groups. Comprising the United Kingdom with red cluster including the other European countries, the blue cluster marks cooperation among China, the United States, Korea, Australia, with Asian counties and Spain with Ukraine together in yellow cluster and green cluster how the Switzerland and Singapore.

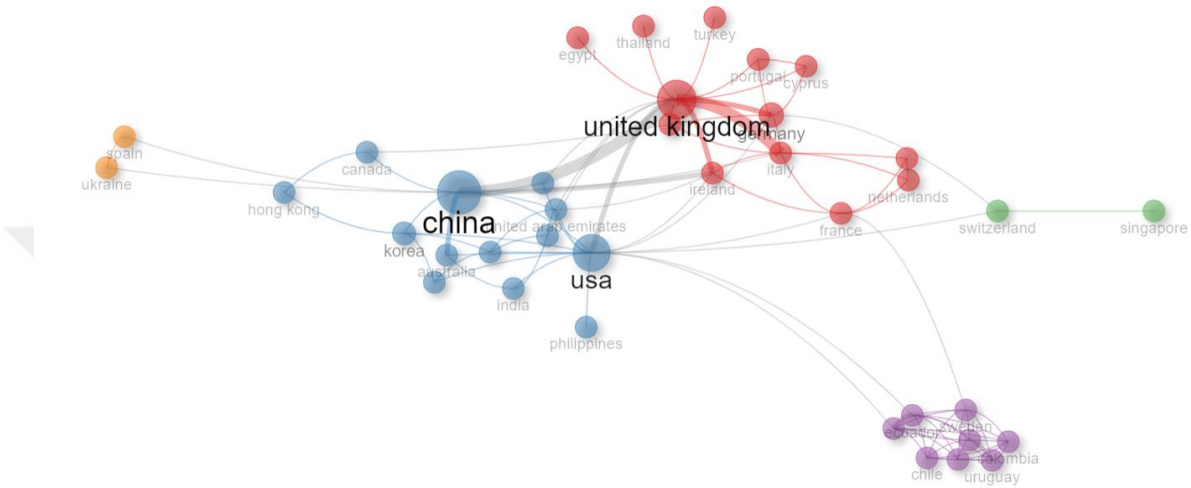


Figure 5.06: Global Collaboration Network

Figure 5.7 displays a Three-Degree Plot, representing the associations between terms (TI_TM), authors (AU), and cited references and sources (CR_SO). On the left side of the plot, key terms such as “privacy,” “digital,” “central,” “monetary,” “currencies,” “bank,” “banks,” and more are highlighted. These terms represent crucial concepts within the CBDC literature, forming the thematic foundation of the research. In the middle column, corresponding authors are identified, including Ozili Pk, Lucey Bm, Davood alhosseini Sm, Wang Y, Kwon O, Huang Z, Han H, among others. This section provides insights into the individuals driving research in the CBDC field and their associated themes. On the right side, cited references and sources are listed,. These cited references contribute to the foundational knowledge base and have been influential. This Three-Degree Plot serves as a comprehensive visualization, offering a understanding of the relationships between terms, authors, and cited references.

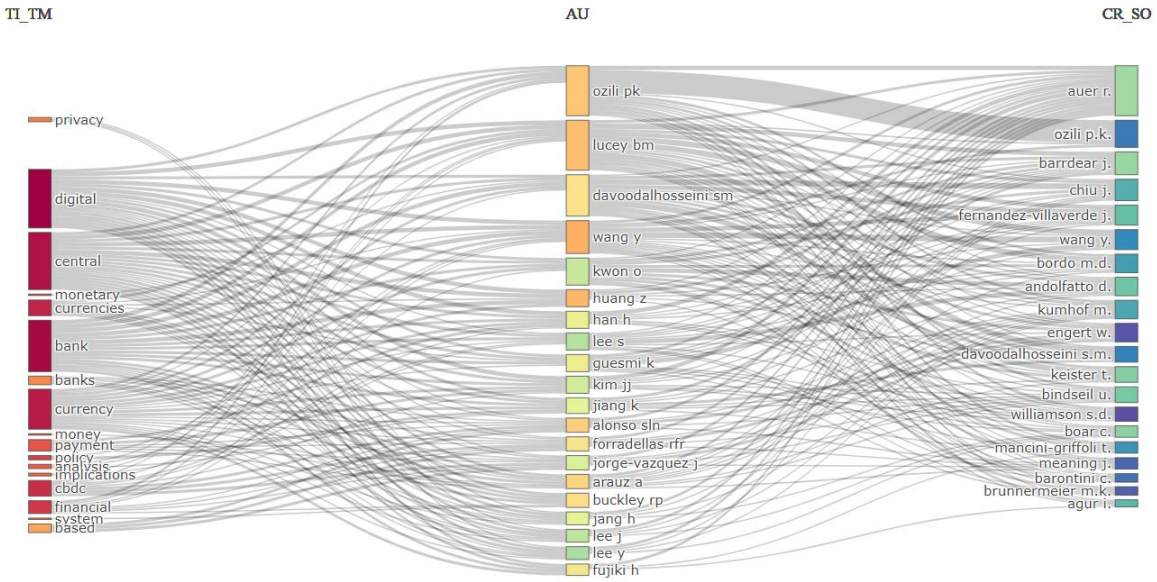


Figure 5.07: Three-degree Plot

Figure 5.8 represents a Word Cloud Map of Keywords' Plus, providing a detailed representation of the most significant terms. The word cloud emphasizes main words within the CBDC literature. The most prominent terms in the word cloud include "Central bank," underscoring the overarching institutional context; "central bank digital currency," highlighting the specific focus on digital forms of national currency issued by central banks; "electronic money," emphasizing the broader digitization of financial transactions; "banking," reflecting the financial services context; "blockchain," indicating the technological foundation often associated with CBDC implementations; "currency," representing the broader monetary landscape; and "China," signifying the geopolitical and economic significance of China in the CBDC discourse. The size and boldness of each word in the word cloud correspond to its frequency or importance within the CBDC literature, offering a visually representation of the key themes and concepts.

Figure 5.08: Word Cloud Map of Keywords' Plus

5.4. Quantitative, Qualitative and Mix Method Approaches

This SLR covers 169 studies on CBDCs arranged according to study method. Of these, 78 research studies use quantitative techniques, 73 use a qualitative approach, and 18 combine elements of both. This classification emphasizes applied research strategies. Table 5.7 shows quantitative techniques used in several different investigations. and human expert labeling. Al Rawashdeh (2023) looked over 293 Scopus bibliometric analysis. Dunbar (2023) merged weekly financial data with CBDC uncertainty indicators, risk aversion and statistics methods.

Y. S. Kim and Kwon (2023) used an overlapping-generations model whereas Fujiki (2023b) applied a survey approach using Cash Alternative Survey data. Using World Development Indicator data, CBDC Tracker, Hofstede website, and regression analysis, Luu, Do, et al. (2023) found. Tian et al. (2023) used sentiment analysis based on cyberwarfare attacks and DeFi protocols. Cioroianu et al. (2023) took an empirical approach using cryptocurrency funds data and sentiment data from Twitter. Ayadi et al. (2023) employed a Cross-Angiogram (CQ) model with CBDC attention and uncertainty indices. W. Li and Huang (2023) applied a GARCH-MIDAS model to time series data from China. J. J. Kim et al. (2023) implemented a two-step approach involving an online survey in China and South Korea. Gupta et al. (2023) adopted a survey method with a self-administered questionnaire in India. Xin and Jiang (2023b) applied a theoretical model based on US and China data. Kosov et al. (2023) used

secondary data from FTSE, MSCI, Gold Index, S&P 500, and Dow Jones. Zhou (2023) adopted a theoretical model, while Azzone and Barucci (2023) conducted market-based evaluation using ECB statistical data and the FED database.

Using a survey with 267 participants, Luu, Nguyen, et al. (2023) used an empirical technique. Using information from S&P Global Market Intelligence, CBDC Tracker, and the World Bank, Jabbar et al. (2023) applied an empirical technique. In India, Fadli et al. (2023) undertook a survey-based study. Yousaf and Goodell (2023) used a web survey method. Rehman et al. (2023) combined Indonesian PLS-SEM with surveys. Ren et al. (2023) employed a Time-Varying Parameter Vector Autoregression (TVP-VAR) approach with weekly data of digital payment stocks. Auer et al. (2022) based their analysis on McCallum's policy rule, using time series data from three leading economies. Z. Wang (2023) applied a New Monetarist model without specifying data sources. Ewanchuk-Kaliska (2023) employed a theoretical model without specifying data sources. J. Li (2023) conducted structural analysis with survey data, drawing from the Canadian Financial Monitor Survey (CFM), Method of Payment Survey (MOP), and demand deposit rates from CANNEX. Grodecki-Messi and Zhang (2023) used a Difference-in-Differences regression analysis with historical Canada Yearbook data and bank balance sheet data. Banerjee and Sinha (2023) applied regression analysis with financial data spanning from 2011-2012 to 2021-2022 in India. Tata (2023) contributed to the literature through a literature review without specifying data sources.

Y. Wang et al. (2023) employed a TVP-VAR model using CBDC attention data and cryptocurrency market data. Le et al. (2023) conducted multinomial logistic regression with data sources including CBDC adoption data, Anti-Money Laundering Index, macroeconomic variables, and financial development data. Alfar et al. (2023) utilized Pooled OLS estimations, Probit, and Logistic regression by using world bank data base. Nguyen et al. (2023) employed a time-varying CBDC adoption index and bank financing gap ratio, using the S&P Global Market Intelligence database. Using a TVP-VAR model with CBDC news indices, S&P 500 index, CBOE Volatility Index, cryptocurrency policy uncertainty index, and Bitcoin returns, Helmi et al. (2023) found Applying Ordinary Least Squares regressions and Simultaneous Equation Models with data from OptionMetrics, Compustat, Fred, EPU website, and OzForex website C. C. Lee et al. (2023) Utizing data from 60 participants in a laboratory simulation, Lin and Chen (2023) performed a mixed factorial design with dynamic

page interaction and multimodal operational feedback. Based on Endogenous Money Theory, Bibi and Canelli (2023) did not mention data sources but rather based their analysis.

Akin et al. (2023) utilized the DCC-GARCH model with data from Coin Market Cap spanning from August 1, 2017, to April 1, 2022. Q. Yang et al. (2023) used a Quasi-natural experiment approach, statistical analysis, and the SBM-GML method with data from CBDC pilot cities in China and the WIND database. G. Wang and Hausken (2022) contributed to the literature through a game theory model, using modeled data without external sources. Y. R. Wang et al. (2022) applied theoretical analysis and numerical experiments with Chinese financial institutions' data. J. Yang and Zhou (2022) conducted an analysis of money demand, supply, and policy transmission. Bhaskar et al. (2022) performed a bibliometric analysis using bibliographic data from the Scopus database spanning from 2018 to 2022. Radic et al. (2022) conducted a situational analysis and questionnaire-based online survey in China, South Korea, and the United States. Ferrari Minesso et al. (2022) employed a DSGE model analysis with macro-variables for the US and the euro area spanning from 1999Q1 to 2019Q4. De Mello and Kanczuk-Alfaro (2022) used a model based on payment choice, calibration, with monthly data spanning from 2004 to 2013. Kwon et al. (2022) applied a dual currency model.

Liu et al. (2022) used a Structural Equation Modeling (SEM), conducting a questionnaire survey in 10 CBDC pilot areas in China. Koziuk and Ivashuk (2022) conducted a survey questionnaire. Solberg Söilen and Benhayoun (2022) used an online survey and statistical analysis. Z. Li, Yang, et al. (2022) conducted text analysis and an empirical approach using CBDC signals from the People's Bank of China, a fintech index, and VAR and TVP-VAR models. Oh and Zhang (2022) conducted OLS regression analysis with a sample of 60 economies for 2013 and 2016. Ma et al. (2022) conducted a survey of consumers in CBDC pilot cities. Eichengreen and Viswanath-Natraj (2022) employed statistical analysis with time-varying estimates of devaluation risk for Tether. Ding et al. (2022) used the decision tree method, GARCH model, and DBSCAN model with data from decision tree method, GARCH (1, 1) model, and DBSCAN model. Mzoughi et al. (2022) employed an event study approach with abnormal returns and market model. Y. Wang et al. (2022) used a DCC-GARCH model, wavelet analysis, and VAR model for the analysis of relationships. Syarifuddin

and Bakhtiar (2022) applied a Medium-sized DSGE model, closed economy, and interest-bearing CBDC, with calibration. Barrdear and Kumhof (2022) employed a DSGE model calibrated to the pre-2008 US economy for the analysis of macroeconomic consequences. Z. Li, Zhang, et al. (2022) used a transaction network-based method with the analysis of transaction networks, the Elliptic dataset, and the AMLSim dataset.

Tong and Jiayou (2021) utilizing a theoretical model, parameter calibration, and quantitative results based on the BGG model. Y. Lee, Son, Jang, et al. (2021) proposed a lattice-based sequential aggregate signature scheme for a blockchain-based settlement system, conducting proof-of-concept experiments. Fantacci and Gobbi (2021) conducted an analysis of Swift's network of payments over 2003-2013 using network analysis. Bian et al. (2021) developed a theoretical payment portfolio model without employing empirical data.

However, the studies in Table 5.7 employ a diverse range of quantitative methods and data sources, reflecting the nature of studies using Quantitative methods. The methods include statistical analyses, regression models, theoretical frameworks, surveys, and various other quantitative approaches.

5.4.1. Studies Using Quantitative Approach

Table 5.5: Quantitative Approach

Sr.	Titles	Method	Data
1.	(Alonso-Robisco & Carbó, 2023)	Dictionary-based methods, Large Language Models (BERT, ChatGPT), human expert labels	Database of speeches and reports on CBDCs
2.	(Fujiki, 2023a)	ROL model, TR model, LCL model	2019 Financial Literacy Survey data
3.	(Alrawashdeh, 2023)	Bibliometric citation analysis	293 documents from Scopus database
4.	(Dunbar, 2023)	Correlation coefficients, regression analysis	Weekly financial data series, CBDC uncertainty indices, risk-aversion and uncertainty data
5.	(Y. Liu et al., 2023)	Configurable butterfly delay chain-based PUF design	Challenge-response pairs (CRPs)
6.	(Z. ao Wang et al., 2023)	Structural equation model with PLS-PM	Questionnaire data from consumers
7.	(Ozili, 2023b)	Review of existing literature, regression analysis	Data from the Nigerian banking sector
8.	(Panwar & Agarwal, 2023)	CBDC project index, random forest model	Not specified
9.	(Y. S. Kim & Kwon, 2023)	Overlapping-generations model	Not specified
10	(Fujiki, 2023b)	Survey	Cash Alternative Survey data
11	(Luu, Do, et al., 2023)	Regression analysis	CBDC Tracker, Hofstede website, World Development Indicator
12	(Tian et al., 2023)	Sentiment analysis	Monthly cyberwarfare attacks, cyberattacks on crypto exchanges and DeFi protocols
13	(Cioroianu et al., 2023)	Empirical approach	Cryptocurrency funds data, sentiment data from Twitter
14	(Ayadi et al., 2023)	Cross-Quantilogram (CQ) model	CBDC attention index (CBDCAI), CBDC uncertainty index (CBDCUI)
15	(W. Li & Huang, 2023)	GARCH-MIDAS model	Time series data of China, daily returns from CNI Indices website
16	(J. J. Kim et al., 2023)	Two-step approach	Online survey, China, South Korea

17	(Gupta et al., 2023)	Survey method	Self-administered questionnaire, India
18	(Xin & Jiang, 2023b)	Theoretical model	Data from the US and China
19	(Kosov et al., 2023)	Quantitative approach	Secondary data (FTSE, MSCI, Gold Index, S&P 500, Dow Jones)
20	(Zhou, 2023)	Theoretical model	Not mentioned
21	(Azzone & Barucci, 2023)	Market-based evaluation	ECB statistical data, FED database
22	(Mohammed et al., 2023)	Nonlinear model of structural equations (SEM)	Data from the previous year
23	(Ngo et al., 2023)	Quantitative research method	World Bank, IMF, Facebook
24	(Luu, Nguyen, et al., 2023)	Empirical approach	Survey with 267 respondents, Demographic data, Reliability checks
25	(Jabbar et al., 2023)	Empirical approach	S&P Global Market Intelligence, CBDC Tracker, World Bank
26	(Fadli et al., 2023)	Survey	Survey, India
27	(Yousaf & Goodell, 2023)	Online survey	Online survey
28	(Rehman et al., 2023)	PLS-SEM	Questionnaires, Indonesia
29	(Ren et al., 2023)	Time-Varying Parameter Vector Autoregression (TVP-VAR) approach	Weekly data of digital payment stocks
30	(Auer et al., 2022)	McCallum's policy rule based on money growth	Time series data of three leading economies
31	(Z. Wang, 2023)	New monetarist model	Not specified
32	(Iwańczuk-Kaliska, 2023)	Theoretical model	Not specified
33	(J. Li, 2023)	Structural analysis with survey data	Canadian Financial Monitor Survey (CFM) data (from 2009), Method of Payment Survey (MOP) 2013 data, Demand deposit rates from CANNEX data
34	(Grodecka-Messi & Zhang, 2023)	Difference-in-differences regression analysis	Historical Canada Year Book (1927-1950) data, Profit and balance sheet data for ten chartered banks (1927-1950)
35	(Banerjee & Sinha, 2023)	Regression analysis	Financial data (2011-2012 to 2021-2022 quarterly) measuring the size of the financial sector in India
36	(Tata, 2023)	Literature review	Not specified

37	(Y. Wang et al., 2023)	Time-varying parameter vector autoregression (TVP-VAR) model	CBDC attention data (CBDCAI), Cryptocurrency market data (top 10 cryptocurrencies)
38	(Le et al., 2023)	Multinomial logistic regression	CBDC adoption data (CBDC Tracker), Anti-Money Laundering Index (AML), macroeconomic variables, financial development data
39	(Alfar et al., 2023)	Pooled OLS estimations, Probit, Logistic regression	CBDC Tracker, World Bank database
40	(Nguyen et al., 2023)	Time-varying CBDC adoption index, Bank financing gap ratio	S&P Global Market Intelligence (SPMI) database
41	(Helmi et al., 2023)	Time-varying parameter vector auto-regression (TVP-VAR) model	CBDC news indices, S&P 500 index, CBOE Volatility Index (VIX), cryptocurrency policy uncertainty index, Bitcoin returns
42	(C. C. Lee et al., 2023)	Ordinary least squares regressions, Simultaneous equation models (SEM)	OptionMetrics, Compustat, Investing website (bitcoin price), Fred (macroeconomics variables), EPU website, OzForex website
43	(Lin & Chen, 2023)	3 (dynamic page interaction) × 4 (multimodal operational feedback) mixed factorial design	Data collected from 60 participants in a laboratory simulation
44	(Bibi & Canelli, 2023)	Endogenous Money Theory (EMT)	Not specified
45	(Akin et al., 2023)	Dynamic conditional correlation-generalized autoregressive conditional heteroskedasticity (DCC-GARCH) model	Data from CoinMarketCap (August 1, 2017, to April 1, 2022)
46	(Q. Yang et al., 2023)	Quasi-natural experiment approach, Statistical analysis, SBM-GML method	Data from CBDC pilot cities in China, WIND database, China Statistical Yearbook
47	(G. Wang & Hausken, 2022)	Game theory model	Modeled data, no external sources
48	(Y. R. Wang et al., 2022)	Theoretical analysis and numerical experiments	Chinese financial institutions data
49	(J. Yang & Zhou, 2022)	Analysis of money demand, supply, and policy transmission	Not specified
50	(Bhaskar et al., 2022)	Bibliometric analysis	Bibliographic data from Scopus database (2018-2022)

51	(Radic et al., 2022)	Situational analysis and questionnaire	Online survey in China, South Korea, and the United States (897 valid responses)
52	(Ferrari Minesso et al., 2022)	DSGE model analysis	10 quarterly macro-variables for the US and the euro area (1999Q1 to 2019Q4)
53	(DE MELLO & Kanczuk-Alfaro, 2022)	Model based on means of payment choice, calibration	Monthly data (2004-2013), monetary aggregates data
54	(Kwon et al., 2022)	Dual currency model	Not specified
55	(Chen & Siklos, 2022)	Simulations	Time series data for a few countries, additional data for more recent history of velocity
56	(Keister & Monnet, 2022)	Model presentation	Not specified
57	(Williamson, 2022)	Model construction	Not specified
58	(Maryaningsih et al., 2022)	Empirical analysis (Ordered Probit regression)	Various sources including Chinn Ito index, Global Innovation Index, Institutional Profile Database, World Bank
59	(X. Liu et al., 2022)	Quantitative research method (Structural Equation Modeling)	Questionnaire survey in 10 CBDC pilot areas in China (344 valid responses)
60	(Koziuk & Ivashuk, 2022)	Survey questionnaire	Responses collected from the survey questionnaire
61	(Solberg Söilen & Benhayoun, 2022)	Online survey, statistical analysis	Online survey, snowball sampling, UTAUT, Institutional Trust Theory
62	(Z. Li, Yang, et al., 2022)	Text analysis, empirical approach	CBDC signals from PBOC, fintech index, VAR and TVP-VAR models
63	(Oh & Zhang, 2022)	OLS regression analysis	OLS regression analysis, sample of 60 economies for 2013 and 2016
64	(Ma et al., 2022)	Survey	Survey of consumers in CBDC pilot cities, questions on perceived privacy, security, system quality, benefits, etc.
65	(Eichengreen & Viswanath-Natraj, 2022)	Statistical analysis	Time-varying estimates of devaluation risk for Tether, statistical analysis
66	(Ding et al., 2022)	Decision tree method, GARCH model	Decision tree method, GARCH (1, 1) model, DBSCAN model
67	(Mzoughi et al., 2022)	Event study approach	Event study approach, abnormal returns, market model

68	(Y. Wang et al., 2022)	DCC-GARCH model, wavelet analysis, VAR model	Analysis of relationships using DCC-GARCH, wavelet, and VAR models
69	(Syarifuddin & Bakhtiar, 2022)	DSGE model	Medium-sized DSGE model, closed economy, interest-bearing CBDC, calibration
70	(Barrdear & Kumhof, 2022)	DSGE model	DSGE model calibrated to pre-2008 US economy, analysis of macroeconomic consequences
71	(Z. Li, Zhang, et al., 2022)	Transaction network-based method	Analysis of transaction networks, Elliptic dataset, AMLSim dataset
72	(Tong & Jiayou, 2021)	Theoretical and practical perspectives	Theoretical model, parameter calibration, quantitative results based on BGG model
73	(Y. Lee, Son, Jang, et al., 2021)	Proposed lattice-based sequential aggregate signature scheme	Proposal for blockchain-based settlement system, proof-of-concept experiments
74	(Fernández-Villaverde et al., 2021)	Theoretical model	Theoretical model, three periods, various types of agents, equivalence result
75	(Alonso et al., 2021)	Pearson’s correlation coefficient, SPSS statistical analysis	Analysis of data from central bank speeches, reports, briefing notes using Pearson's correlation coefficient and SPSS statistical analysis
76	(Fantacci & Gobbi, 2021)	Not specified	Analysis of Swift's network of payments over 2003-2013 using network analysis
77	(Bian et al., 2021)	Theoretical payment portfolio model	No empirical data used, theoretical examination
78	(Kochergin & Yangirova, 2019)	Lasso regression analysis method and SARIMA model	Analysis of statistical indicators of the sustainable financial growth system of the largest oil and gas companies in Russia and China

Table 5.5 offers a summary of works using qualitative methodologies to look at Mooij (2023) leaves out the technique or statistics employed. Using a consortium blockchain and UTXO paradigm without stating the data source, Islam and In (2023) Using legislative and policy tools together with pertinent literature, Chitimira and Torerai (2023) apply a qualitative research methodology, more especially legal doctrinal research. With 21 sample data, Tronnier et al. (2023) did qualitative document analysis with semi-structured interviews.

Ozili (2023c) uses CBDC research and literature to analyze data. Xin and Jiang (2023a) use a DSGE, while Karau (2023) uses a two-country asset pricing model. Hoang et al. (2023) review and mine CBDC-related Scopus abstracts. Babin et al. (2022) does a case study using financial institution executive interviews and current research. Son et al. (2023) build a theoretical model; Peruffo et al. (2023) analyze the IMF, ECB, BIS, and SWIFT among other sources.
Chan (2023) uses academic papers, journals, news, and literature reviews for secondary data. Souissi and Nabi (2023) are developing an OLG-based theoretical model. Salmony (2023) practice paper H. Wang (2023) builds a theoretical framework using S&P Global Market Intelligence, CBDC Tracker, and World Development Indicators. Cullen (2022) uses analysis, current research, and scholarly works. Using theory, Fegatelli (2022) From current facts and literature, T. Zhang and Huang (2022) investigate thoroughly. Didken and Buckley (2022) reviewed literature. Also reviewing literature are Elsayed and Nasir (2022).

Davood alhosseini (2022) does a secondary source-based literature review. Kóczián & associates. Ozili (2022) uses a desk study approach. Reviewing recent publications, Allen et al. (2022) offer a general picture of China's fintech experience and CBDC experiments. Using a social media analytics platform NVivo, Ozturkcan et al. (2022) analyze Twitter data under the hashtag CBDC and Bolt et al. (2022) review and evaluate scholarly publications, academic articles, and reports.
Reviewing current occurrences and going over material on money laundering and CBDC. Lloyd (2022) offers an analytical essay looking at the justification and going over past research. Reviewing the history, motivations, problems, and CBDC preparation, Terták and Kovács (2022) offer a review paper. Reviewing global research and practices, D. K. C. Lee et al. (2021) show using China's CBDC how they reflect Adams et al. (2021) do an article on expert opinion combined with a literary

evaluation. Andolfatto (2021) creates a theoretical framework, scenarios, and simulations free of empirical data. Reviewing material and evaluating important elements and their effects on the financial system, Sakharov (2021) synthesizes, analyzes, employs logical approaches, compares, inducts, and deduces. Theoretically, Jun and Yeo (2021) examine the portfolio, solvency, and liquidity risks of a bank. Examining current knowledge and data on CBDC development in China and the US, Chorzempa (2021) does a literary evaluation and analysis.

Using a peer review approach, Morales-Resendiz et al. (2021) compile information from pilot research of retail CBDCs in Uruguay, Sweden, and the Bahamas, Sweden, using a case study method, Rennie and Steele (2021) interview important players and go over pertinent research. An outline of China's central bank digital money, e-CNY, design and ramifications are given by S. Li and Huang (2021). Scarcella (2021) offers a study and observations on the possible consequences of implementing a European CBDC. Analyzing hazards and regulatory alternatives connected to CBDCs and stablecoins, Arauz (2021) delivers a theoretical and analytical article. Discussing privacy issues in CBDCs, Ballaschk and Paulick (2021) Best ideas and practices for CBDCs are compiled by Opare and Kim 2020 Using a survey technique, Belke and Beretta (2020) investigate worldwide CBDC design and look at regulatory issues. 2020 Cukierman explores CBDCs' political and welfare dimensions of economic development Nabilou (2020) reviews the body of current research on CBDC and associated subjects. Using a conceptual research technique, Viñuela et al. (2020) create a conceptual framework for examining several payment methods. Examining legal features of CBDC transactions, Fonseca (2019) does a legal study. Examining financial system consequences and CBDC control, Bindseil (2019) does a review and analysis of the literature In 2019 Qian provides a conceptual paper on CBDC benefits, problems, and design issues.

2.2.8. Studies Using Qualitative Approach

Table 5.6: Qualitative Approach

Sr.	Title	Method	Data
1.	(Mooij, 2023)	Not specified	Not specified
2.	(Islam & In, 2023)	Consortium blockchain, UTXO model	Not specified
3.	(Chitimira & Torerai, 2023)	Qualitative research, legal doctrinal research	Legislative and policy instruments, literature
4.	(Tronnier et al., 2023)	Qualitative content analysis, semi-structured interviews	Semi-structured interviews with 21 participants
5.	(Maruo & Sugino, 2023b)	Literature review, theoretical analysis, empirical data	Primary and secondary sources (academic articles, reports, statistical data)
6.	(S. Lee et al., 2023)	Expansion of a simple money multiplier model	Not specified
7.	(Ozili, 2023a)	Systematic literature review	Not specified
8.	(Tercero-Lucas, 2023)	Diamond and Dybvig model	Not specified
9.	(Kuehnlenz et al., 2023)	Literature review	Not specified
10.	(Denecker et al., 2023)	Not specified	Not specified
11.	(Ozili, 2023c)	Literature review, data analysis	Existing research on CBDCs, data analysis conducted by the author
12.	(Xin & Jiang, 2023a)	Dynamic stochastic general equilibrium (DSGE) model	Not specified
13.	(Karau, 2023)	Standard two-country asset pricing model	Not specified
14.	(Hoang et al., 2023b)	Systematic literature review, text mining	Abstracts of academic publications related to CBDC from Scopus
15.	(Babin et al., 2023)	Case study approach, interviews	Interviews with financial institution executives, existing research

16.	(Son et al., 2023)	Theoretical model	Not specified
17.	(Peruffo et al., 2023)	Theoretical analysis	Various sources including IMF, ECB, BIS, SWIFT
18.	(Chan, 2023)	Literature review	Secondary data from academic articles, reports, news sources
19.	(Souissi & Nabi, 2023)	Theoretical model based on OLG model	Not specified
20.	(Salmony, 2023)	Practice paper	No specific data
21.	(H. Wang, 2023)	Theoretical framework	Data from S&P Global Market Intelligence, CBDC Tracker, World Development Indicators
22.	(Sandhu et al., 2023)	Theoretical framework	Not specified
23.	(Q. Zhang et al., 2023)	Participant analysis	Conceptual analysis
24.	(Siu, 2023)	Theoretical analysis	Not specified
25.	(H. Wang & Gao, 2023)	Document analysis	Not specified
26.	(Leinonen, 2023)	Not specified	Not specified
27.	(Cullen, 2022)	Scholarly article, existing literature and analysis	Not specified
28.	(Fegatelli, 2022)	Theoretical framework	Not specified
29.	(T. Zhang & Huang, 2022)	Comprehensive analysis	Existing literature and research
30.	(Didenko & Buckley, 2022)	Literature review	Not specified
31.	(Elsayed & Nasir, 2022)	Literature review	Not specified
32.	(Davoodalhosseini, 2022)	Literature review	Secondary sources
33.	(Kóczián et al., 2022)	Not specified	Not specified
34.	(Kaczmarek, 2022)	Not specified	Not specified
35.	(Boros & Horváth, 2022)	Not specified	Not specified
36.	(Jin & Xia, 2022)	Not specified	Not specified

37.	(Ozili, 2022)	Desk research method	Not specified
38.	(van Oordt, 2022)	Not specified	Not specified
39.	(Wilkins, 2022)	Not specified	Not specified
40.	(Laband, 2022)	Not specified	No specific data mentioned
41.	(Allen et al., 2022)	Literature review	Review of recent literature, overview of China's fintech experience and CBDC pilots
42.	(Ozturkcan et al., 2022)	Social web data analytics	Twitter data with hashtag #CBDC, social media analytics framework, NVivo
43.	(Bolt et al., 2022)	Document review	Review and analysis of existing literature, academic papers, reports
44.	(Horváth, 2022)	Not specified	References to other publications and working papers
45.	(Dupuis et al., 2022)	Document review	Analysis of recent events, literature review on money laundering and CBDC
46.	(Morgan, 2022)	Not specified	Critique of the Bank of England's framing, qualitative analysis
47.	(Lloyd, 2022)	Analytical paper	Examination of the rationale, review of existing literature
48.	(Terták & Kovács, 2022)	Review article	Review of history, motives, challenges, and preparations for CBDC
49.	(D. K. C. Lee et al., 2021)	Literature review	Literature review, analysis of global research and practices, illustration with China's CBDC
50.	(Adams et al., 2021)	Literature review, expert opinion	Literature review and expert opinion piece
51.	(Andolfatto, 2021)	Theoretical framework, scenarios, simulations	Theoretical framework, scenarios, simulations, no empirical data
52.	(Sakharov, 2021)	Synthesis, analysis, logical method, comparison, induction, deduction	Review of literature, analysis of key aspects, and potential impact on financial system
53.	(Jun & Yeo, 2021)	Theoretical analysis	Theoretical analysis of a bank's portfolio, (in)solvency, and (il)liquidity risks
54.	(Chorzempa, 2021)	Literature review and analysis	Analysis of existing information and data on CBDC development in China and the US
55.	(Shen & Hou, 2021)	Literature review and analysis	Examination of existing information on China's CBDC

56.	(Laboure et al., 2021)	Not specified	Analysis of the current state of cryptocurrencies and CBDCs, as well as their potential future developments
57.	(D. Li et al., 2021)	Literature review and analysis	Various scholarly articles, reports, and a BIS survey
58.	(Arauz et al., 2021)	Case study approach	Range of primary and secondary sources, including official reports, academic articles, and news articles
59.	(Cunha et al., 2021)	Snowballing review	English language literature, both academic and grey sources
60.	(Morales-Resendiz et al., 2021)	Peer review methodology	Data from pilot studies of retail CBDCs in the Bahamas, Sweden, and Uruguay
61.	(Rennie & Steele, 2021)	Case study approach	Interviews with key stakeholders and a review of relevant literature
62.	(S. Li & Huang, 2021)	Not specified	Overview of the design and implications of China's central bank digital currency, e-CNY
63.	(Scarcella, 2021)	Not specified	Analysis and insights on the potential implications of adopting a European CBDC
64.	(Arauz, 2021)	Analytical article	Analysis of risks and regulatory alternatives related to CBDCs and stablecoins
65.	(Ballaschk & Paulick, 2021)	Not specified	Privacy considerations in CBDCs
66.	(Opare & Kim, 2020)	Not specified	Collection of best practices and principles for CBDCs
67.	(Belke & Beretta, 2020)	Survey approach	Exploration of regulatory challenges and investigation of global CBDC design
68.	(Cukierman, 2020)	Not specified	Welfare and political economy aspects of CBDCs
69.	(Nabilou, 2020)	Literature review	Review of existing research on CBDC and related topics
70.	(Viñuela et al., 2020)	Conceptual research	Conceptual framework for analyzing different means of payment
71.	(Fonseca, 2019)	Legal research	Examination of legal aspects related to CBDC transactions
72.	(Bindseil, 2019)	Literature review	Examination of control of CBDC and financial system implications
73.	(Qian, 2019)	Theoretical analysis	Discussion of challenges, benefits and design of CBDC

Table 5.7 explains mixed-method research. Theoretically, Chiu et al. (2023) evaluate macro factors, call reports, M1 series, and bank balance sheets. Based presumably on secondary data, Sethaput and Innet (2023) survey the literature. Through conversation, Arakelian (2023) supports fieldwork. Especially the Chinese e-CNY experiment, Cheng (2023) reviews CBDC literature. Takaragi et al. (2023) survey the literature without revealing the data source. Using CBDC trackers and empirical data from many internet sources. Using data from InthanonLionRock2, Jura, Dunbar, and Bridge, the BIS Innovation Hub lets Bech et al. (2023) execute pragmatic experiments. Agur and associates (2022) model Using graphs and charts. By using a hybrid blockchain model, J. Zhang et al. (2021) suggest a hybrid model for CBDC architecture, hence facilitating simulation tests. Y. Lee, Son, Park, et al. (2021) review the body of knowledge already in publication on security and privacy in blockchain-based CBDCs. Using a mixed-methods approach, Alonso et al. (2020) survey 1,200 people and create an index of cash access. Niepelt (2020) suggests an equivalency between Reserve Fund Accounts (RFA) and cryptocurrencies differentiating them from Estimating cash use for 11 nations, projecting future cash use, and investigating the possible advantages and disadvantages of CBDCs, Khiaonarong and Humphrey (2019) mix quantitative and qualitative approaches.

5.4.3. Studies Using Mix Method Approach

Table 5.7: Mix method approach

Sr.	Title	Method	Data
1.	(Chiu et al., 2023b)	Theoretical and quantitative analysis	Bank balance sheets, call report data, M1 series, macro variables
2.	(Sethaput & Innet, 2023)	Literature review	Not specified, likely secondary data
3.	(Arakelian, 2023)	Discussion	Not specified
4.	(Cheng, 2023)	Literature review, analysis	Literature on CBDCs, focus on e-CNY pilot in China
5.	(Takaragi et al., 2023)	Extensive literature review	Not specified
6.	(Singh et al., 2023)	Systematic Literature Review (SLR), Fuzzy Analytic Hierarchy Process (F-AHP)	Literature survey, Expert interviews
7.	(Themistocleous et al., 2023)	Multivocal Systematic Literature Review (MSLR)	CBDC trackers, Empirical data from various online resources
8.	(Bech et al., 2023)	Practical experiments by BIS Innovation Hub	Data from projects InthanonLionRock2, Jura, Dunbar, and mBridge
9.	(Rösl & Seitz, 2022)	Not specified	Not specified
10.	(Agur et al., 2022)	Model presentation	Not specified
11.	(Sarmiento, 2022)	Literature review	Literature review, analysis of e-Peso pilot plan, graphs and charts
12.	(J. Zhang et al., 2021)	Proposed hybrid model	Proposal for CBDC model on hybrid blockchain model
13.	(Y. Lee, Son, Park, et al., 2021)	Literature review	Survey of existing literature on security and privacy in blockchain-based CBDCs
14.	(Meaning et al., 2021)	Not specified	No specific method mentioned, no specific data mentioned
15.	(Zams et al., 2020)	Delphi-Analytic Network Process	Primary data from interviews, Focus Group Discussions (FGD), and questionnaires
16.	(Alonso et al., 2020)	Mixed-methods approach	Survey of 1,200 respondents and construction of an index of access to cash

17.	(Niepelt, 2020)	Not specified	Distinguishing RFA from cryptocurrencies and proposing an equivalence result
18.	(Khiaonarong & Humphrey, 2019)	Combination of quantitative and qualitative methods	Estimation of cash use for 11 countries, forecast future cash use, and analysis of potential benefits and costs of CBDC

CHAPTER VI

CRYPTOCURRENCIES, FINTECH, DEFI-BLOCKCHAIN, CBDCS, AND STRUCTURAL TRANSFORMATION IN THE FINANCIAL SYSTEM

Fintech, or financial technology, has profoundly impacted the past decade by increasing financial inclusion, and the same has also been achieved by decentralized finance (DeFi). Standard financial entities have been disrupted, and there is a greater probability that financing, investment, and money transfer computations will become fragmented, with no mediator needed. Many new financial products offering innovations, such as real-time payment transactions, internet borrowing, and various financial services via mobile devices, have witnessed significant expansion. Digital technology has accelerated the pace of reducing disparities in financial and payment processes during the pandemic.

If we look at the Chinese financial system, it is different in nature and state-owned. Research has found that the Chinese economy has developed at a faster rate despite the apparent lack of a very well-defined financial structure (Allen et al., 2005). Their monetary sector has been dominated by a nationalized financial system created to support the traditional economic model, characterized by greater funds, employment, and international businesses (Song et al., 2011).

In addition to traditional methods, innovative technology should be considered for rapid financial growth and advancements towards self-sustainability. The Chinese financial system and its growth due to technological considerations are the best examples for the rest of the world to follow. Equity markets and alternative financial industries, such as FinTech, have proven to be more effective than traditional bank loans in financing these emerging industries. China’s equity and stock market have shown tremendous growth since their inception in the early 1990s, but they have underperformed in terms of shareholder dividends (Allen et al., 2021).

Fintech companies have filled the borrowing gap faced by SMEs and the traditional banking sector, as well as the stock and bond markets. Additionally, a modern electronic payments revolution has emerged, led by the Ant Group and Tencent, Chinese-origin

companies, where innovative technology and more comprehensive data were used in the commercial services sector (Cornelli et al., 2020).

Originally meant to speed up financial transactions and improve financial inclusion, cryptocurrencies Launching a Central Bank Digital Currency (CBDC) by the People's Bank of China offers clear benefits for increasing China's worldwide market share and so supporting international trade. This project represents a possible worldwide paradigm change in the financial system. Chinese authorities banned Initial Coin Offerings (ICOs) in September 2017 to safeguard investors and lessen detrimental effects on the economy. To protect people from engaging in dangerous trades, unstable currencies, and to stop activities including money laundering, fraud, and major investor losses, all cryptocurrencies' transfers were thus ruled unlawful until September 2021. The People's Bank of China was the first central bank to actively encourage and show a clear purpose to create a CBDC, known as the e-CNY, which stands for the digital form of its fiat money despite the original ban on ICOs and crypto transactions.

6.1. Fintech payments, Alternative Data, Credit Scoring

Particularly for lenders without credit history or financial statements or banking relationships, financial firms and fintech borrowers have used big data and sophisticated data algorithms to overcome the constraints of traditional modeling techniques and data in assessing borrower default risk and nonpayment possibilities. (Jagtiani and Lemieux, 2019; Goldstein et al., 2019; Croux et al., 2020).

China lacks a standardized scorecard like the United States and the United Kingdom. The official Chinese financial system has stringent compliance and regulatory requirements, leading many debtors to rely on basic information, making it difficult for them to access regular banking credit. Surprisingly, the entry of Fintech and innovative technology companies, such as big-tech firms with extensive networks, like payment transactions through banking channels, represents a significant recent achievement.

1. Innovative platforms like Alipay (2004) and Wechat (2011) have permeated the lives of real people, both offline and online, creating a vast quantity of data sources for innovative technology and financial technology (Fintech firms) to use in credit risk assessment.

2. Ant Financial, for example, employs algorithm-based auto financial assessment using data from Alibaba and Taobao online platforms, as well as offline Alipay payments, to provide lines of credit to distributors and lenders with improved credit scoring using various media.

The widespread consumption of information based on updated technology, particularly data related to consumer behavior, has raised concerns about client privacy and prevention of misuse (Chen et al., 2021; Luohan Academy, 2021).

Liu et al. (2021) based on customer data from the Alipay database discovered no notable relationship between privacy concerns and data sharing, therefore supporting the idea of complicated data confidentiality and inconsistencies. They relate this result to the likelihood that people with more privacy issues may find more value on digital platforms, implying that the ease provided by such platforms exceeds their privacy issues. Examining consumer privacy and data protection in the framework of digital platforms, Liu et al. (2021) Though this comes at the expense of exposing users to targeted advertising, which may promote items unrelated to their immediate consumption needs, their theoretical research suggests that data sharing can benefit consumers by enhancing the efficiency of matching products to their tastes. Cong et al. (2021) similarly offers a microeconomic framework for analyzing the function of consumer data, underlining that although it is extremely important in the larger macroeconomic setting, it also compromises personal information confidentially.

6.2. Innovative Technology-Based Banking and Investment Services in USA and China

The quality of internet infrastructure, improved payment systems, and effective data management determines much innovation in banking and investment services. Banks started using internet banking about thirty years ago, with the Information Technology explosion that brought sophisticated computing and internet services. More recently, some ten years ago, they entered mobile banking (Rysman and Schuh, 2016). Since then, several banks have teamed with creative technological companies to upgrade their credit starting procedures using digital solutions, therefore enabling more proactive risk management than with more conventional approaches.

Particularly China stands out with its better digital payment methods and mobile services than USA and European countries in this respect. "As of 2019, Alipay and WeChat Pay had 500 million and 900 million monthly active users, respectively representing 36 percent and 65 percent of China's total population, respectively," Frost et al., 2019 say. The rise of fintech companies providing digital payment options marks a major change from conventional commerce and investing practices. Further changing the financial scene in 2012, fintech sites in China were allowed to provide mutual fund products.

6.3. Peer to Peer (P2P) Financing Solution or Marketplace

Lenders and borrowers are connected through online platforms, commonly referred to as peer-to-peer (P2P) lending marketplaces, a crucial component of the fintech ecosystem. China leads the global market in P2P lending, alongside advancements in machine learning, artificial intelligence, and big data, closely followed by the USA. In 2007, China became the first country to legalize P2P lending. From 2008 to 2018, the P2P market in China witnessed significant growth, culminating in the establishment of 6,621 fintech P2P platforms and facilitating the financial accumulation of approximately US$120.9 trillion (He and Li, 2021). However, subsequent regulatory reforms led to a substantial contraction in the P2P fintech market in China, reducing the number of operational platforms. Despite these challenges, peer-to-peer lending continues to present substantial opportunities for online investing.

Recent studies have analyzed the expansion of fintech, its impacts, and the factors driving market performance and volatility. Prior to 2018, the rapid growth of the Chinese P2P market was primarily fueled by a highly structured yet traditional financial system, an underdeveloped financing system, and weak regulatory oversight. Huang and Wang (2021) examined the role of the central regulatory framework in the decline of the P2P market. Additionally, research has explored the role of venture capital financing in platform success. Using datasets comparable to those of Jiang et al. (2021) and Li et al. (2020), studies have shown that credit size and financier size increased by 25% and 49%, respectively, following platforms' successful acquisition of venture capital funding.

Venture capital-backed platforms are generally perceived as less risky compared to those without such backing. He and Li (2021) further noted that P2P platforms with higher

transparency and better information disclosure have a greater chance of survival and are less vulnerable to defaults. Hasan et al. (2021), utilizing loan data from Renrendai, China's largest P2P platform, investigated additional determinants of platform success. They found that social capital plays a significant role in shaping the structure and outcomes of P2P loans. Borrowers from regions with higher social capital tend to receive larger loan deals and bids than individual creditors, and these borrowers often achieve greater capital success with larger, lower-risk credit offerings. Additionally, they exert a more significant influence on riskier clients with lower credit quality.

6.4. The Innovative Financial and Investment Services Through Digital Means

Digital financial services rely on technological advancements and high-speed broadband and internet infrastructure. These elements are essential for enhancing payment mechanisms and managing large volumes of data effectively.

Today, the development of sophisticated digital financial services is made possible by the high-quality internet infrastructure that seamlessly connects technology with the financial sector (e.g., Rysman and Schuh, 2016). Banks have forged partnerships with innovative technology companies to facilitate digital credit evaluation and approval through end-to-end solutions and to manage risk effectively. Mobile and digital payment options abound in China, far more than they do elsewhere. With 500 million and 900 million monthly active users as of 2019, Alipay and WeChat Pay respectively accounted for 36% and 65% of China's overall population respectively (Frost et al., 2019). Trading and investing have flourished via fintech, so transforming the financial scene. Chinese fintech companies were given license to distribute mutual funds in 2012.

6.5. Stablecoins and CBDC

Crypto assets have experienced exponential growth, serving as an innovative payment system that encompasses investment solutions and wealth management features. Cryptocurrencies operate on an open distributed ledger constructed using blockchain technology, which ensures the efficient and accurate recording of transactions between parties.

There are three primary types of blockchains:

1. Private blockchain (with a single gatekeeper)
2. Permissioned blockchain (with multiple gatekeepers)
3. Public blockchain (which requires a consensus mechanism)

Mostly based on public blockchain technologies, digital currencies including Bitcoin are Along with many other digital currencies, Bitcoin uses a public blockchain with a consensus process that requires users to solve difficult calculations to have the authority to change the record. With a combined market valuation of USD 2.28 trillion, 15,000 unique cryptocurrencies were in use as of December 2021. But the value of cryptocurrencies has been somewhat erratic, which begs questions about their quick price swings, usually motivated by market uncertainty and speculation.

For example, Bitcoin fell 23% in December 2021 after reaching a peak of USD 67,000 the previous month. Bitcoin's price history includes a drop below USD 3,000 in 2018, a high of USD 20,000 in 2017, and a climb to USD 4,000 in March 2020 (Table 6.1).

Table 6.1: Bitcoin's Key Price (2017-2021)

Year	Value	Status
2017	USD 20,000	High
2018	USD3000	Low
2020	USD4000	Low
2021	USD67000 –Nov,2021 23% sharp decrease in Dec 2021.	High Low

Source: Allen et al., 2021

Bitcoin has been banned in some countries, including South Korea and China, because to its severe price volatility. Because of this instability, it has been unable to operate efficiently as a medium of exchange and payment service, causing it to fall short of its stated purpose.

While also evaluating the expected impact on the money supply and their wider economic consequences, Jagtiani et al. (2021) investigated cryptocurrencies to assess their possible to replace fiat money and central bank digital currencies (CBDCs). Halaburda et al. (2022)

gives a summary of the microeconomic elements influencing cryptocurrencies, comprising supply, demand, trading prices, and market rivalry. While Hardle et al. (2020) concentrate especially on cryptocurrencies, Chen et al. (2021) explores the economics of blockchain technologies. A thorough overview of the literature on bitcoin values, market structure, and legal concerns, Allen et al. (2021) presents important issues in their application, like platform funding, user acceptance, crowdsourcing, and related agency difficulties, Cong and Xiao (2021) offer a thorough taxonomy of crypto tokens.

Responding to the great price fluctuation of several cryptocurrencies, stable coins have developed. Stable currencies, supported by assets, are better fit for use as a medium of exchange and store of value since they are meant to preserve a more consistent value. They could improve the effectiveness and economy of overseas payments. Stable coin issuers use different strategies to keep price stability; the most often used one is to peg the value of the stable coin to a single currency or a basket of designated assets. Using the financial fortitude and stability of the issuing companies is another way to guarantee stability. Stable coins are a substitute for conventional deposit money, banknotes, or other financial tools that commercial banks can produce (BIS, 2019).

6.6. Facebook stable coin, Libra and Diem

Facebook introduced its stablecoin called Libra to address the shortcomings of other cryptocurrencies, including Bitcoin, as a means of payment. However, Libra also faced challenges in achieving stability and gaining recognition. Since its launch, Facebook's stable currency, Libra, has encountered regulatory issues as it posed competition to state-issued fiat money. It has faced transparency concerns, technological challenges, and issues related to customer privacy and protection.

The initial version of Facebook's Libra, launched in June 2019 as Libra 1.0, aimed to back the digital currency 1:1 with a pool of assets, including fiat currencies such as the USD, Euro, Pound, Yen, and other government-backed currencies. Facebook intended to leverage its vast user base to position Libra as a global stablecoin for international trade, settlements, and real-time payments. In response to regulatory concerns, Libra 2.0 was introduced in April 2020, featuring several adjustments based on feedback from various regulatory authorities, including Switzerland's Financial Market Supervisory Authority

(FINMA). Instead of creating a global digital currency, Libra 2.0 adopted a system of local currency stablecoins tied to a global reserve of fiat currencies, governed by a central authority and adhering to international regulatory standards.

In December 2020, Facebook rebranded the Libra project by partnering with Diem, effectively replacing the Libra Association. Diem, a new stablecoin initiative, adopted a different strategy from Libra 2.0. Each Diem stablecoin was backed by a single fiat currency, rather than a basket of currencies, with the goal of minimizing friction in current payment systems and enabling faster, more cost-effective transactions.

Had the project proceeded as planned, major currencies such as the USD, Euro, and Pound would have been represented as Diem stablecoins, serving as legitimate mediums of payment and settlement. Diem was intended to operate on a blockchain platform accessible to all partners. However, due to rising concerns about the stability of stablecoins in early 2022 and the potential for regulatory restrictions, Facebook began exploring options to divest from Diem. Consequently, the Diem project was officially terminated on January 27, 2022.

While stablecoins generally exhibit lower price volatility compared to Bitcoin, Ether, and other cryptocurrencies (Arner et al., 2020), they are not entirely "stable." Over the past year, stablecoins have played a pivotal role in providing immediate liquidity for international transactions and payments. The market capitalization of stablecoins grew significantly during the COVID-19 pandemic, reaching a cumulative market value of US$157.6 billion as of December 14, 2021, accounting for 7.3% of the total cryptocurrency market.

6.7. CBDCs and Stable Coins Experience in the USA, Europe, and China

The positive reception of Facebook's Libra and other stablecoins like Diem prompted the People's Bank of China to explore the potential costs and benefits of launching a central bank digital currency (CBDC). Globally, China is at the forefront of CBDC development, followed by several European nations, particularly Sweden. A survey by the Bank for International Settlements (BIS), involving responses from 68 central banks representing jurisdictions covering approximately 80% of the world’s population, reveals that different countries are progressing at various speeds in developing CBDCs. As noted by Barontini

and Holden (2019), many central banks have moved beyond the conceptual stage and are now conducting experiments and proof-of-concept trials, often in collaboration with other central banks.

A key debate centers on whether central banks should take on the primary role of issuing CBDCs or merely facilitate digital currencies developed by the private sector. According to the latest BIS report from 2022, CBDC pilot programs are emerging across the globe. Allen et al. (2021) and Jagtiani et al. (2021), in their reviews of the latest literature, emphasize two critical questions: first, whether central banks can successfully develop their own digital retail currencies, and second, whether CBDCs are a desirable replacement for traditional fiat money (Keister and Sanches, 2019; Brunnermeier et al., 2019). Furthermore, concerns about the broader implications of CBDCs and strategies to mitigate associated risks, including volatility, have been raised by Brunnermeier and Niepelt (2019), Niepelt (2020), and Fernandez-Villaverde et al. (2021).

Veneris et al. (2021) present a theoretical case for CBDC strategy and implementation, considering the legal, financial, and high-tech frameworks underpinning CBDCs. In terms of policy implications, the design of CBDCs has generated intense debate. One key issue is whether CBDCs should function as a global currency for international payments and settlements or as a retail mechanism for everyday consumer transactions. In the case of the latter, there are questions about the role of central banks in interacting directly with the general public, and whether public sector institutions, such as banks, will handle all customer-facing activities, or whether the private sector, including banks, will engage directly with consumers.

6.8. RegTech for Innovative Currencies - Cryptocurrencies and Stablecoins

Cryptocurrencies and digital currencies have experienced significant growth and complexity in recent years. However, regulation and regulatory technology (RegTech) for cryptocurrencies have lagged behind the rapid expansion of these technologies and the associated price volatility. The People's Bank of China (PBOC) declared all cryptocurrencies and stablecoins illegal in September 2021, and the central bank of Russia followed suit in January 2022. The absence of regulation, standardization, and clarity regarding the nature of cryptocurrencies and stablecoins has exposed them to risks, fraud,

and irregularities. RegTech and regulation for innovative technologies are particularly challenging due to the continuous evolution of technology.

Switzerland and the U.K. have established regulatory frameworks for FinTech and created regulatory sandboxes to support the innovative industry. However, central banks and financial authorities face challenges in formulating cryptocurrency-related regulations. These challenges include protecting customer data and privacy, addressing anti-money laundering and know-your-customer requirements, managing various risks, ensuring transaction transparency, considering Shariah compliance, and addressing other essential factors when developing FinTech regulations. In October 2020, the Financial Stability Board (FSB) issued comprehensive recommendations for regulating cryptocurrencies and stablecoins. Key recommendations for developing stablecoin guidelines include:

1. Implementing regulation while staying adaptable to rapidly evolving technologies.
2. Mitigating financial model risks associated with advanced technology.
3. Preventing regulatory arbitrage.
4. Safeguarding customer data and privacy.
5. Ensuring regulations do not impede innovation.

6.9. Chinese Stablecoin Regulations

As previously noted, in October 2021, China declared all activities and transactions involving virtual currencies, cryptocurrencies, and stablecoins illegal, imposing a comprehensive ban on the mining, issuance, and use of privately issued digital currencies. Prior to this ban, privately issued cryptocurrencies held the largest market share. China has since taken a leading position in the global race to develop a Central Bank Digital Currency (CBDC). While it remains uncertain whether the ban on cryptocurrencies will be lifted in the future, Chinese financial institutions are currently prohibited from participating in any cryptocurrency-related activities. However, individuals who already possess cryptocurrencies are allowed to retain them.

The People's Bank of China (PBOC) has introduced its own CBDC, known as the e-CNY, and is conducting pilot deployments in various major cities. In tandem with the ban on privately issued cryptocurrencies and stablecoins, the PBOC has stressed the importance

of government control over digital currencies, excluding private sector involvement. However, a final decision on the authority responsible for issuing these currencies has not yet been made. Through the creation of a CBDC-backed environment, the PBOC has encouraged public acceptance of the e-CNY by implementing a series of experimental initiatives. The regulatory framework surrounding cryptocurrencies and stablecoins in China may facilitate the widespread adoption and trust in the e-CNY, potentially unlocking new economic opportunities in areas such as global e-commerce, and contributing to the expansion of the Chinese financial sector. This outcome appears increasingly probable if the high adoption rates observed in trial regions, including those surrounding the Winter Olympics in February 2022, continue.

China's crypto policy, which restricts private cryptocurrencies and promotes the development of a government-issued CBDC, has the potential to address key challenges within the Chinese financial system. By improving credit access for previously underserved small and medium-sized enterprises (SMEs) and entrepreneurs, this policy could lead to faster growth in the financial sector. The resulting increase in more efficient lending and payment services outside of traditional banking could also help mitigate the risks associated with privately generated cryptocurrencies.

6.10. Regulations for Stablecoins in the United States

In November 2021, the U.S. President’s Working Group on Financial Markets (PWG) submitted a document on stablecoins, followed by the release of two Federal Reserve papers on central bank digital currencies (CBDCs) on January 20, 2022. On the same day, Project Hamilton, a collaboration between the Federal Reserve Bank of Boston and the Massachusetts Institute of Technology (MIT) Digital Currency Initiative, also published a report on CBDCs. Schwarcz (2021) identified two significant risks that must be addressed in stablecoin legislation: reclamation risk and the potential failure or hacking of the cryptographic systems supporting stablecoins. The proposed U.S. PWG legislation from November 2021, as well as the Stablecoin Categorization and Regulation Act of 2020, acknowledge these risks. Stablecoins are inherently complex, multidimensional financial products with various associated risks, as highlighted in the November 2021 PWG study. It recommended that only secure depository institutions should issue

stablecoins convertible to U.S. dollars, with robust regulations in place to monitor compliance at both the financial institution and holding entity levels.

Schwarcz (2021) further recommended that stablecoin issuers strengthen cryptographic security by employing multiple networks to reduce the risk of cryptographic failure. Other risks associated with stablecoins include user protection, concerns about stablecoin runs, payment system vulnerabilities, structural and credit risks, concentration of economic power among large tech companies, illegal financial activities, operational resilience, and market integrity hazards. To address these challenges, Schwarcz (2021) advocated for the creation of a public-private partnership to safeguard the government's ability to execute monetary and economic policies amid the growing use of stablecoins. Stablecoins serve various functions, such as payments and investment (regulated as securities by the Securities and Exchange Commission, SEC), and commodity-based stablecoins (regulated by the Commodity Futures Trading Commission, CFTC). Additionally, several U.S. regulatory bodies, including the Financial Crimes Enforcement Network (FinCEN), the Office of the Comptroller of the Currency (OCC), the Consumer Financial Protection Bureau (CFPB), state agencies, and the Financial Stability Oversight Council (FSOC), play a role in overseeing stablecoins. Given the multitude of regulatory agencies involved, implementing stablecoin regulations could be challenging and would require significant coordination to prevent inconsistencies and unintended consequences.

The focus of the U.S. PWG's proposed guidelines on stablecoins was on payment applications. Both stablecoins and CBDCs are digital tokens pegged to the value of fiat currencies, but there are key differences between them. Stablecoins are issued by banks and operate on decentralized exchanges, while CBDCs are issued by central banks and function under government oversight in a centrally managed system. Regarding the issuance of a U.S. CBDC, the Federal Reserve's 2022 study outlined four essential factors: (1) ensuring consumer privacy and security, (2) maintaining financial intermediation rather than offering direct consumer accounts with the Federal Reserve, (3) ensuring the broad transferability of the CBDC, and (4) requiring identity verification, similar to existing know-your-customer (KYC) banking practices. However, the study did not provide a definitive policy conclusion regarding whether a U.S. CBDC would be introduced. In a February 18, 2022 speech, Federal Reserve Governor Brainard

emphasized the importance of preparing for the future of payment systems and exploring all potential options, noting that a U.S. CBDC could help ensure global users of the dollar can continue to rely on its stability and security in the digital financial ecosystem.

In contrast, Project Hamilton's 2022 CBDC study focuses on the technical feasibility of CBDCs and addresses key design challenges. The project emphasizes technological innovation to inform future policy decisions, though it does not indicate whether or not a CBDC will be introduced in the U.S. or what form it might take. Project Hamilton made its code open-source to encourage wider participation in CBDC development. This technical study differs from the Federal Reserve's policy review of CBDC advantages and disadvantages (January 2022).

Beyond stablecoins and CBDCs, the U.S. Federal Reserve is also developing a regional real-time payment system known as FedNow. Expected to be fully operational by 2023, FedNow will provide real-time payment services to approximately 6,000 financial institutions. The introduction of FedNow could reduce the need for privately issued stablecoins, at least for domestic transactions.

6.11. European Stablecoin Regulations

The current legal framework for digital assets in the European Union (E.U.) is primarily governed by the Regulation on Markets in Crypto-Assets (MiCA), which was introduced in September 2020. MiCA covers utility tokens, stablecoins (including remittance and asset-backed tokens), and other "significant" stablecoins. Security tokens and venture capital tokens, however, remain under the purview of existing E.U. financial and securities regulations.

The scope of MiCA remains somewhat unclear, as highlighted by Zetzsche et al. (2020), due to its ambiguous classification of utility and security tokens, the absence of a comprehensive strategy for E.U. legislation, and the lack of a framework for administrative cooperation regarding global stablecoins. In contrast, the United Kingdom's regulatory plan for crypto-assets, introduced in January 2021, takes a tiered and phased approach. Unlike in the U.S., where stablecoins must be issued by insured depository institutions and are treated similarly to bank accounts, MiCA does not impose such requirements. Instead, MiCA creates hurdles for stable coins to trade legally, as they

must be registered with government authorities. Major stablecoins such as Tether, USDC, and Dai would also be subject to strict capital and reserve requirements under the MiCA framework. As a result, the issuance of stable coins in Europe is expected to be largely unviable, potentially leading to an effective ban on stable coins in the E.U. and shifting activity to more crypto-friendly jurisdictions.

To evaluate the feasibility of a European Central Bank Digital Currency (CBDC), sometimes known as the digital euro, the ECB has also started a two-year research program. Published in January 2022, initial research tackles important questions on the goal, operation, and possible influence on financial institutions and consumers of the digital euro. This study looks at trade-offs between several policy choices as described by Brunner Meier and Landau (2022) including a cost-benefit analysis.

6.12. Digital Currency in the Muslim World

Digital currencies, such as cryptocurrencies and Bitcoin, are prohibited in the Muslim world by many Shariah scholars for the following reasons:

a) They lack legal tender status.
b) The issuer's identity is unknown.
c) They exhibit volatility and speculative characteristics.
d) They can be used for money laundering and fraud.

6.13. Turkish Government' Approach

According to Diyanet, trading in virtual currencies is currently considered incompatible with religion due to the speculative nature of their value. Turkish religious authorities have ruled that the cryptocurrency Bitcoin, which is gaining global traction, is not in conformity with Islamic principles. While most countries, including Malaysia, are taking a cautious approach and conducting in-depth research on this emessrging phenomenon, the Turkish government is among the first to deem digital currency incompatible with Islam. According to Diyanet, virtual currencies are unsuitable for religious reasons because of their speculative valuation, potential use in illegal activities like money laundering, and lack of oversight by the state.

6.14. Lesson for the Muslim World

The Muslim world should prioritize further research in this area. Centralized digital currency can have a future presence with proper legal tender status and government backing. To facilitate innovation in technology, financial services, and currencies, there is a need for improved technology infrastructure to prevent cyber fraud and malfunctions. Adequate technical education, platform development, and understanding should be promoted with the involvement of relevant authorities.

The lack of acceptance of digital currencies in Muslim countries can be attributed, in part, to the absence of comprehensive regulatory frameworks for the technology sector. Other challenges include a lack of understanding and education about innovative technology, insufficient information technology infrastructure, and limited government willingness. Prior to regulating the technology sector and introducing cryptocurrency, stablecoin, and Bitcoin, it is essential to establish proper information technology infrastructure and provide education for both users and developers.

CHAPTER VII

A PARADIGM SHIFT IN ISLAMIC FINANCE INDUSTRY: VALUE BASED INTERMEDIATION, HUMAN DEVELOPMENT, ECOLOGICAL FOOTPRINT, AND SOCIAL IMPACT FINANCING

7.1. Human Development Index and the Ecological Footprint

The Human Development Index (HDI) and the Ecological Footprint (EF) are two critical indicators used to evaluate countries' performance in terms of human well-being and environmental sustainability. The HDI measures a country's achievements in longevity, education, and income, indicating the level of human development. The EF, on the other hand, assesses the environmental impact of human activities by calculating the amount of biologically productive land and water area required to produce the resources a population consumes and to assimilate the wastes it generates. A significant discussion around these indicators revolves around their relationship and how they can be integrated to achieve sustainable development. The theory behind their relationship suggests two approaches: the win-win approach and the trade-off approach. The win-win approach believes it's possible to simultaneously improve environmental quality and human well-being, while the trade-off approach suggests that improvements in human well-being might come at the cost of environmental degradation, making it challenging to achieve both simultaneously (S. P. Nathaniel, 2021).

Research has shown that the level of human development can impact the EF. High human development tends to increase ecological footprints, mainly due to higher consumption levels associated with better living standards. Conversely, investments in human capital, such as education and health, can lead to a reduction in the EF as societies adopt more sustainable practices and technologies (Adedoyin et al., 2021). Some studies have found that globalization and financial development have mixed effects on the EF, with globalization sometimes increasing the EF due to higher consumption and production patterns, but renewable energy and certain types of human capital can mitigate these effects (Ahmed, Cary, et al., 2021; Ahmed, Nathaniel, et al., 2021).

7.2. Alarming Point

In the contemporary discourse on global challenges, environmental sustainability has emerged as a paramount concern, increasingly capturing the public and academic attention with every passing day. The intricate task of nurturing a sustainable environment alongside ensuring the uninterrupted progression of human well-being represents a profound and ubiquitous challenge. This challenge is accentuated by the complexity of factors contributing to environmental degradation, among which human activities have been identified as significant, yet frequently underestimated, contributors. The empirical evidence from several studies underscores the pivotal role of human factors in driving ecological imbalances, highlighting a critical area that demands greater scrutiny and action (Murshed, Alam, et al., 2021; Murshed, Ali, et al., 2021; S. Nathaniel, Anyanwu, et al., 2020; S. Nathaniel, Nwodo, et al., 2020).

7.3. Ecology and Human Well-Being

The relationship between ecological health and human well-being is a testament to the interconnectedness of our planet's biological systems and societal health. Acknowledging this interdependence is crucial for developing strategies that foster a symbiotic relationship between the environment and humanity. MEa (2005) posits that judicious environmental management can yield substantial benefits, catalyzing a virtuous cycle of improved human welfare and enhanced ecological conditions. This potential for positive synergy illuminates the path toward a future where human progress and environmental stewardship are not mutually exclusive but are instead complementary forces. However, aspiring to such a harmonious coexistence necessitates a nuanced understanding that the relationship between human well-being and environmental quality is not inherently self-reinforcing. The assumption that these objectives naturally support one another without trade-offs is overly simplistic and overlooks the complexities inherent in balancing ecological and economic considerations. Klugman (2011), cautions against this oversimplification, arguing for a critical examination of the inevitable compromises that arise, especially when environmental conservation efforts and economic growth policies are misaligned or inadequately formulated.

The phenomena of urbanization, globalization, increased energy consumption, and the relentless exploration and exploitation of natural resources serve as catalysts for ecological disturbances. These disturbances, in turn, amplify the demands on systems that are fundamental to human development, such as healthcare, food supply, education, and economic stability. The escalation of these demands in the face of environmental stressors underscores the urgent need for policies that are not only responsive to the challenges of human development but are also cognizant of their environmental impacts.

7.4. Islamic Finance, Sustainability, and Equity

Islamic finance significantly contributes to addressing global challenges, such as environmental sustainability and human well-being, by adhering to principles of responsible finance and fostering socially conscious development. The Islamic finance industry is recognized for its alignment with the Sustainable Development Goals (SDGs), promoting socially responsible development and linking economic growth with social welfare. This industry offers substantial and non-traditional sources of financing for sustainable development, highlighting its potential to mobilize financial resources towards underfunded humanitarian and development needs (table 7.1).

Research emphasizes that Islamic social finance instruments, including Zakat, Waqf, Sadaqat, and Qard-hasan, are pivotal in realizing SDGs through fairness, justice, and equity. A systematic literature review spanning over two decades has shown that Islamic social financing mechanisms can address many social issues and improve welfare conditions by ensuring economic, social, and environmental sustainability. This approach aligns with 11 out of the 17 SDGs, while Islamic commercial finance can address the remaining goals, showcasing the sector's significant potential to fill the SDG funding gap (Dirie et al., 2023).

Moreover, Islamic financial instruments, particularly green sukuk, play a crucial role in combating climate change and promoting environmental protection. The Sovereign Green Sukuk issued by Indonesia, which raised US$2 billion for green and sustainable projects, exemplifies how these instruments can finance initiatives that mitigate and adapt to climate change, preserve biodiversity, and support the country’s Nationally Determined Contributions under the Paris Agreement. This initiative underscores the importance of

transparency in Islamic finance and its ability to attract both sharia and conventional investors (UNDP, 2019).

The global framework for Islamic Finance and Sustainable Development explores various experiences and practices from around the world, including the Gulf, African countries, and the SAARC region, emphasizing the role of zakat, waqf, and other Islamic financial instruments in promoting sustainability. This comprehensive approach highlights the challenges and opportunities within Islamic finance to contribute to sustainable economic growth, environmental protection, and social equity (M. K. Hassan et al., 2021).

To effectively align Human Development Indexes (HDIs) with Ecological Footprints (EFs), a strategy encompassing sustainable development, ecological restoration, and innovative economic and educational paradigms is paramount. This comprehensive approach aims not only at reducing our ecological footprint through waste elimination, emissions reduction, and a transition to renewable energy sources but also at restoring ecosystems through reforestation and biodiversity conservation measures. Such efforts are crucial for the sustainability of our planet and the well-being of its inhabitants. Role of Islamic Finance GET requires significant reforms in many areas. Some of the reforms needed are:

7.5. Economic Paradigm Shift

The necessity for a new economic model is evident, one that prioritizes sustainability and is built upon the principles of zero waste, zero emissions, and minimal financialization of natural resources. This paradigm shift is critical to address the current unsustainable practices that contribute to environmental degradation and climate change. According to the Ellen MacArthur Foundation, the circular economy model is a systemic approach to economic development designed to benefit businesses, society, and the environment. It contrasts with the traditional linear economy, advocating for the reduction, reuse, and recycling of materials to minimize waste and emissions (MacArthur & others, 2013).

7.6. Educational Reforms

Innovative changes in the educational sector are equally important. Integrating sustainable development goals (SDGs) and ecological concepts into curricula can foster a generation

that is knowledgeable about and committed to environmental stewardship. The United Nations Educational, Scientific and Cultural Organization (UNESCO) emphasizes the role of education in promoting sustainability, arguing that education for sustainable development (ESD) is a key instrument in transforming our society into one that is more sustainable (Jeronen, 2022).

7.7. Islamic Finance and Sustainability

Islamic finance offers unique opportunities to support sustainable development and ecological conservation. Its principles of risk-sharing, prohibition of interest, and ethical investments make it a viable framework for promoting environmental sustainability. The Islamic Development Bank has highlighted the potential of Islamic finance in supporting green projects through instruments like Green Sukuk, which fund renewable energy projects and other environmental initiatives (IsDB, 2020).

7.8. Regulatory and Technological Support

Regulatory bodies have a crucial role in facilitating this transition by implementing Shariah-based standards that promote green initiatives and sustainability. The International Islamic Financial Market (IIFM) and the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) have been pivotal in developing standards that align Islamic finance with global sustainability goals.

Moreover, technological advancements play a significant role in supporting the Green Economic Transition (GET). Green technologies, or “Greentech,” offer innovative solutions for reducing environmental impacts and promoting sustainable growth. The International Energy Agency (IEA) reports on the significance of green technologies in achieving energy efficiency and reducing greenhouse gas emissions, underscoring their role in the transition to a sustainable economy (IEA, 2020).

Achieving a sustainable balance between HDIs and EFs requires an integrated approach that includes rethinking our economic models, reforming education to include sustainable development principles, leveraging the unique position of Islamic finance, enforcing supportive regulatory frameworks, and embracing technological innovations. These strategies are essential for fostering a sustainable, equitable, and prosperous future for all.

7.9. Climate Change

The conventional model of economic development, heavily reliant on the exploitation of finite natural resources, has propelled unprecedented improvements in living standards globally. Yet, this progress comes at a significant environmental cost, including resource depletion and detrimental climate impacts. The concept of decoupling economic growth from physical growth emerges as a vital strategy in navigating towards sustainable development.

7.10. The Finite Limits of Earth's Resources

The Earth's natural resources are finite, and the current trajectory of resource use and environmental degradation is unsustainable. Despite advancements in resource efficiency, the fundamental challenge remains: how to sustain economic growth without exacerbating physical growth and resource exploitation. Evidence suggests that beyond a certain wealth threshold, nations can achieve higher levels of resource efficiency, waste reduction, and environmental stewardship (Almond et al., 2021). However, this improvement is often offset by the tendency of wealthier countries to relocate resource-intensive and environmentally harmful activities to less affluent nations, perpetuating global environmental disparities.

7.11. Economic Growth and Environmental Impact

The relationship between economic growth and environmental impact is complex. While economic prosperity has traditionally been associated with increased resource consumption and environmental degradation, there is growing evidence to suggest that it is possible to achieve economic growth while reducing the environmental footprint. The concept of "green growth" as outlined by the Organisation for Economic Co-operation and Development (OECD) emphasizes strategies for achieving economic growth and development while preventing environmental degradation, biodiversity loss, and unsustainable natural resource use (Chang et al., 2022).

7.12. Historical Context and Future Directions

The historical increase in living standards, facilitated by economic growth, has come at the expense of environmental health. Concepts such as "peak oil" and the broader

implications of climate change illustrate the limits of traditional growth models. The Intergovernmental Panel on Climate Change (IPCC) provides comprehensive assessments that underscore the urgent need to address climate change and its relationship with economic activities (IPCC, 2021).

7.13. Decoupling Economic Growth from Resource Consumption

The notion of decoupling economic growth from resource consumption and environmental degradation is gaining traction. The United Nations Environment Programme (UNEP) discusses decoupling in its "Global Resources Outlook," highlighting the necessity and potential for economies to grow without proportional increases in environmental pressure (Oberle et al., 2019). This approach is fundamental to sustainable development, aiming to ensure that economic growth can continue without compromising the planet's ecological balance.

Achieving sustainable development in the face of climate change requires a paradigm shift towards decoupling economic growth from environmental degradation. By leveraging innovative strategies, technologies, and policies that promote efficiency, renewable energy, and sustainable practices, it is possible to chart a path towards a resilient and prosperous future for all. The references cited herein, including reports from the WWF, OECD, IPCC, and UNEP, provide a solid foundation for understanding and addressing the challenges at the intersection of economic growth and environmental sustainability.

The emerging framework of Islamic finance is increasingly recognized for its potential to contribute significantly to sustainable development, boasting robust capabilities to positively influence the Human Development Index (HDI) and Ecological Footprints (EFs). By promoting innovative products closely aligned with ecological sustainability and human development effectiveness, Islamic finance stands as a potent force in the global financial landscape. However, this promising domain is not without its challenges. Key among these are the regulatory hurdles and variations in legal frameworks across different jurisdictions, necessitating concerted efforts to standardize legal frameworks and guidelines to fully harness its potential. Moreover, the advent of technology as a catalyst for global transformation offers immense opportunities, particularly in advancing the Sustainable Development Goals (SDGs) (Harahap et al., 2023). Technological

innovations in Islamic finance could further enhance productivity and sustainability, especially in relation to the Ecological Framework and the Human Development Index. Nonetheless, the path towards integrating these advancements is fraught with complexities, including the economic and political ramifications of transitioning away from fossil fuels—a dominant economic force in Gulf countries. This shift towards green energy sources poses significant economic and political challenges, especially for nations heavily reliant on oil exports, highlighting the intricate balance between ecological sustainability and economic and political interests in the global pursuit of sustainable development and human welfare.

Table 7.2: SDG's and Islamic Finance

SDG	Description	Islamic Finance Contribution
1. No Poverty	End poverty in all its forms everywhere.	Zakat (compulsory charity), Sadaqah (voluntary charity), and Qard Hasan (benevolent loans) provide direct financial support to the needy, aiming to reduce poverty.
2. Zero Hunger	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.	Islamic microfinance can support small-scale farmers, while investments in Halal industries promote sustainable agriculture practices.
3. Good Health and Well-being	Ensure healthy lives and promote well-being for all at all ages.	Islamic social finance instruments can fund healthcare services and infrastructure, particularly in underserved regions.
4. Quality Education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.	Waqf (endowments) can be used to establish and maintain educational institutions, scholarships for students, and funding for educational materials.
5. Gender Equality	Achieve gender equality and empower all women and girls.	Islamic finance emphasizes equitable treatment and provides opportunities for women to participate in economic activities, including business ownership and financial decisions.
6. Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation for all.	Investments in water and sanitation projects through Islamic bonds (Sukuk) can finance infrastructure developments in line with Shariah principles.
7. Affordable and Clean Energy	Ensure access to affordable, reliable, sustainable, and modern energy for all.	Islamic finance can fund renewable energy projects through green Sukuk, promoting environmental stewardship and clean energy.

8. Decent Work and Economic Growth	Promote sustained, inclusive, and sustainable economic growth, full and productive employment.	Islamic finance supports SMEs and entrepreneurship through Mudarabah (profit-sharing contracts) and Musharakah (joint venture), fostering economic growth and job creation.
10. Reduced Inequalities	Reduce inequality within and among countries.	Islamic finance principles promote wealth distribution and discourage excessive leveraging, aiming to reduce financial inequalities.
11. Sustainable Cities and Communities	Make cities and human settlements inclusive, safe, resilient, and sustainable.	Financing urban development projects through Islamic finance can support infrastructure that is sustainable and benefits communities equitably.
13. Climate Action	Take urgent action to combat climate change and its impacts.	Green Sukuk and Islamic investments in sustainable projects support environmental preservation and combat climate change.
16. Peace, Justice, and Strong Institutions	Promote peaceful and inclusive societies for sustainable development.	Shariah principles advocate for justice, ethical conduct, and transparency, which align with building strong and accountable institutions.
17. Partnerships for the Goals	Strengthen the means of implementation and revitalize the global partnership for sustainable development.	Islamic finance encourages partnerships and collaborative investments to achieve broader social, economic, and environmental goals.

As nations look to recover and rebuild from recent challenges, there is a significant emphasis on leveraging green transformation to create a balance between Human Development Index (HDI) and Ecological Footprints (EFs). The call for a green transmission and distribution architecture encompasses financial, political, and social paradigms, highlighting the importance of sustainable development. Academics, governing bodies, and reporting entities advocate for green transformation as pivotal in addressing contemporary challenges, suggesting various reforms to achieve this balance. This approach is particularly relevant for countries aiming to improve their infrastructure in health, education, and employment sectors, with some regions, like Europe, exploring social bond issuances as a mechanism to support these efforts.

Figure 7.1 illustrates a structured flow of funds that integrates various financial sources to achieve social impact financing. Government and private funds are channeled through public-private partnerships to support social impact initiatives. Additionally, cash waqf and philanthropic contributions such as Zakat, Sadaqah, and other charitable donations play a crucial role. These contributions are directed towards cash waqf organizations and philanthropic institutions, including Bait ul Mal, which then collaborate in financing social impact projects. This model highlights the combination of public, private, and philanthropic efforts in creating sustainable financing solutions for social development.

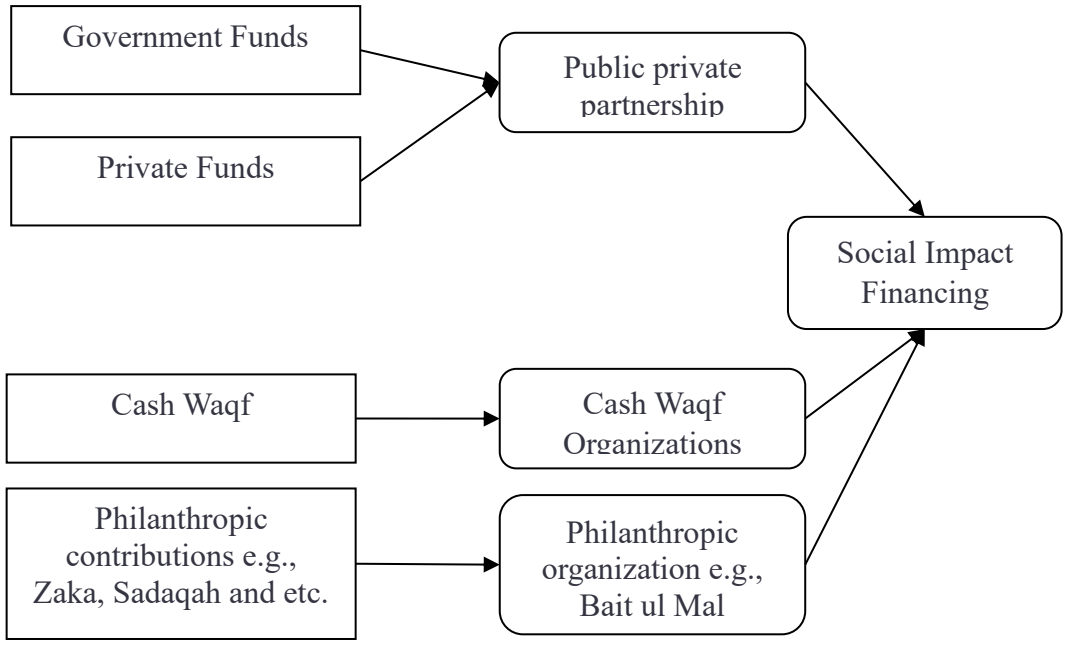


Figure 7.9: Islamic Blended Finance Model

7.14. Sukuk

Sukuk, plural of Sakk, historically served as an innovative financial instrument within the Islamic mercantile era, acting as a precursor to the modern cheque. This instrument embodies a proportional beneficial ownership in an underlying asset pool, offering a Shariah-compliant means of generating returns based on asset performance. Unlike conventional bonds, Sukuk structures necessitate asset backing, aligning investment returns with real economic activities and adhering to Islamic finance principles.

7.14.1. Market Evolution

The Sukuk market has witnessed significant evolution from its traditional roots, expanding its reach to address contemporary challenges such as climate change and environmental degradation. The advent of Green Sukuk is particularly noteworthy in this context, serving as a bridge between the rich heritage of Islamic finance and the urgent need for sustainable development practices. It offers a novel approach for investors to engage in ethical financing that not only yields financial returns but also contributes to the greater good of the environment.

7.14.2. Green Sukuk's Role in Sustainable Development

The role of Green Sukuk in promoting sustainable development is multifaceted. By providing necessary funding for green projects, Green Sukuk plays a crucial role in advancing renewable energy projects, enhancing energy efficiency, and supporting the transition to low-carbon economies. This alignment with sustainable development goals (SDGs) positions Green Sukuk as a key player in the global effort to mitigate the adverse effects of climate change and promote environmental sustainability. The World Bank's 2020 report on Green Sukuk marks a significant milestone, underscoring the instrument's effectiveness in mobilizing Islamic finance capital for environmentally sustainable initiatives. This report highlights the innovative nature of Green Sukuk and its capacity to address financing gaps in green projects, thereby accelerating progress towards achieving SDGs (World Bank, 2020).

At its core, Green Sukuk is tailored to finance a range of environmental projects. This includes the development and expansion of renewable energy sources such as solar parks, wind farms, and hydroelectric facilities, which are essential for reducing the global carbon footprint and combating climate change. Additionally, it extends to funding green infrastructure projects that incorporate sustainable design and

construction practices to minimize environmental impact, and eco-friendly transportation solutions like electric vehicles and mass transit systems that aim to reduce pollution and enhance urban mobility (Simonyan & Solntsev, 2010).

The framework provided by Green Sukuk for ethical investment does not only ensures financial returns but also guarantees that the investments contribute positively to society and the environment. The ethical dimension of Green Sukuk aligns perfectly with global sustainability objectives, making it an attractive option for investors seeking to make a difference. Green Sukuk is instrumental in mobilizing resources to combat climate change. By channelling funds into renewable energy projects, it supports the transition away from fossil fuels towards more sustainable energy sources, thereby reducing greenhouse gas emissions and mitigating global warming. The promotion of renewable energy adoption through Green Sukuk not only addresses environmental concerns but also enhances energy security and reduces dependency on volatile oil markets (Fitrah & Soemitra, 2022).

Moreover, it also plays a vital role in facilitating sustainable urban development. Investments in green infrastructure and eco-friendly transportation contribute to creating sustainable cities that offer high-quality life for their inhabitants while minimizing their ecological footprint. Through these investments, Green Sukuk supports the development of urban areas that are resilient, environmentally friendly, and economically vibrant.

7.14.3. Challenges and Opportunities

Green Sukuk represents a pivotal innovation in Islamic finance, offering a shariah-compliant mechanism to fund environmentally sustainable projects. Despite its potential to contribute significantly to global sustainability goals, the widespread adoption of Green Sukuk faces numerous challenges. These challenges stem from both within the Islamic finance industry and the broader context of global finance, sustainability standards, and regulatory environments. Conversely, the successful integration of Green Sukuk presents substantial opportunities for economic, environmental, and social development, aligning with the principles of Islamic finance and the broader objectives of sustainable investment (A. Alam et al., 2023).

7.15. Challenges

7.15.1. Lack of Awareness and Understanding

A fundamental challenge is the lack of awareness and understanding among Islamic finance professionals regarding the critical importance of environmental sustainability and its integration into financial products like Green Sukuk. This gap in knowledge inhibits the development and marketing of Green Sukuk instruments (A. Alam et al., 2023).

7.15.2. Regulatory and Standardization Issues

The absence of unified regulatory frameworks and standards for Green Sukuk across jurisdictions complicates their adoption. Divergent regulatory environments and the lack of standardization in what qualifies as a "green" project can create uncertainty among investors and issuers alike (Keshminder et al., 2022).

7.15.3. Limited Environmental Expertise

Islamic financial institutions often lack the environmental expertise necessary to assess and monitor the environmental impact of projects financed through Green Sukuk. This limitation challenges the credibility and authenticity of Green Sukuk as a tool for genuine environmental impact (F. H. M. Liu & Lai, 2021).

7.16. Opportunities

7.16.1. Alignment with Global Sustainability Goals

Green Sukuk aligns closely with global sustainability goals, providing a shariah-compliant instrument for mobilizing funds for renewable energy projects, sustainable agriculture, and other environmentally beneficial initiatives. This alignment offers a significant opportunity for Islamic finance to contribute to the global sustainability agenda (Foo et al., 2023).

7.16.2. Market Expansion and Diversification

The growing global interest in sustainable and responsible investment opens new market opportunities for Islamic finance. Green Sukuk can attract a broader range of investors, including non-Islamic investors interested in green investments, thereby expanding and diversifying the investor base for Islamic financial products (KHAMIS, 2023).

7.16.3. Enhancing Reputation and Compliance

Adopting Green Sukuk enables Islamic financial institutions to enhance their reputation by demonstrating a commitment to ethical and sustainable financing. Additionally, it provides a pathway to compliance with emerging regulatory requirements focused on sustainability and environmental, social, and governance (ESG) criteria (Abdullah & Keshminder, 2022).

CHAPTER VIII

STRUCTURAL AND DIGITAL TRANSFORMATION OF THE FINANCIAL INDUSTRY, A FUTURISTIC APPROACH FOR SUSTAINABLE AND GREEN DIGITALIZATION

8.1. An Overview of Digital Transformation

The shift towards digitalization in financial management is focused on improving data security and operational efficiency, underlining the significance of technology adoption for protecting data and enhancing business operations (Ayuandiani et al., 2023). Financial institutions are focusing on digital transformation to increase profitability, enhance customer experiences, and manage cybersecurity risks, with a strong emphasis on digital technology investments and employee skill development (Taka & Bayarçelik, 2023). AI is identified as a core technology that enhances customer experience, increases sales, and supports real-time decision-making processes, indicating its central role in the digital transformation journey (Hajishirzi & Costa, 2021). The banking sector is utilizing AI and big data analytics to become more customer-centric, focusing on data-driven services and personalization to improve customer engagement and attract new clients (Indriasari et al., 2019).

The digital transformation of accounting firms is facilitated by technologies like blockchain, RPA, cloud, big data, and AI, transforming the workplace and how services are delivered (Tiron-Tudor et al., 2022). A comprehensive review identifies key factors at individual, group, and organizational levels important for digital transformation, emphasizing the role of technology adoption, team collaboration, and organizational culture (Trenerry et al., 2021). Blockchain technology is explored for its potential to revolutionize the financial sector, highlighting its application beyond cryptocurrencies to redefine financial services with digital resources (J. Li et al., 2020).

8.2. Sustainability in Finance

Fintech platforms contribute to green finance through the process of making financial business more sustainable. European and global regulations, especially those which aim at safeguarding consumer rights, are instrumental in the transition towards sustainable finance and the fight against greenwashing (Chueca Vergara & Ferruz

Agudo, 2021). The application of green finance is also confronted by several impediments, especially in the case of developing countries. A study shows that the lack of international organization pressure and the deficiency of universal green criteria are the two major factors that need to be addressed in order to overcome these problems (Khan et al., 2022). Banks are major players in sustainable development and green economy, shifting traditional products and services into environmentally-friendly and socially-oriented ones. This will involve the use of green financial instruments like green bonds, loans, and insurance (Miroshnichenko & Brand, 2021). A green banking system, which entails the implementation of environmentally friendly policies and products, is a key factor in environmental conservation. The banks and financial institutions worldwide are more and more including the green banking initiatives to make a positive contribution to the sustainable development goals (Mir & Bhat, 2022).

8.3. Synthesis

Arner et al. (2019) point out that financial technology (FinTech) is one of the main drivers for financial inclusion, which is a factor that supports the sustainable balanced development as described in the UN Sustainable Development Goals (SDGs). Arner et al. (2019) emphasize the need for developing underlying infrastructure to support digital financial transformation through four primary pillars: digital identity and e-KYC systems, open interoperable electronic payments systems, electronic provision of government services and payments, and the design of digital financial markets and systems. This holistic approach has the ability to transform not only finance but also economies and societies through FinTech, financial inclusion and sustainable development. Oberer and Erkollar (2023) highlight how digital transformation, involving the integration of digital technologies into every facet of an organization, is not just about technology but also necessitates a cultural shift. This transformation is crucial for any comprehensive business strategy, potentially leading to success by leveraging the right technologies and involving people, processes, and operations. To ensure long-term sustainability, integrating sustainability strategies across various dimensions of the digital transformation roadmap is essential.

Despite the recognized potential, the literature also points out challenges in effectively integrating sustainability with digital transformation. These include the need for significant resources and know-how, which particularly medium-sized companies may

not possess, and the risk of digital solutions exacerbating sustainability issues such as electronic waste or widening the digital divide (Katsamakas, 2022). Feroz et al. (2021) emphasize the lack of studies mapping digital transformation in the environmental sustainability domain. They call for more research to identify organizational capabilities, performance, and digital transformation strategy regarding environmental sustainability. This highlights a gap in empirical evidence and the need for future research to better understand how management practices must transform to leverage digital technologies for ongoing, learning-based engagement with sustainability challenges.

8.4. Digitalization in the Financial Sector

Digital finance and FinTech are revolutionizing the financial industry, offering new products, businesses, and customer interaction modes. This evolution extends beyond enhancing traditional tasks to creating entirely new business opportunities. Digital technologies like blockchain, algorithmic trading, and decentralized finance (DeFi) are reshaping financial markets, improving operational efficiency, and enhancing customer engagement. On the other hand, this transition is accompanied by regulatory and cybersecurity issues (Babych, 2023; Gomber et al., 2017). The financial sector is experiencing disruption from FinTech startups which are making institutions to adopt digital solutions like AI and cloud computing to remain relevant and improve service delivery. Digitalization in finance is manifested through new business models and the transformation of value chains, which focus on the development of innovative services and industries (N. Alam et al., 2019; Mavlutova et al., 2021). The introduction of digital technologies into financial services, like electronic document management and automation, is leading to the creation of personalized and efficient customer service models (Shyriaieva & Adamkevych, 2021).

8.5. Challenges and Opportunities in Sustainable Digital Transformation

8.5.1. Challenges

This could pose a challenge to the seamless adoption of new and emerging technologies, such as cloud computing, big data analytics, and the Internet of Things (IoT), because of problems in their legacy systems, compatibility, and high modernization costs (Hu et al., 2023). Internal resistance to change is one of the big blocking factors, which are characterized by its own lack of digital literacy among its

employees, cultural inertia, and missing is a comprehensive and cohesive digital strategy that aligns with organization objectives holistically (Wolf et al., 2018). The situation becomes worse as there is a talented shortage in digital technologies across the world, besides a technical talent gap in areas such as AI, data science, and cybersecurity, among other soft capabilities required to create a digital culture that augments innovation (Doan, 2023). This becomes more evident in the developing countries whereby their limited infrastructure, such as poor internet connections and a lack of digital tools, limits them (Gupya, 2023).

8.5.2. Opportunities

High levels of efficiency are attained from the elimination of any redundancies, streamlining processes of operations, and automation of any manual processes. This, in addition to cutting costs only, will help the business become leaner and more competitive, as espoused by Jewapatarakul and Ueasangkomsate (2022). Transition creates the way for the development of new business models and the reinvention of products and services. This innovation is assumed to be the process of putting digital features into conventional products, developing completely new digital services, and combining data analytics to adapt the offers according to the needs. These systems are also of much importance in promoting the environmental sustainability of Digital Health platforms. In fact, Katsamakas (2022) points out that such innovations are paramount in developing more intelligent management of resources, waste reduction, and efficient processes of production. It also enables the advancement of a circular economy model, a model aimed at the reuse and recycling of products and materials to minimize the environmental impact from those materials. Digital technologies also offer organizational empowerment to have greater customer experiences, streamlined operations, and rapid responses to changes in the market. According to Feroz et al. (2021), digital transformation is largely understood to be the enabler through which businesses may grow within the rapidly changing digital world, taking competitive advantage by effectively and efficiently addressing changing customer needs.

8.6. Pathways for Sustainable Digital Transformation

Digital transformation, a phenomenon that is characterized by the use of technologies such as artificial intelligence, big data analytics, cloud computing and the Internet of Things (IoT) is leading to massive disruptions across the society, industries, and

organizations. This framework emphasizes the areas like pollution control, waste management, sustainable production, and urban sustainability which are the key components of the framework. There is a need for more research on organizational capabilities, digital transformation strategy and the connection to environmental sustainability (Feroz et al., 2021).

Companies will be able to make the most of their digital transformation strategy if they develop a sustainable business model (SBM). This method considers the dynamic complexity of digital transformation and recommends a systems approach for the future research directions (Katsamakas, 2022). Sustainable digital transformation is not just digitizing information processing but also includes the organizational change through new digital services or business models. This transition is expected to ensure the implementation of the sustainable development agenda, especially the need for a wide-ranging dialogue on the alignment of information system development and use with sustainability goals (Gils & Weigand, 2020).

Sustainable Systems Engineering Leadership (SustSEL) is intended to make the green digital transformation. This approach is based on the system thinking model which applies cultural considerations and environmental challenges to increase the team learning and communication (Kroculick, 2022). Digitalization is viewed as both the driver and the predecessor of sustainability at the firm level, which means that a research framework can be created that sees digital capabilities as the key to balancing economic, environmental, and social impacts (Gomez-Trujillo & Gonzalez-Perez, 2021).

8.7. Role of Policies and Regulations in Green Digitalization

The role of policies and regulations in promoting green digitalization includes encouraging sustainable innovation, enabling green technological progress, and ensuring environmental sustainability as well as positive impacts of digitalization. Research proves that environmental regulations and digitalization drive sustainable innovation, especially for the small and medium-sized enterprises (SMEs). Digital tools are recognized as being very important in helping regulations achieve their objectives on green innovation, and the approach should be tailored to harvest the transformative potential of digitalization (Xu et al., 2023).

Digitalization, which is facilitated by smart systems and technologies, offers a unique chance to solve sustainability problems, such as sustainable food production, clean water access, and green energy generation. These directly contribute to the United Nations Sustainable Development Goals (Mondejar et al., 2021). Digital finance and environmental regulations also have the synergetic effect of green development efficiency in which digital finance offers new opportunities for eco-environmental governance and promotes optimal resource allocation (Han et al., 2023).

Policies governing urban transport sustainability should be comprehensive enough to guide digitalization towards enhancing social and environmental sustainability (Creutzig et al., 2019). Furthermore, the combination of digital and green economies creates conditions for sustainable development and economic recovery opportunities, which is why environmental policy and the digital economy must be closely intertwined (Ciocoiu, 2011).

8.8. Impact of Sustainable Digital Finance on Society and the Environment

Digital finance is a key element of enhancing the efficiency of green development. Besides, it not only helps to realize green development efficiency but also reduces the financial problems caused by environmental regulation. This interaction between digital finance and environmental regulation has a positive effect on green development, suggesting the importance of digital finance in the eco-environmental governance and optimal allocation of financial resources (Han et al., 2023). Digital finance facilitates the innovation of corporate green technology by removing financial constraints. It has a direct and driving effect on the development of green technologies, especially in state-owned enterprises and those located in the eastern part of China. This also illustrates the role of digital finance in the development of the green digital economy and the promotion of corporate green innovation (Tang et al., 2023).

Digital finance is capable of minimizing the environmental consequences of economic growth. Cities with higher economic efficiency are characterized by better air quality and this is an indicator of the importance of technology-intensive sectors during economic development. Furthermore, technological and educational investments are vital for improving the citizens' health status and developing sustainable practices. This stresses the importance of digital finance in fostering environmental awareness and the reduction of air pollution (Yuan & Li, 2023).

Tang et al. (2023) performed an empirical study using data from Chinese A-share public companies that were traded between 2011 and 2020. Digital finance as a major factor in green technology innovation is the fact that it removes the financial constraints. This study outlines the functions of digital finance coverage depth and use depth in enabling business innovation towards green technologies. In addition, it was discovered that digital finance's impact on green technology innovation is more remarkable in state-owned enterprises and those located in China's eastern regions. This gives an understanding of the geographic and ownership-related aspects in the effectiveness of digital finance.

8.9. Trends in Sustainable Digital Transformation

FinTech and sustainable development has become a catalyst in the transformation of the financial sector into one that is more inclusive, efficient, and environmentally friendly. This trend is manifested by the growing number of studies that focus on the digital innovations in the context of global financial system which are aimed at achieving sustainability and financial inclusion.

FinTech is being acknowledged as a key player in the financial inclusion process, which serves as the powerhouse for a stable and balanced development. Arner et al. (2019) argue that the rollout of a strategic framework that consists of digital identity, electronic Know Your Customer (e-KYC) systems, interoperable electronic payment systems and the design of digital financial markets can significantly improve the efficiency of financial inclusion. Such infrastructural improvement is not only fundamental for the economic transformation of the country, but also for the achievement of the United Nations Sustainable Development Goals (SDGs), which reflects the symbiotic relationship between FinTech and sustainable development. A link between FinTech and sustainability is not limited to financial inclusion, but also includes the wider context of sustainable finance. Vergara and Agudo (2021) explore this relationship, unravelling how FinTech assists green finance projects and ultimately brings sustainability to the financial sector. The study highlights the need for efficient and effective European and global regulatory systems in order to protect consumer interests and ensure a sustainable growth of the FinTech industry. This is the most important aspect of the role of regulatory policies in shaping the direction of FinTech in the pursuit of broader sustainability goals. Digital transformation in traditional banking institutions is a very important factor in the process of sustainability. Sendjaja

et al. (2012) examine sustainable innovation in banking sector by showing that digital technologies help financial inclusion and need to adhere to sustainable finance regulations. This transformation is a sign that companies are moving towards more sustainable and competitive business models that are based on the principles of sustainability.

Furthermore, the digitization trend is not limited to the financial sector only. Abad-Segura et al. (2020) investigated global research trends in digital transformation within the education sector that is applicable to financial institutions as well. The study indicates that the interest in sustainability and digital innovation is rising exponentially. It is clear that there is a general transformation of the financial sector to integrate sustainable practices in different sectors. The emergence of BigTech and platform finance is not only a chance but also a threat for sustainable development in the financial sector. Arner et al. (2021) propose the need to create new regulatory frameworks that would allow digital finance platforms to take advantage of the benefits while at the same time mitigating the risks. The study proposes a principles-based regulatory system which considers the complexities raised by the platformization of finance and highlights the importance of governance in the long-term stability of digital financial ecosystems.

8.10. Barriers and Enablers

The shift towards sustainable digital transformation of the financial sector, including micro-, small-, and medium-sized enterprises (MSMEs) and the banking sector, is faced with numerous obstacles which must be overcome with care. The first challenge is in the area of IT security and the lack of qualified professionals in the external market, which has a negative impact on the implementation of digital technologies (Rupeika-Apoga & Petrovska, 2022). This problem highlights the necessity of a strong talent pipeline and robust security measures to protect digital infrastructures. Furthermore, the application of digital transformation in the accounting sector reveals the resistance to change, deep-rooted organizational cultures, and cost considerations as the main obstacles (Gonçalves et al., 2022). Such factors point to the necessity of cultural adaptation and financial planning in tackling the inertia which hinders digital development.

The other aspect of this challenge is the digital transformation effect on knowledge flow and industry dynamics. Digital transformation definitely makes knowledge more accessible and attracts the best talent but at the same time it poses the problem of talent barriers and the possibility of creating monopolies in the industry (C. Zhang et al., 2022). This duality implies that while digital technologies are endowed with numerous benefits, their application should be managed to avoid unintended consequences such as reduced competition and increased barriers to entry for new players. The banking sector specifically, is faced with a myriad of hurdles, including strategy, management, technology, regulation, customer engagement, and employee participation (Diener & Špaček, 2021). Each of these barriers comprises several sub-barriers, demonstrating that digital transformation in financial industry is complex and multifaceted. Eliminating these obstacles can be achieved through a holistic approach which involves strategic planning, regulatory compliance, technological innovations, and human capital management. Furthermore, the regulatory and market hurdles that financial services industry, especially in the developing and emerging markets, highlight the delicacy of balancing the benefits of financial technologies with the risks associated with digital progress (Alexander & Karametaxas, 2020). This underlines the importance of having well-built policy frameworks and regulatory guidance to handle the digital transformation landscape successfully.

Overcoming these hurdles will require the financial industry to make the emerging environment conducive to innovation by nurturing a culture of innovation, raising the levels of cybersecurity and digital literacy, working with other industries in strategic collaboration and exploiting the regulations that support digital adoption. The inclusive approach and used of digital services for the financial sector will also be very essential in order to ensure that everyone will benefit the revolution of digital finance, which will contribute to the sustainable development of the sector. But the path for sustainable digital transformation in financial institutions pits various problems including technical and talent based problems, cultural and regulatory barriers. Through the application of a strategic and inclusive approach that employs enablers and handles the impediments identified, the industry would find it efficient to pass through the period of transition. Such a shift would then create a more robust and truly innovative financial ecosystem.

8.11. Future Pathways

The future of the financial sector industry is characterized not by a single technological innovation, which is marginal, but by in-depth strategic changes. The table 8.1, below shows the major trends that are driving digital transformation in banking. Digital areas such as digital banking, blockchain, artificial intelligence, and sustainability will be determinative. These innovations are anticipated to solve problems by increasing efficiency, security, and customer experience, ushering in a new era of financial services.

Table 8.3: Key Trends Driving the Future of The Financial Industry

Key Area	Technologies/Concepts Involved	Impact on Financial Industry
Digital and Open Banking	APIs, Open Banking, Banking as a Service (BaaS)	- Enables secure data sharing and fosters innovation through third-party services. - Expands financial ecosystems by allowing non-bank businesses to offer financial services.
Blockchain and Decentralized Finance (DeFi)	Blockchain, Smart Contracts, DeFi Platforms	- Increases transaction transparency and efficiency. - Facilitates peer-to-peer financial services without central intermediaries.
Artificial Intelligence and Machine Learning	AI, Machine Learning, Chatbots, Robo-advisors	- Provides personalized banking experiences and financial advice. - Enhances fraud detection and risk management capabilities.
Cybersecurity Enhancements	Biometrics, Encryption, Blockchain, Regulatory Technology (RegTech)	- Protects data integrity and privacy. - Simplifies compliance with evolving regulatory requirements.
Sustainability and Social Responsibility	ESG Investing, Green Finance	- Prioritizes investments based on environmental, social, and governance criteria. - Promotes financial products that support environmental sustainability.

Digital Currencies and Central Bank Digital Currencies (CBDCs)	Cryptocurrencies, CBDCs	- Offers efficient, secure alternatives to traditional money. - Potential to enhance financial inclusion.
Infrastructure Modernization	Cloud Computing, Quantum Computing	- Enables scalability, improves agility, and reduces costs. - Holds potential to revolutionize financial modelling, cryptography, and risk analysis.

8.12. Digital and Open Banking

The adoption of open banking, APIs, and banking as a service (BaaS) technologies empower the secure sharing of financial data, thus enabling innovation around third-party services. Open Banking is an API-based concept, which enables customers to securely share their financial data with other third-party providers of financial services in order to develop competition and innovation. The BaaS platforms, in essence, democratize the financial service, giving non-banking firms the tool to offer financial products and in return, take part in a new age of financial inclusion and diversity.

8.13. Blockchain and Decentralized Finance (DeFi)

Apart from its known capability in cryptocurrency, Blockchain Technology brings with it the benefits of transaction transparency and efficiency to the vast financial sector. It is, therefore, basically the base of smart contracts and the DeFi platforms for offering a secured, transparent, and direct P2P financial transaction without involvement in the central intermediaries. This is not only highly complex technology and cost-efficient, but directly it challenges the domains of innovation, such as borrowing, lending, and models of investment in banks.

8.14. Artificial Intelligence and Machine Learning

AI and machine learning are revolutionizing the financial industry with personalized banking experiences for better customer service and improved, advanced, and sophisticated financial advice developed by chatbots and robo-advisors. In addition to customer engagement, the technologies help industries improve their abilities in fraud detection and risk management. AI algorithms can identify patterns that point to fraud in the massive data, having precision never seen before, to give a proactive stance against possible threats and vulnerabilities.

8.15. Cybersecurity Enhancements

The risk to data integrity and personal privacy is also rapidly changing, advancing as the digital environment strengthens itself. Advanced technologies in the form of biometrics, encryption, and blockchain are being deployed to fortify security measures. This has been further enhanced by the introduction of Regulatory Technology (RegTech), where compliance with the new regulation is more smoothly managed, and financial institutions can, therefore, easily keep abreast of the changing regulatory requirement. More than beefing up security to existing and new threats, it aims to earn the trust of consumers and regulators in digital financial services.

8.16. Sustainability and Social Responsibility

ESG investing and green finance underpin duties to both sustainability and social responsibility for the financial industry. This trend is making investors base their choices on criteria of environmental, social, and governance, with the consequence that companies are ever more sustainable in their behavior. Green finance initiatives, like the green bonds and sustainable loans, contribute to projects that promote environmental positive impacts, in an effort for financial activities to be in tune with global sustainability goals.

8.17. Digital Currencies and CBDCs

Cryptocurrencies, including CBDCs, represent a totally new idea of money perception and the ways it is used. These digital currencies promise efficient, secure, and inclusive alternative substitutions for traditional money, promising to be game changers in the global financial landscape by becoming more reachable for underserved communities and smoothing international transactions.

8.18. Infrastructure Modernization

The push to modernize infrastructure with cloud computing and the potential quantum computing brings to industries are set to revolutionize set in the financial industry. While cloud computing offers scalable, agile, and cost-effective solutions for financial institutions, quantum computing promises larger-scale improvements in financial modelling, cryptography, and risk analysis. These are core technological developments that any financial institution willing to hold on to the competitive edge in an ever-busy digital world, seeing to it that it's able to meet the growing consumer demand that innovates at a very high pace, adapts. Each of these points is representative of key

cornerstones in the ongoing change witnessed within the financial industry by the relationship that technology holds with strategic innovation. These are the kinds of trends that will help define, in very profound ways, the contours of the financial landscape as trends mature and develop.

CHAPTER IX

DIGITAL TRANSFORMATION IN THE ISLAMIC FINANCIAL INSTITUTIONS: A COMPARATIVE CASE STUDY ANALYSIS

Digital transformation is crucial for contemporary financial institutions seeking to stay competitive, boost operational efficiency, and elevate customer satisfaction. This study examines and contrasts the digital transformation initiatives of Hayat Finance Turkey, Dubai Islamic Bank, Raqami Islamic Digital Bank, and Mashreq Islamic Digital Bank, focusing on various critical areas.

9.1. Customer Experience

Table 9.1 provides a comparative analysis of customer experience strategies across four Islamic banks, emphasizing their utilization of digital platforms, customer-focused technologies, and personalization efforts. Hayat Finance Turkey and Dubai Islamic Bank both offer mobile banking services, with Hayat Finance incorporating AI-powered customer support to provide personalized product recommendations, while Dubai Islamic Bank integrates blockchain and AI for customized financial advice. Raqami Islamic Digital Bank adopts a fully digital strategy, utilizing AI and big data analytics to deliver tailored services. Mashreq Islamic Digital Bank combines mobile banking with AI-driven customer support to enhance personalized banking experiences. This comparison highlights the varied approaches Islamic banks are taking to improve customer interaction and satisfaction through advanced technology integration.

Table 9.4: Customer Experience

Bank	Digital Channels	Customer-Centric Technologies	Personalization Initiatives
Hayat Finance Turkey	Mobile banking	AI-driven customer service	Personalized product recommendations
Dubai Islamic Bank	Mobile banking	Blockchain, AI	Tailored financial advice
Raqami Islamic Digital Bank	Digital-only	AI, big data analytics	Customized banking services
Mashreq Islamic Digital Bank	Mobile banking	AI-based customer support	Personalized banking experience

9.2. Operational Efficiency

Table 9.2 presents the operational efficiency strategies adopted by the four Islamic banks, focusing on their use of automation tools, process optimization techniques, and the resulting efficiency metrics. Hayat Finance Turkey employs Robotic Process Automation (RPA) and Lean Six Sigma to reduce transaction times and cut costs, with a strong focus on eliminating waste and enhancing processes. Dubai Islamic Bank combines RPA and AI with business process reengineering, which results in better service delivery and cost reductions by reworking existing workflows. Raqami Islamic Digital Bank leverages AI and machine learning alongside continuous process improvement to boost transaction speed and enhance cost efficiency. Mashreq Islamic Digital Bank utilizes RPA and AI in conjunction with workflow automation, aiming to increase operational efficiency and minimize errors, demonstrating a strong commitment to precision and effective operations. Each bank applies a unique blend of technologies and methodologies to streamline operational processes and achieve improved efficiency outcomes.

Table 9.5: Operational Efficiency

Bank	Automation Tools	Process Optimization Techniques	Efficiency Metrics
Hayat Finance Turkey	Robotic Process Automation (RPA)	Lean Six Sigma	Reduced transaction times, cost savings
Dubai Islamic Bank	RPA, AI	Business process reengineering	Improved service delivery, reduced costs
Raqami Islamic Digital Bank	AI, machine learning	Continuous process improvement	Enhanced transaction speed, cost efficiency
Mashreq Islamic Digital Bank	RPA, AI	Workflow automation	Increased operational efficiency, reduced errors

9.3. Technology Adoption

Table 9.3 outlines the strategies for technology adoption across four Islamic banks, emphasizing key technologies, implementation approaches, and the challenges encountered. Hayat Finance Turkey integrates biometric authentication and AI, using a phased implementation strategy to address constraints related to digital infrastructure

and the need for staff training. Dubai Islamic Bank adopts blockchain and AI, relying on strategic partnerships to navigate challenges such as regulatory compliance and cybersecurity concerns. Raqami Islamic Digital Bank focuses on AI and big data analytics, committing to a full-scale digital adoption strategy while managing cybersecurity threats and digital risks. Mashreq Islamic Digital Bank prioritizes AI and digital payments, taking an incremental approach to technology integration to overcome challenges related to customer adoption and the rapid pace of technological change. This table highlights the various strategic decisions and obstacles each bank faces as it advances in its digital transformation efforts.

Table 9.6: Technology Adoption

Bank	Key Technologies	Implementation Strategies	Challenges Faced
Hayat Finance Turkey	Biometric authentication, AI	Phased implementation	Limited digital infrastructure, staff training
Dubai Islamic Bank	Blockchain, AI	Strategic partnerships	Regulatory compliance, cybersecurity
Raqami Islamic Digital Bank	AI, big data analytics	Full-scale digital adoption	Cybersecurity, managing digital risks
Mashreq Islamic Digital Bank	AI, digital payments	Incremental technology integration	Customer adoption, rapid tech advancements

9.4. Regulatory Compliance

Table 9.4 provides an overview of the regulatory compliance measures undertaken by four Islamic banks, focusing on their strategies for upholding Sharia compliance and the challenges they encounter within regulatory environments. Hayat Finance Turkey prioritizes adherence to both local and international standards, maintaining a strict commitment to Sharia principles while navigating the challenge of balancing innovation with regulatory compliance. Dubai Islamic Bank implements regular audits and compliance checks, with a strong emphasis on Sharia governance to effectively manage complex regulatory requirements. Raqami Islamic Digital Bank employs integrated compliance systems to ensure thorough adherence to Sharia, facing the challenge of ensuring that its digital platforms fully meet compliance standards. Mashreq Islamic Digital Bank engages in continuous monitoring and utilizes dedicated

Sharia boards, addressing the challenges associated with regulatory changes and the costs linked to maintaining compliance. This table underscores the proactive measures these banks take to ensure their operations comply with financial regulations and Islamic law.

Table 9.7: Regulatory Compliance

Bank	Compliance Measures	Sharia Compliance	Regulatory Challenges
Hayat Finance Turkey	Adherence to local and international standards	Strict adherence to Sharia principles	Balancing innovation with compliance
Dubai Islamic Bank	Regular audits, compliance checks	Strong Sharia governance	Complex regulations
Raqami Islamic Digital Bank	Integrated compliance systems	Comprehensive Sharia compliance	Ensuring digital platforms meet compliance
Mashreq Islamic Digital Bank	Continuous monitoring	Dedicated Sharia boards	Regulatory changes, compliance costs

9.5. Risk Management

Table 9.5 outlines the risk management strategies adopted by four Islamic banks, focusing on the tools they use, the key risks they address, and the mitigation strategies they implement. Hayat Finance Turkey employs a Risk IT Framework to manage cybersecurity and operational risks, addressing these challenges with strengthened IT security measures and comprehensive staff risk training. Dubai Islamic Bank utilizes a robust risk management system to handle risks related to digital transformation and market volatility, incorporating proactive management practices and regular assessments to ensure stability. Raqami Islamic Digital Bank uses advanced analytics to tackle digital risks and cybersecurity threats, emphasizing continuous monitoring and the creation of strong risk mitigation plans. Mashreq Islamic Digital Bank implements risk assessment tools to address cyber threats and compliance risks, enhancing cybersecurity measures and performing regular audits to maintain ongoing protection. Each bank’s approach demonstrates a strategic and structured effort to mitigate the risks associated with digital banking, thereby improving security and reliability in their operations.

Table 9.8: Risk Management

Bank	Risk Management Tools	Key Risks Addressed	Mitigation Strategies
Hayat Finance Turkey	Risk IT Framework	Cybersecurity, operational risks	Enhanced IT security, risk training
Dubai Islamic Bank	Comprehensive risk management systems	Digital transformation risks, market risks	Proactive risk management, regular assessments
Raqami Islamic Digital Bank	Advanced analytics	Digital risks, cybersecurity	Continuous monitoring, risk mitigation plans
Mashreq Islamic Digital Bank	Risk assessment tools	Cyber threats, compliance risks	Robust cybersecurity measures, regular audits

9.6. Comparative Overview of Digital Transformation Efforts

Table 9.6 offers a comparative analysis of the digital transformation initiatives across four Islamic banks, focusing on their strategies in customer experience, operational efficiency, technology adoption, regulatory compliance, and risk management. Hayat Finance Turkey emphasizes mobile banking and AI-driven services to enhance customer engagement, while Dubai Islamic Bank combines blockchain and AI to strengthen service delivery. Raqami Islamic Digital Bank operates a fully digital platform with advanced analytics, prioritizing personalized services, whereas Mashreq Islamic Digital Bank uses AI and mobile banking to provide efficient customer support. In terms of operational efficiency, each bank utilizes specific tools and strategies—such as RPA and Lean Six Sigma—to enhance performance. They also maintain strict adherence to regulatory standards and implement effective risk management practices, demonstrating a comprehensive approach to leveraging technology for improved financial services.

Table 9.9: Comparative Overview of Digital Transformation Efforts

Aspect	Hayat Finance Turkey	Dubai Islamic Bank	Raqami Islamic Digital Bank	Mashreq Islamic Digital Bank
Customer Experience	Mobile banking, AI-driven services	Blockchain, AI, mobile banking	Digital-only, AI, big data analytics	Mobile banking, AI-based support

Operational Efficiency	RPA, Lean Six Sigma	RPA, AI, business process reengineering	AI, continuous process improvement	RPA, AI, workflow automation
Technology Adoption	Biometric authentication, AI	Blockchain, AI	AI, big data analytics	AI, digital payments
Regulatory Compliance	Adherence to local/international standards	Regular audits, compliance checks	Integrated compliance systems	Continuous monitoring
Risk Management	Risk IT Framework	Comprehensive risk management systems	Advanced analytics	Risk assessment tools

9.7. Digital Channels

Table 9.7 provides a comparative overview of the availability of digital channels among four Islamic banks, focusing on their adoption of various technologies to enhance customer accessibility and service efficiency. Hayat Finance Turkey offers mobile and online banking, along with ATM services and chatbots, but does not include digital wallets in its offerings. Both Dubai Islamic Bank and Mashreq Islamic Digital Bank provide a comprehensive range of digital services, including mobile banking, online banking, digital wallets, ATM services, and chatbots, reflecting a robust digital strategy. On the other hand, Raqami Islamic Digital Bank focuses on mobile and online banking but does not offer digital wallets, ATM services, or chatbots, indicating a more streamlined or specialized digital approach. This comparison underscores the varied digital strategies each bank employs to effectively meet the needs of their customer base.

Table 9.10: Digital Channels

Bank	Mobile Banking	Online Banking	Digital Wallets	ATM Services	Chatbots
Hayat Finance Turkey	✓	✓	✗	✓	✓
Dubai Islamic Bank	✓	✓	✓	✓	✓
Raqami Islamic Digital Bank	✓	✓	✗	✗	✗
Mashreq Islamic Digital Bank	✓	✓	✓	✓	✓

9.8. Key Technologies

Table 9.8 presents a comparative analysis of the key technologies adopted by four Islamic banks to drive their digital strategies. All the banks have embraced Artificial Intelligence/Machine Learning (AI/ML) and Cloud Computing, indicating a strong focus on leveraging advanced technologies to enhance their operational capabilities. Additionally, most of the banks, except Dubai Islamic Bank, have adopted Application Programming Interfaces (APIs) to enable seamless system integration and interoperability.

Dubai Islamic Bank distinguishes itself with the broadest adoption of technologies, including Blockchain, Big Data, and the full range of other listed technologies, highlighting its leadership in digital innovation within the sector. Raqami Islamic Digital Bank and Hayat Finance Turkey have taken a more selective approach, choosing not to implement Blockchain or Big Data. Mashreq Islamic Digital Bank, while also not adopting Blockchain, incorporates Big Data, emphasizing its focus on data-driven strategies. This comparison underscores the strategic technology choices made by each bank, tailored to their unique operational needs and digital transformation objectives.

Table 9.11: Key Technologies

Bank	AI/ML	Blockchain	Big Data	Cloud Computing	APIs
Hayat Finance Turkey	✓	✗	✗	✓	✓
Dubai Islamic Bank	✓	✓	✓	✓	✓
Raqami Islamic Digital Bank	✓	✗	✗	✓	✓
Mashreq Islamic Digital Bank	✓	✗	✓	✓	✓

9.9. Customer Feedback and Engagement

Table 9.9 provides a comparative analysis of customer feedback and engagement metrics, offering insights into customer satisfaction, user ratings on app stores, social media engagement, and the availability of 24/7 support. Dubai Islamic Bank and Mashreq Islamic Digital Bank stand out with particularly high customer satisfaction scores of 4.5 and 4.4 out of 5, respectively, alongside strong social media engagement. These figures reflect the effectiveness of their engagement strategies and the strength

of their customer service offerings. Both banks also enjoy high user ratings on app stores and provide 24/7 customer support, demonstrating their commitment to accessibility and quality service. In comparison, Hayat Finance Turkey and Raqami Islamic Digital Bank exhibit slightly lower customer satisfaction and user ratings, coupled with moderate social media engagement. Despite this, they maintain robust service support, also offering 24/7 availability. This comparison illustrates how each bank's approach to digital engagement and customer service correlates with customer perceptions and interactions across various digital platforms.

Table 9.12: Customer Feedback and Engagement

Bank	Customer Satisfaction (1-5)	User Ratings (App Stores)	Social Media Engagement	24/7 Support
Hayat Finance Turkey	4.2	4.0	Moderate	Yes
Dubai Islamic Bank	4.5	4.3	High	Yes
Raqami Islamic Digital Bank	4.3	4.2	Moderate	Yes
Mashreq Islamic Digital Bank	4.4	4.1	High	Yes

9.10. Financial Impact

Table 9.10 provides a detailed analysis of the financial impacts of digital investments, showcasing the benefits in terms of cost savings, revenue growth, return on investment (ROI), and improvements in operational efficiency. Dubai Islamic Bank stands out with the most significant gains, achieving 20% in cost savings, 12% in revenue growth, and a 25% ROI, along with marked enhancements in operational efficiency. These results indicate a highly successful digital strategy that not only reduces costs but also drives revenue and overall performance improvements.

Mashreq Islamic Digital Bank also demonstrates impressive financial outcomes, with 17% cost savings, the highest revenue growth at 13%, and a 23% ROI, reflecting strong returns from its digital initiatives. Hayat Finance Turkey and Raqami Islamic Digital Bank also report notable improvements, with ROI figures of 20% and 22% respectively, and both showing increased operational efficiency. This comparison highlights the substantial financial benefits these banks are reaping from their digital

transformation efforts, emphasizing the significant value of such investments within the banking sector.

Table 9.13: Financial Impact

Bank	Cost Savings (%)	Revenue Growth (%)	ROI on Digital Investments (%)	Operational Efficiency
Hayat Finance Turkey	15	10	20	Improved
Dubai Islamic Bank	20	12	25	Significantly Improved
Raqami Islamic Digital Bank	18	11	22	Improved
Mashreq Islamic Digital Bank	17	13	23	Improved

CONCLUSION

This dissertation highlights the transformative potential of digital technologies within Islamic financial institutions, particularly for Muslim-majority countries seeking to balance technological advancements with Shariah compliance. One of the most significant implications uncovered through this research is the opportunity for digital transformation to enhance operational efficiency, financial inclusion, and customer satisfaction, all while adhering to Islamic financial principles. This research delves deeply into the unique position of Islamic finance, revealing that Shariah-compliant financial products and services must integrate advanced digital technologies to remain competitive and aligned with global financial trends.

The analysis of blockchain technology, for instance, shows that this digital innovation is particularly well-suited for Islamic finance. Blockchain's ability to enhance transparency and traceability directly supports the risk-sharing and profit-loss paradigms that are central to Shariah-compliant transactions. By ensuring the immutability of records and enabling smart contracts, blockchain allows for innovations such as Islamic Sukuk to be traded more efficiently while maintaining Shariah integrity. This finding underscores the critical role of technology in resolving one of the major challenges Islamic finance faces: balancing innovation with ethical adherence.

Further, the research outlines how Central Bank Digital Currencies (CBDCs) could potentially transform financial ecosystems in Muslim-majority countries. The integration of CBDCs can advance financial inclusion, a fundamental goal of Islamic finance. However, the research reveals that significant regulatory and Shariah governance frameworks must be developed to ensure these currencies align with Islamic principles. CBDCs, as explored in this thesis, have the potential to streamline cross-border payments, making Islamic financial institutions more globally competitive, but only if properly regulated to avoid violations of riba (interest) and other prohibitions.

This study also reveals that Islamic financial institutions in various regions, such as Indonesia, Malaysia, and Turkey, are already spearheading the digital transformation. The examples of Bank Syariah Indonesia (BSI) and Dubai Islamic Bank, as discussed

in the research, demonstrate that early adoption of digital wallets, mobile payments, and biometric authentication systems has enhanced customer engagement and market competitiveness. This has resulted in improved service delivery and operational efficiency, offering a roadmap for other Islamic financial institutions to follow.

Another crucial implication of this research lies in its demonstration that Islamic finance and sustainability goals are increasingly aligned. The deployment of green Sukuk and the use of digital technologies to track environmental impacts offer a means to support sustainable development goals (SDGs). As this dissertation indicates, digitalization can facilitate the monitoring and evaluation of investments to ensure they meet both financial and ethical benchmarks, reinforcing the value of Islamic finance in promoting social justice and environmental responsibility.

10.1. Recommendations

10.1.1. Establish a Unified Digital and Shariah Compliance Framework

To ensure that digital transformation efforts in Islamic finance align with both technological advancements and Shariah principles, it is essential to develop unified frameworks that guide the adoption of fintech and digital banking solutions. These frameworks should incorporate regulatory clarity, enabling financial institutions to confidently innovate while ensuring strict compliance with Islamic law. As the research shows, frameworks must be tailored to the specific economic, cultural, and technological contexts of Muslim-majority countries.

10.1.2. Invest in Capacity Building

The research emphasizes a skills gap within Islamic financial institutions, particularly concerning digital technologies like AI, blockchain, and data analytics. As highlighted in the case studies of Malaysia and Turkey, the success of digital transformation depends on the availability of qualified personnel who understand both Islamic finance principles and cutting-edge technologies. Investment in education, training programs, and capacity-building initiatives is crucial to developing a workforce that can lead digital transformation in these institutions.

10.1.3. Promote Cross-Institutional Collaborations

One of the key insights of the dissertation is the need for collaborative approaches between Islamic financial institutions, fintech companies, and regulators. Institutions

should pursue partnerships to co-develop Shariah-compliant fintech solutions that not only enhance financial inclusivity but also address operational challenges. As seen in the efforts of Bank Syariah Indonesia, partnerships can help overcome technological barriers and foster innovation.

10.1.4. Support Financial Inclusion Through Digitalization

A significant theme of this dissertation is the potential for digital transformation to extend financial services to underbanked and unbanked populations. Islamic financial institutions should prioritize the deployment of mobile banking, digital wallets, and low-cost fintech solutions that cater to marginalized populations, particularly in rural areas. Doing so not only aligns with the ethical obligations of Islamic finance but also enhances its economic sustainability.

10.1.5. Adapt to Global Trends in Fintech

Islamic financial institutions must stay attuned to global trends in fintech and digital currencies. By participating in the global discourse around CBDCs, DeFi, and cryptocurrencies, Islamic finance can develop Shariah-compliant alternatives that position these institutions competitively on the global stage. Shariah-compliant CBDCs, for instance, could serve as a critical tool in facilitating cross-border Islamic trade while adhering to Islamic principles, as demonstrated in the research's exploration of emerging CBDC projects.

10.2. Limitations

10.2.1. Geographic and Cultural Specificity

The research primarily focuses on specific regions, including Indonesia, Malaysia, Turkey, and Saudi Arabia. While these countries are leaders in Islamic finance, the findings may not fully apply to other Muslim-majority countries with different economic or cultural contexts. Future research could expand the scope to include Africa, Central Asia, and other regions where Islamic finance is developing rapidly but under different conditions.

10.2.2. Rapid Technological Change

The fast-evolving nature of digital technologies means that some of the findings and recommendations may quickly become outdated as new innovations emerge. Technologies such as quantum computing or advanced AI models could dramatically

shift the landscape of digital finance, necessitating ongoing research to keep pace with technological changes.

10.2.3. Regulatory Uncertainty

The legal and regulatory frameworks governing digital finance, particularly in Muslim-majority countries, are still in their infancy. While the dissertation outlines current efforts to regulate Shariah-compliant fintech, ongoing regulatory developments could affect the future applicability of the recommendations made here.

10.2.4. Cultural Barriers to Digital Adoption

Although the research touches on social and cultural factors, the extent to which cultural resistance to technology adoption might slow the progress of digital transformation in more conservative Muslim societies was not fully explored. Understanding these dynamics could provide a more comprehensive picture of the challenges faced by Islamic financial institutions.

10.3. Future Research Directions

10.3.1. Long-Term Case Studies on Digital Transformation

To better understand the long-term impacts of digital transformation on Islamic finance, future studies should track the progress of specific institutions over time, providing empirical data on the effectiveness of digital strategies, particularly with regard to financial inclusion and customer satisfaction.

10.3.2. Cross-Country Comparative Studies

A comparative analysis of digital transformation efforts across a broader range of Muslim-majority countries would help identify best practices and common challenges. Such research could examine countries at different stages of digital adoption, providing a more nuanced understanding of how local regulatory frameworks, technological readiness, and cultural factors affect the process.

10.3.3. Technological Compatibility with Shariah

As Islamic finance continues to evolve, future research should delve deeper into the compatibility of new technologies such as decentralized finance (DeFi), smart contracts, and artificial intelligence with Shariah principles. This research could develop detailed frameworks for Shariah governance in digital transactions.

10.3.4. Consumer Behavior and Digital Finance

Given the importance of customer trust and adoption rates in driving the success of digital financial products, future studies could explore the psychological, cultural, and economic factors that influence consumer attitudes towards Shariah-compliant digital services. Understanding these dynamics is crucial for designing products that meet the needs of diverse customer bases.

10.3.5. Emerging Trends in CBDCs and Fintech

The rapid development of CBDCs and their potential for cross-border trade in the Islamic finance sector warrants further exploration. Future research should focus on how central banks in Muslim-majority countries can design Shariah-compliant CBDCs that maintain financial stability while promoting inclusive economic growth.

10.4. Final Remarks

In conclusion, this dissertation has provided a comprehensive analysis of the role that digital transformation can play in advancing the goals of Islamic finance. By embracing digital technologies such as blockchain, AI, and mobile banking, Islamic financial institutions can significantly improve their operational efficiency, market competitiveness, and global standing. However, as demonstrated throughout this research, these advancements must be grounded in Shariah compliance, ensuring that the core values of social justice, ethical governance, and financial inclusion remain intact.

The path forward for Muslim-majority countries lies in the strategic adoption of digital finance, underpinned by strong regulatory frameworks, collaborative partnerships, and a commitment to ethical innovation. Islamic finance stands at a critical juncture, and the lessons gleaned from digital transformation in the West and East provide valuable insights for crafting a future that is both technologically advanced and rooted in the ethical principles that define Islamic finance.

REFERENCES

Abad-Segura, E., González-Zamar, M.-D., Infante-Moro, J., & García, G. R. (2020). Sustainable Management of Digital Transformation in Higher Education: Global Research Trends. *Sustainability*, *12*, 2107. https://doi.org/10.3390/su12052107

Abdullah, M. S., & Keshminder, J. S. (2022). What drives green sukuk? A leader's perspective. *Journal of Sustainable Finance and Investment*, *12*(3), 985–1005. https://doi.org/10.1080/20430795.2020.1821339

Adams, M., Boldrin, L., Ohlhausen, R., & Wagner, E. (2021). An integrated approach for electronic identification and central bank digital currencies. *Journal of Payments Strategy and Systems*, *15*(3), 287–304.

Adedoyin, F. F., Nathaniel, S., & Adeleye, N. (2021). An investigation into the anthropogenic nexus among consumption of energy, tourism, and economic growth: do economic policy uncertainties matter? *Environmental Science and Pollution Research*, *28*(3), 2835–2847.

Agur, I., Ari, A., & Dell'Ariccia, G. (2022). Designing central bank digital currencies. *Journal of Monetary Economics*, *125*, 62–79. https://doi.org/10.1016/j.jmoneco.2021.05.002

Ahmed, Z., Cary, M., & Le, H. P. (2021). Accounting asymmetries in the long-run nexus between globalization and environmental sustainability in the United States: an aggregated and disaggregated investigation. *Environmental Impact Assessment Review*, *86*, 106511.

Ahmed, Z., Nathaniel, S. P., & Shahbaz, M. (2021). The criticality of information and communication technology and human capital in environmental sustainability: evidence from Latin American and Caribbean countries. *Journal of Cleaner Production*, *286*, 125529.

Akin, I., Khan, M. Z., Hameed, A., Chebbi, K., & Satiroglu, H. (2023). The ripple effects of CBDC-related news on Bitcoin returns: Insights from the DCC-GARCH model. *Research in International Business and Finance*, *66*(August 2022), 102060. https://doi.org/10.1016/j.ribaf.2023.102060

Alam, A., Ratnasari, R. T., Jannah, I. L., & Ashfahany, A. El. (2023). "Development

and evaluation of Islamic green financing: A systematic review of green sukuk." In *Environmental Economics* (Vol. 14, Issue 1, pp. 61–72). https://doi.org/10.21511/ee.14(1).2023.06

Alam, N., Gupta, L., & Zameni, A. (2019). Digitalization and Disruption in the Financial Sector. *Fintech and Islamic Finance*, 1–9. https://doi.org/10.1007/978-3-030-24666-2_1

Alexander, K., & Karametaxas, X. (2020). Digital Transformation and Financial Inclusion. *Sustainability Research & Policy Negative Results EJournal*. https://doi.org/10.2139/ssrn.3645994

Alfar, A. J. K., Kumpamool, C., Nguyen, D. T. K., & Ahmed, R. (2023). The determinants of issuing central bank digital currencies. *Research in International Business and Finance*, *64*, 101884. https://doi.org/10.1016/j.ribaf.2023.101884

Aliqulova, N. (2023). Development of islamic finance in the digital economy through financial technologies. *Новый Узбекистан: Успешный Международный Опыт Внедрения Международных Стандартов Финансовой Отчетности*, *1*(5), 239–242. https://doi.org/10.47689/stars.university-5-pp239-242

Allen, F., Gu, X., & Jagtiani, J. (2022). Fintech, Cryptocurrencies, and CBDC: Financial Structural Transformation in China. *Journal of International Money and Finance*, *124*, 102625. https://doi.org/10.1016/j.jimonfin.2022.102625

Almond, R. E. A., Grooten, M., & Petersen, T. (2021). Living planet report 2020-bending the curve of biodiversity loss. *Natural Resources \& Environment*, *35*(3), 62.

Alonso-Robisco, A., & Carbó, J. M. (2023). Analysis of CBDC narrative by central banks using large language models. *Finance Research Letters*, *58*. https://doi.org/10.1016/j.frl.2023.104643

Alonso, S. L. N., Jorge-Vazquez, J., & Forradellas, R. F. R. (2020). Detection of financial inclusion vulnerable rural areas through an access to cash index: Solutions based on the pharmacy network and a CBDC. Evidence based on Ávila (Spain). *Sustainability (Switzerland)*, *12*(18). https://doi.org/10.3390/SU12187480

Alonso, S. L. N., Jorge-Vazquez, J., & Forradellas, R. F. R. (2021). Central banks

digital currency: Detection of optimal countries for the implementation of a CBDC and the implication for payment industry open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), 1–23. https://doi.org/10.3390/joitmc7010072

Alrawashdeh, N. (2023). Bibliometric Analysis on the Central Bank Digital Currency and Monetary Policy. *Journal of Logistics, Informatics and Service Science*, *10*(2), 43–58. https://doi.org/10.33168/JLISS.2023.0204

Anan, B. L., Barrett, B. A., Mahajan, B. D., & Nadeau, B. M. (2021). US digital payments : Achieving the next phase of consumer engagement. *McKinsey & Company: Banking Matters*, 1–6. https://www.mckinsey.com/industries/financial-services/our-insights/banking-matters/us-digital-payments-achieving-the-next-phase-of-consumer-engagement

Andolfatto, D. (2021). Assessing the Impact of Central Bank Digital Currency on Private Banks. *Economic Journal*, *131*(634), 525–540. https://doi.org/10.1093/ej/ueaa073

Anwer, Z., Khan, S., & Abu Bakar, M. (2020). Sharīʿah-compliant central banking practices: lessons from Muslim countries' experience. *ISRA International Journal of Islamic Finance*, *12*(1), 7–26. https://doi.org/10.1108/IJIF-01-2019-0007

Arakelian, V. (2023). Central bank digital currency challenges: The case of Greece. *Journal of Payments Strategy and Systems*, *17*(1), 36–45.

Arauz, A. (2021). The International Hierarchy of Money in Cross-Border Payment Systems: Developing Countries' Regulation for Central Bank Digital Currencies and Facebook's Stablecoin. *International Journal of Political Economy*, *50*(3), 226–243. https://doi.org/10.1080/08911916.2021.1984728

Arauz, A., Garratt, R., & Ramos F., D. F. (2021). Dinero Electrónico: The rise and fall of Ecuador's central bank digital currency. *Latin American Journal of Central Banking*, *2*(2). https://doi.org/10.1016/j.latcb.2021.100030

Arner, D., Buckley, R. P., Charamba, K., Sergeev, A., & Zetzsche, D. (2021). BigTech and Platform Finance: Governing FinTech 4.0 for Sustainable Development. *Cyberspace Law EJournal*. https://doi.org/10.2139/ssrn.3915275

Arner, D., Buckley, R. P., Zetzsche, D., & Veidt, R. (2019). Sustainability, FinTech and Financial Inclusion. *European Business Organization Law Review*, *21*, 7–35. https://doi.org/10.2139/ssrn.3387359

Auer, R., Böhme, R., Clark, J., & Demirag, D. (2022). Mapping the Privacy Landscape for Central Bank Digital Currencies. *Queue*, *20*(4), 16–38. https://doi.org/10.1145/3561796

Ayadi, A., Ghabri, Y., & Guesmi, K. (2023). Directional predictability from central bank digital currency to cryptocurrencies and stablecoins. *Research in International Business and Finance*, *65*, 101909. https://doi.org/10.1016/j.ribaf.2023.101909

Ayuandiani, W., Fausiah, Mukhram, M., Listiawati, N., & B, I. (2023). Digital Transformation in Financial Management: Security and Efficiency. *International Journal of Applied Research and Sustainable Sciences*. https://doi.org/10.59890/ijarss.v1i3.875

Aziz, M. R. A. (2022). Digital Transformation Through Islamic Digital Banking For Financial Inclusion. *Proceeding of International Conference on Science and Technology*. https://doi.org/10.36378/internationalconferenceuniks.v0i0.2818

Azzone, M., & Barucci, E. (2023). Evaluation of sight deposits and central bank digital currency. *Journal of International Financial Markets, Institutions and Money*, *88*(April), 101841. https://doi.org/10.1016/j.intfin.2023.101841

Babin, R., Smith, D., & Shah, H. (2023). Central bank digital currency: Advising the financial services industry. *Journal of Information Technology Teaching Cases*, *13*(2), 145–153. https://doi.org/10.1177/20438869221116901

Babych, O. (2023). Digitalisation Of Financial Markets, Current Issues And Challenges. *State and Regions. Series: Economics and Business*. https://doi.org/10.32782/1814-1161/2023-3-1

Baker, P. (2021). Today's blockchain use cases and industry applications. *TechTarget [Online]*. https://www.techtarget.com/searchcio/feature/Todays-blockchain-use-cases-and-industry-applications

Ballaschk, D., & Paulick, J. (2021). The public, the private and the secret: Thoughts on privacy in central bank digital currencies. *Journal of Payments Strategy and*

Systems, *15*(3), 277–286.

Banerjee, S., & Sinha, M. (2023). Promoting Financial Inclusion through Central Bank Digital Currency: An Evaluation of Payment System Viability in India. *Australasian Accounting, Business and Finance Journal*, *17*(1), 176–204. https://doi.org/10.14453/aabfj.v17i1.14

Barrdear, J., & Kumhof, M. (2022). The macroeconomics of central bank digital currencies. *Journal of Economic Dynamics and Control*, *142*, 104148. https://doi.org/10.1016/j.jedc.2021.104148

Bech, M., Boar, C., Eidan, D., Haene, P., Holden, H., & Toh, W. K. (2023). Using central bank digital currencies across borders: Lessons from practical experiments. *Journal of Payments Strategy and Systems*, *17*(1), 46–57. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85153530624&partnerID=40&md5=3c14624b9d60f664284f6ba8a1f346bd

Belke, A., & Beretta, E. (2020). From cash to central bank digital currencies and cryptocurrencies: a balancing act between modernity and monetary stability. In *Journal of Economic Studies* (Vol. 47, Issue 4). https://doi.org/10.1108/JES-07-2019-0311

Bhaskar, R., Hunjra, A. I., Bansal, S., & Pandey, D. K. (2022). Central Bank Digital Currencies: Agendas for future research. *Research in International Business and Finance*, *62*(May), 101737. https://doi.org/10.1016/j.ribaf.2022.101737

Bian, W., Ji, Y., & Wang, P. (2021). The crowding-out effect of central bank digital currencies: A simple and generalizable payment portfolio model. *Finance Research Letters*, *43*(August 2020), 1–5. https://doi.org/10.1016/j.frl.2021.102010

Bibi, S., & Canelli, R. (2023). The interpretation of CBDC within an endogenous money framework. *Research in International Business and Finance*, *65*(May 2022), 101970. https://doi.org/10.1016/j.ribaf.2023.101970

Bindseil, U. (2019). Central Bank Digital Currency: Financial System Implications and Control. *International Journal of Political Economy*, *48*(4), 303–335. https://doi.org/10.1080/08911916.2019.1693160

BNM. (2018). Implementation guide for value-based intermediation. In *Bank Negara*

Malaysia. https://www.bnm.gov.my/documents/20124/761682/Implementation+Guide+for+Value-based+Intermediation.pdf

Bolt, W., Lubbersen, V., & Wierts, P. (2022). Getting the balance right: Crypto, stablecoin and central bank digital currency. *Journal of Payments Strategy and Systems*, *16*(1), 39–50.

Boros, E., & Horváth, M. (2022). Central Bank Digital Currency: The Next Money Revolution? *Public Finance Quarterly*, *67*(4), 506–521. https://doi.org/10.35551/PFQ_2022_4_2

Chan, S. (2023). China's Central Bank Digital Currency: Impact and Policy Implications. *China: An International Journal*, *21*(3), 141–157.

Chang, T.-H., Ma, K.-M., & Chang, S.-L. (2022). Towards green growth: Industry structure and energy transition in OECD countries. *Energy \& Environment*, 0958305X221135978.

Chen, H., & Siklos, P. L. (2022). Central bank digital currency: A review and some macro-financial implications. *Journal of Financial Stability*, *60*, 100985. https://doi.org/10.1016/j.jfs.2022.100985

Cheng, P. (2023). Decoding the rise of Central Bank Digital Currency in China: designs, problems, and prospects. *Journal of Banking Regulation*, *24*(2), 156–170. https://doi.org/10.1057/s41261-022-00193-5

Chitimira, H., & Torerai, E. (2023). A regulatory analysis of digital financial services and the adoption of central bank digital currencies in Zimbabwe and South Africa. *Juridical Tribune*, *13*(3), 384–407. https://doi.org/10.24818/TBJ/2023/13/3.04

Chiu, J., Davoodalhosseini, S. M., Jiang, J., & Zhu, Y. (2023a). Bank Market Power and Central Bank Digital Currency: Theory and Quantitative Assessment. *Journal of Political Economy*, *131*(5), 1213–1248. https://doi.org/10.1086/722517

Chiu, J., Davoodalhosseini, S. M., Jiang, J., & Zhu, Y. (2023b). Bank Market Power and Central Bank Digital Currency: Theory and Quantitative Assessment. *Journal of Political Economy*, *131*(5), 1213–1248. https://doi.org/10.1086/722517

Chorzempa, M. (2021). China, the United States, and central bank digital currencies: how important is it to be first? *China Economic Journal*, *14*(1), 102–115. https://doi.org/10.1080/17538963.2020.1870278

Chu, Y., Lee, J., Kim, S., Kim, H., Yoon, Y., & Chung, H. (2022). Review of Offline Payment Function of CBDC Considering Security Requirements. *Applied Sciences (Switzerland)*, *12*(9). https://doi.org/10.3390/app12094488

Chueca Vergara, C., & Ferruz Agudo, L. (2021). Fintech and sustainability: do they affect each other? *Sustainability*, *13*(13), 7012.

Ciocoiu, C. N. (2011). Integrating Digital Economy And Green Economy: Opportunities For Sustainable Development. *Theoretical and Empirical Researches in Urban Management*, *6*, 33–43.

Cioroianu, I., Corbet, S., Larkin, C., & Oxley, L. (2023). Developing central bank digital currencies: A reality check during cryptocurrency euphoria. *Economics and Business Letters*, *12*(2), 105–114. https://doi.org/10.17811/ebl.12.2.2023.105-114

CONSENSYS. (2024). Blockchain Use Cases and Applications by Industry. In *Consensys*. https://consensys.io/blockchain-use-cases

Costa, E., & Pesci, C. (2022). Putting stakeholders at the centre: Multi-stakeholder approaches to social impact measurement. *Social Impact Measurement for a Sustainable Future: The Power of Aesthetics and Practical Implications*, 129–144.

Creutzig, F., Franzen, M., Moeckel, R., Heinrichs, D., Nagel, K., Nieland, S., & Weisz, H. (2019). Leveraging digitalization for sustainability in urban transport. *Global Sustainability*, *2*. https://doi.org/10.1017/sus.2019.11

Cukierman, A. (2020). Reflections on welfare and political economy aspects of a central bank digital currency. *Manchester School*, *88*(S1), 114–125. https://doi.org/10.1111/manc.12333

Cullen, J. (2022). "Economically inefficient and legally untenable": constitutional limitations on the introduction of central bank digital currencies in the EU. *Journal of Banking Regulation*, *23*(1), 31–41. https://doi.org/10.1057/s41261-021-00162-4

Cunha, P. R., Melo, P., & Sebastião, H. (2021). From bitcoin to central bank digital currencies: Making sense of the digital money revolution. *Future Internet*, *13*(7), 1–19. https://doi.org/10.3390/fi13070165

Daley, S. (2021). 34 Top Blockchain Applications to Know for 2022 | Built In. In *Builtin.Com*. https://builtin.com/blockchain/blockchain-applications

Dash, R., Kremer, A., & Petrov, A. (2021). *Designing next-generation credit-decisioning models*.

David Attlee. (2023). *South Korea to invite 100K citizens to test CBDC in 2024*. https://cointelegraph.com/news/south-korea-invite-100-000-citizens-test-cbdc-2024

Davoodalhosseini, S. M. (2022). Central bank digital currency and monetary policy. *Journal of Economic Dynamics and Control*, *142*. https://doi.org/10.1016/j.jedc.2021.104150

DE MELLO, J. M. P., & Kanczuk-Alfaro, I. (2022). Central Bank Digital Currency in Brazil. *Finance a Uver - Czech Journal of Economics and Finance*, *72*(3), 242–264. https://doi.org/10.32065/CJEF.2022.03.03

Deep, G. (2023). Digital transformation's impact on organizational culture. *International Journal of Science and Research Archive*. https://doi.org/10.30574/ijsra.2023.10.2.0977

Deloitte. (2023). *New Deloitte report finds digital transformation*. https://www.deloitte.com/global/en/about/press-room/new-deloitte-report-finds-digital-transformation.html

Denecker, O., d'Estienne, A., Gompertz, P. M., & Sasia, E. (2023). Central bank digital currencies: An active role for commercial banks. *Journal of Payments Strategy and Systems*, *17*(1), 26–35.

Desky, H., & Maulina, I. (2022). Digital Transformation in Islamic Banking. *International Journal of Multidisciplinary Research and Analysis*. https://doi.org/10.47191/ijmra/v5-i12-42

Dhesi, D. (2022). Taking value-based intermediation to a higher level. *The Star*. https://www.thestar.com.my/business/business-news/2022/03/21/taking-value-based-intermediation-to-a-higher-level

DIB. (2022). *Dubai Islamic Bank Joins Etisalat Digital's Blockchain Platform - UAE Trade Connect*. https://www.dib.ae/about-us/news/2022/02/01/dubai-islamic-bank-joins-etisalat-digital-s-blockchain-platform-uae-trade-connect

Didenko, A. N., & Buckley, R. P. (2022). Central bank digital currencies as a potential response to some particularly Pacific problems. *Asia Pacific Law Review*, *30*(1), 44–69. https://doi.org/10.1080/10192557.2022.2045706

Diener, F., & Špaček, M. (2021). Digital Transformation in Banking: A Managerial Perspective on Barriers to Change. *Sustainability*. https://doi.org/10.3390/SU13042032

Ding, S., Cui, T., Wu, X., & Du, M. (2022). Supply chain management based on volatility clustering: The effect of CBDC volatility. *Research in International Business and Finance*, *62*(February), 101690. https://doi.org/10.1016/j.ribaf.2022.101690

Dirie, K. A., Alam, M. M., & Maamor, S. (2023). Islamic social finance for achieving sustainable development goals: a systematic literature review and future research agenda. *International Journal of Ethics and Systems*.

Doan, Y. T. (2023). Challenges to employees in the context of digital transformation. *World Journal of Advanced Research and Reviews*. https://doi.org/10.30574/wjarr.2023.19.2.1686

Dunbar, K. (2023). CBDC uncertainty: Financial market implications. *International Review of Financial Analysis*, *87*(February), 102607. https://doi.org/10.1016/j.irfa.2023.102607

Dupuis, D., Gleason, K., & Wang, Z. (2022). Money laundering in a CBDC world: a game of cats and mice. *Journal of Financial Crime*, *29*(1), 171–184. https://doi.org/10.1108/JFC-02-2021-0035

Eichengreen, B., & Viswanath-Natraj, G. (2022). Stablecoins and Central Bank Digital Currencies: Policy and Regulatory Challenges. *Asian Economic Papers*, *21*(1), 29–46. https://doi.org/10.1162/asep_a_00843

Elsayed, A. H., & Nasir, M. A. (2022). Central bank digital currencies: An agenda for future research. *Research in International Business and Finance*, *62*, 101736. https://doi.org/10.1016/j.ribaf.2022.101736

Epstein, M. J., & McFarlan, F. W. (2011). Measuring the efficiency and effectiveness of a nonprofit's performance. *Strategic Finance*, *10*(October), 27–34.

Fadli, J. A., Hamsal, M., Rahim, R., & Furinto, A. (2023). Investigating The Adoption Factors Of Indonesia's Central Bank Digital Currency. *Quality - Access to Success*, *24*(196), 262–267. https://doi.org/10.47750/QAS/24.196.32

Fahad, S. and Bulut, M. (2024), "Central bank digital currencies: a comprehensive systematic literature review on worldwide research emergence and methods used. American Journal of Business, Vol. 39 No. 3, pp. 137-157.

Fantacci, L., & Gobbi, L. (2021). Stablecoins, Central Bank Digital Currencies and US Dollar Hegemony: The Geopolitical Stake of Innovations in Money and Payments. *Accounting, Economics and Law: A Convivium*. https://doi.org/10.1515/ael-2020-0053

Fegatelli, P. (2022). A central bank digital currency in a heterogeneous monetary union: Managing the effects on the bank lending channel. *Journal of Macroeconomics*, *71*(December 2021), 103392. https://doi.org/10.1016/j.jmacro.2021.103392

Fernández-Villaverde, J., Sanches, D., Schilling, L., & Uhlig, H. (2021). Central bank digital currency: Central banking for all? *Review of Economic Dynamics*, *41*, 225–242. https://doi.org/10.1016/j.red.2020.12.004

Feroz, A. K., Zo, H., & Chiravuri, A. (2021). Digital transformation and environmental sustainability: A review and research agenda. *Sustainability*, *13*(3), 1530.

Ferrari Minesso, M., Mehl, A., & Stracca, L. (2022). Central bank digital currency in an open economy. *Journal of Monetary Economics*, *127*, 54–68. https://doi.org/10.1016/j.jmoneco.2022.02.001

FinTech Magazine. (2024a). 2024: Digital Transformation in Financial Services Trends. *FinTech Magazine*. https://fintechmagazine.com/articles/2024-digital-transformation-financial-services-trends

FinTech Magazine. (2024b). Digital Banking Transformation: Accelerating into 2024. *FinTech Magazine*. https://fintechmagazine.com/articles/digital-banking-transformation-accelerating-into-2024

Fitrah, R., & Soemitra, A. (2022). Green Sukuk For Sustainable Development Goals

in Indonesia: A Literature Study. *Jurnal Ilmiah Ekonomi Islam*, *8*(1), 231–240.

Fonseca, G. (2019). An analysis of the legal impact of central bank digital currency on the European payments landscape. *Journal of Payments Strategy and Systems*, *13*(4), 288–299.

Foo, S. M., Ab Razak, N. H., Kamarudin, F., Azizan, N. A. B., & Zakaria, N. (2023). Islamic versus conventional financial market: a meta-literature review of spillover effects. *Journal of Islamic Accounting and Business Research*.

François, G. G. H., K, G. F., Marcelle, G. S. L., Mooney, H. A., Cropper, A., Leemans, R., Arico, S., Bridgewater, P., Peterson, G., Revenga, C., Rivera, M., Peter, A. W., Fallis, A. ., Dubay, L., Point, P., Aboutayeb, H., Mermet, L., Raphaël Billé, Maya Leroy, … Schuyt, K. (2005). Ecosystems AND HUMAN WELL-BEING: WETLANDS AND WATER - Synthesis. *Regions and Cohesion*, *13*(3), 127–137. http://berghahnjournals.com/view/journals/regions-and-cohesion/1/3/reco010305.xml

Franko, A., Olah, B., Sass, Z., Hegedus, C., & Varga, P. (2022). Towards CBDC-supported Smart Contracts for Industrial Stakeholders. *Proceedings - 2022 IEEE 5th International Conference on Industrial Cyber-Physical Systems, ICPS 2022*, *July*. https://doi.org/10.1109/ICPS51978.2022.9816857

Fuje, H., Quayyum, S., & Ouattara, F. (2022). More African Central Banks Are Exploring Digital Currencies. In *IMF Blog*. IMF BLOG. https://blogs.imf.org/2022/06/23/more-african-central-banks-are-exploring-digital-currencies/

Fujiki, H. (2023a). Attributes needed for Japan's central bank digital currency. In *Japanese Economic Review* (Vol. 74, Issue 1). Springer Singapore. https://doi.org/10.1007/s42973-021-00106-7

Fujiki, H. (2023b). Central bank digital currency, crypto assets, and cash demand: evidence from Japan. *Applied Economics*, *00*(00), 1–19. https://doi.org/10.1080/00036846.2023.2186362

Future, B. (2011). Human Development Report 2011 A Better Future for All. *Sustainability and Equity: A Better Future for All (November 2, 2011). UNDP-HDRO Human Development Reports*.

Gebayew, C., Hardini, I. R., Panjaitan, G., Kurniawan, N., & Suhardi. (2018). A Systematic Literature Review on Digital Transformation. *2018 International Conference on Information Technology Systems and Innovation (ICITSI)*, 260–265. https://doi.org/10.1109/ICITSI.2018.8695912

Gils, B. V, & Weigand, H. (2020). Towards Sustainable Digital Transformation. *2020 IEEE 22nd Conference on Business Informatics (CBI)*, *1*, 104–113. https://doi.org/10.1109/CBI49978.2020.00019

Gomber, P., Koch, J.-A., & Siering, M. (2017). Digital Finance and FinTech: current research and future research directions. *Journal of Business Economics*, *87*, 537–580.

Gomez-Trujillo, A. M., & Gonzalez-Perez, M. (2021). Digital transformation as a strategy to reach sustainability. *Smart and Sustainable Built Environment*. https://doi.org/10.1108/SASBE-01-2021-0011

Gonçalves, M. J. A., da Silva, A. C. F., & Ferreira, C. G. (2022). The future of accounting: how will digital transformation impact the sector? *Informatics*, *9*(1), 19.

Gong, C., & Ribière, V. (2021). Developing a unified definition of digital transformation. *Technovation*, *102*, 102217. https://doi.org/10.1016/j.technovation.2020.102217

Grodecka-Messi, A., & Zhang, X. (2023). Private bank money vs central bank money: A historical lesson for CBDC introduction. *Journal of Economic Dynamics and Control*, *154*. https://doi.org/10.1016/j.jedc.2023.104707

Groenfeldt, T. (2021). Growth of Digital Wallets and Contactless Payments Set to Explode. *The Financial Brand*. https://thefinancialbrand.com/news/payments-trends/growth-digital-wallets-contactless-payments-data-108592/

Gulzhan Musaeva. (2020). Value-based intermediation: Remaking Islamic finance to parallel sustainable finance. *Eco-Business*. https://www.eco-business.com/opinion/value-based-intermediation-remaking-islamic-finance-to-parallel-sustainable-finance/

Gupta, M., Taneja, S., Sharma, V., Singh, A., Rupeika-Apoga, R., & Jangir, K. (2023). Does Previous Experience with the Unified Payments Interface (UPI) Affect the

Usage of Central Bank Digital Currency (CBDC)? *Journal of Risk and Financial Management*, *16*(6). https://doi.org/10.3390/jrfm16060286

Gupya, O. (2023). Digital Transformation in Supply Chain India: Challenges and Opportunities. *PsychologyandEducation*. https://doi.org/10.48047/pne.2018.55.1.52

Hajishirzi, R., & Costa, C. J. (2021). Artificial Intelligence as the core technology for the Digital Transformation process. *2021 16th Iberian Conference on Information Systems and Technologies (CISTI)*, 1–6. https://doi.org/10.23919/CISTI52073.2021.9476607

Han, Y., Li, Y., & Wang, Q. (2023). Digital finance, environmental regulation, and green development efficiency of China. *Frontiers in Environmental Science*, *11*. https://doi.org/10.3389/fenvs.2023.1131058

Harahap, B., Risfandy, T., & Futri, I. N. (2023). Islamic Law, Islamic Finance, and Sustainable Development Goals: A Systematic Literature Review. *Sustainability (Switzerland)*, *15*(8). https://doi.org/10.3390/su15086626

Hassan, M., Banna, H., & Alam, M. (2020). Digital Financial Inclusion, Islamic Banking Stability and Sustainable Economic Growth. *Islamic Perspective for Sustainable Financial System*. https://doi.org/10.26650/b/ss10.2020.017.06

Hassan, M. K., Saraç, M., & Khan, A. (2021). *Islamic finance and sustainable development*. Springer.

Helmi, M. H., Çatık, A. N., & Akdeniz, C. (2023). The impact of central bank digital currency news on the stock and cryptocurrency markets: Evidence from the TVP-VAR model. *Research in International Business and Finance*, *65*, 101968. https://doi.org/10.1016/j.ribaf.2023.101968

Hoang, Y. H., Ngo, V. M., & Bich Vu, N. (2023a). Central bank digital currency: A systematic literature review using text mining approach. *Research in International Business and Finance*, *64*(May 2022), 101889. https://doi.org/10.1016/j.ribaf.2023.101889

Hoang, Y. H., Ngo, V. M., & Bich Vu, N. (2023b). Central bank digital currency: A systematic literature review using text mining approach. *Research in International Business and Finance*, *64*, 101889.

https://doi.org/10.1016/j.ribaf.2023.101889

Horváth, G. (2022). Monetary Sovereignty and Central Bank Digital Currency. *Public Finance Quarterly*, *67*(4), 539–552. https://doi.org/10.35551/PFQ_2022_4_4

Hu, C., Wu, C., & Yu, L. (2023). Challenges and Opportunities of Digital Transformation in Enterprises. *Accounting and Corporate Management*. https://doi.org/10.23977/acccm.2023.051201

IEA. (2020). Energy Technology Perspectives 2020. In *Energy Technology Perspectives 2020*. https://doi.org/10.1787/ab43a9a5-en

IFN News. (2023). Value-based intermediation via digital platform. *IFN News*. https://www.islamicfinancenews.com/value-based-intermediation-via-digital-platform.html

Indriasari, E., Gaol, F., & Matsuo, T. (2019). Digital Banking Transformation: Application of Artificial Intelligence and Big Data Analytics for Leveraging Customer Experience in the Indonesia Banking Sector. *2019 8th International Congress on Advanced Applied Informatics (IIAI-AAI)*, 863–868. https://doi.org/10.1109/IIAI-AAI.2019.00175

Inozemtsev, M. I., Sidorenko, E. L., & Khisamova, Z. I. (2022). The Platform Economy: Designing a Supranational Legal Framework. In *The Platform Economy: Designing a Supranational Legal Framework*. https://doi.org/10.1007/978-981-19-3242-7

IPCC. (2021). *Climate Change 2021: The Physical Science Basis*. http://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport.pdf

IsDB. (2020). *2020 ANNUAL REPORT RESPOND, RESTORE, RESTART: POST-COVID RESILIENCE AND PROSPERITY FOR ALL*. https://www.isdb.org

Islam, M. M., & In, H. P. (2023). A Privacy-Preserving Transparent Central Bank Digital Currency System Based on Consortium Blockchain and Unspent Transaction Outputs. *IEEE Transactions on Services Computing*, *16*(4), 2372–2386. https://doi.org/10.1109/TSC.2022.3226120

Iwańczuk-Kaliska, A. (2023). Potential Implications of Retail Central Bank Digital Currency for Banking Systems Identified in the Literature and by Central Banks.

Accounting, Economics and Law: A Convivium. https://doi.org/10.1515/ael-2022-0005

Jabbar, A., Geebren, A., Hussain, Z., Dani, S., & Ul-Durar, S. (2023). Investigating individual privacy within CBDC: A privacy calculus perspective. *Research in International Business and Finance*, *64*(May 2022), 101826. https://doi.org/10.1016/j.ribaf.2022.101826

Jeronen, E. (2022). Education for sustainable development. In *Encyclopedia of Sustainable Management* (pp. 1–10). Springer.

Jewapatarakul, D., & Ueasangkomsate, P. (2022). Digital Transformation: The Challenges for Manufacturing and Service Sectors. *2022 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT & NCON)*, 19–23. https://doi.org/10.1109/ECTIDAMTNCON53731.2022.9720411

Jin, S. Y., & Xia, Y. (2022). CEV Framework: A Central Bank Digital Currency Evaluation and Verification Framework With a Focus on Consensus Algorithms and Operating Architectures. *IEEE Access*, *10*, 63698–63714. https://doi.org/10.1109/ACCESS.2022.3183092

Jun, J., & Yeo, E. (2021). Central bank digital currency, loan supply, and bank failure risk: a microeconomic approach. *Financial Innovation*, *7*(1). https://doi.org/10.1186/s40854-021-00296-4

Kaczmarek, P. (2022). Central Bank Digital Currency: Scenarios of Implementation and Potential Consequences for Monetary System. *Journal of Central Banking Theory and Practice*, *11*(3), 137–154. https://doi.org/10.2478/jcbtp-2022-0027

Kamdzhalov, M. (2020). Islamic Finance and the New Technology Challenges. *European Journal of Islamic Finance*, *May 2020*, 1–5. https://doi.org/10.13135/2421-2172/3813

Karau, S. (2023). Central bank digital currency competition and the impossible trinity. *Finance Research Letters*, *54*, 103723. https://doi.org/10.1016/j.frl.2023.103723

Kathy Charmaz. (2014). Constructing Grounded Theory research. *NLN Publications*, *15–2233*, 33–59.

Katsamakas, E. (2022). Digital Transformation and Sustainable Business Models. *Sustainability*. https://doi.org/10.3390/su14116414

Keister, T., & Monnet, C. (2022). Central bank digital currency: Stability and information. *Journal of Economic Dynamics and Control*, *142*, 104501. https://doi.org/10.1016/j.jedc.2022.104501

Keshminder, J. S., Abdullah, M. S., & Mardi, M. (2022). Green sukuk – Malaysia surviving the bumpy road: performance, challenges and reconciled issuance framework. *Qualitative Research in Financial Markets*, *14*(1), 76–94. https://doi.org/10.1108/QRFM-04-2021-0049

KHAMIS, M. S. (2023). Green Sukuk or Green Bonds: A Comparative Study of Diversification and Hedging Prospects. *Bait Al-Mashura Journal*, *20*.

Khan, K. I., Mata, M. N., Martins, J. M., Nasir, A., Dantas, R. M., Correia, A. B., & Saghir, M. U. (2022). Impediments of Green Finance Adoption System: Linking Economy and Environment. *Emerging Science Journal*, *6*(2), 217–237. https://doi.org/10.28991/ESJ-2022-06-02-02

Khiaonarong, T., & Humphrey, D. (2019). Cash use across countries and the demand for central bank digital currency. *Journal of Payments Strategy and Systems*, *13*(1), 32–46. https://doi.org/10.5089/9781484399606.001

Kim, J. J., Kim, S., Hailu, T. B., Ryu, H. B., & Han, H. (2023). Does Central Bank Digital Currency (CBDC) Payment Create The Opportunity For the Tourism Industry? *Journal of Hospitality and Tourism Research*. https://doi.org/10.1177/10963480231158773

Kim, Y. S., & Kwon, O. (2023). Central Bank Digital Currency, Credit Supply, and Financial Stability. *Journal of Money, Credit and Banking*, *55*(1), 297–321. https://doi.org/10.1111/jmcb.12913

Kochergin, D. A., & Yangirova, A. I. (2019). Central bank digital currencies: Key characteristics and directions of influence on monetary and credit and payment systems. *Finance: Theory and Practice*, *23*(4), 80–98. https://doi.org/10.26794/2587-5671-2019-23-4-80-98

Kóczián, B., Kollarik, A., Kiss, L., & Simon, P. (2022). Central Bank Digital Currency: A New Instrument of Monetary Policy. *Public Finance Quarterly*,

67(4), 522–538. https://doi.org/10.35551/PFQ_2022_4_3

Kosov, M., Borisova, L., Popkov, S., Kiseleva, T., Ponkratov, V., Volkova, M., Vatutina, L., Kuznetsov, N., Dzusova, S., & Mazzorana, F. (2023). Effects of the Development of Central Bank Digital Currencies on Financial Markets amid the Pandemic. *Emerging Science Journal*, *7*(Special issue), 186–200. https://doi.org/10.28991/ESJ-2023-SPER-013

Kosse, A., & Szemere, R. (2021). Covid-19 accelerated the digitalisation of payments. *Commentary on the BIS Committee on Payments and Market Infrastructures (CPMI)*.

Koziuk, V., & Ivashuk, Y. (2022). Does it Matter for CBDC Design? Privacy-Anonymity Preferences from the Side of Hierarchies and Egalitarian Cultural Patterns. *ECONOMICS - Innovative and Economics Research Journal*, *10*(1), 35–54. https://doi.org/10.2478/eoik-2022-0008

Kroculick, J. (2022). Enabling Green Digital Transformation through a Sustainable Systems Engineering Leadership Model. *INCOSE International Symposium*, *32*. https://doi.org/10.1002/iis2.12896

Kuehnlenz, S., Orsi, B., & Kaltenbrunner, A. (2023). Central bank digital currencies and the international payment system: The demise of the US dollar? *Research in International Business and Finance*, *64*, 101834. https://doi.org/10.1016/j.ribaf.2022.101834

Kwon, O., Lee, S., & Park, J. (2022). Central bank digital currency, tax evasion, and inflation tax. *Economic Inquiry*, *60*(4), 1497–1519. https://doi.org/10.1111/ecin.13091

Laband, J. (2022). Existential Threat or Digital Yawn: Evaluating China's Central Bank Digital Currency. *Harvard International Law Journal*, *63*(2), 515–559. https://doi.org/10.2139/ssrn.3990141

Laboure, M., H.-P. Müller, M., Heinz, G., Singh, S., & Köhling, S. (2021). Cryptocurrencies and CBDC: The Route Ahead. *Global Policy*, *12*(5), 663–676. https://doi.org/10.1111/1758-5899.13017

Le, T. D. Q., Tran, S. H., Nguyen, D. T., & Ngo, T. (2023). The degrees of central bank digital currency adoption across countries: A preliminary analysis.

Economics and Business Letters, *12*(2), 97–104. https://doi.org/10.17811/ebl.12.2.2023.97-104

Lee, C. C., Wang, C. W., Hsieh, H. Y., & Chen, W. L. (2023). The impact of central bank digital currency variation on firm's implied volatility. *Research in International Business and Finance*, *64*, 101878. https://doi.org/10.1016/j.ribaf.2023.101878

Lee, D. K. C., Yan, L., & Wang, Y. (2021). A global perspective on central bank digital currency. *China Economic Journal*, *14*(1), 52–66. https://doi.org/10.1080/17538963.2020.1870279

Lee, S., Lee, J. W., & Park, W. Y. (2023). CBDC and its Implications for Reserve Markets and Central Bank Balance Sheets. *Journal of Economic Theory and Econometrics*, *34*(1), 84–117.

Lee, Y., Son, B., Jang, H., Byun, J., Yoon, T., & Lee, J. (2021). Atomic cross-chain settlement model for central banks digital currency. *Information Sciences*, *580*, 838–856. https://doi.org/10.1016/j.ins.2021.09.040

Lee, Y., Son, B., Park, S., Lee, J., & Jang, H. (2021). A survey on security and privacy in blockchain-based central bank digital currencies. *Journal of Internet Services and Information Security*, *11*(3), 16–29. https://doi.org/10.22667/JISIS.2021.08.31.016

Leinonen, H. (2023). Wholesale central bank digital currency vs traditional real-time gross settlement: Benefits beyond a new acronym? *Journal of Payments Strategy and Systems*, *17*(1), 68–85.

Lewis, S. (2015). Qualitative Inquiry and Research Design: Choosing Among Five Approaches. In *Health Promotion Practice* (Vol. 16, Issue 4). Sage publications. https://doi.org/10.1177/1524839915580941

Li, D., Wong, W. E., Pan, S., Koh, L. S., & Chau, M. (2021). Design principles and best practices of central bank digital currency. *International Journal of Performability Engineering*, *17*(5), 411–421. https://doi.org/10.23940/ijpe.21.05.p1.411421

Li, J. (2023). Predicting the demand for central bank digital currency: A structural analysis with survey data. *Journal of Monetary Economics*, *134*, 73–85.

https://doi.org/10.1016/j.jmoneco.2022.11.007

Li, J., Huang, X., Wu, C., Yang, Y., Zhang, D., Bai, X., Li, F., & Sun, Y. (2020). How Can Blockchain Shape Digital Transformation: A Scientometric Analysis and Review for Financial Services. *2020 Management Science Informatization and Economic Innovation Development Conference (MSIEID)*, 264–267. https://doi.org/10.1109/MSIEID52046.2020.00054

Li, S., & Huang, Y. (2021). The genesis, design and implications of China's central bank digital currency. *China Economic Journal*, *14*(1), 67–77. https://doi.org/10.1080/17538963.2020.1870273

Li, W., & Huang, Z. (2023). Do different stock indices volatility respond differently to Central bank digital currency signals? *Electronic Research Archive*, *31*(9), 5573–5588. https://doi.org/10.3934/era.2023283

Li, Z., Yang, C., & Huang, Z. (2022). How does the fintech sector react to signals from central bank digital currencies? *Finance Research Letters*, *50*, 103308. https://doi.org/10.1016/j.frl.2022.103308

Li, Z., Zhang, Y., Wang, Q., & Chen, S. (2022). Transactional Network Analysis and Money Laundering Behavior Identification of Central Bank Digital Currency of China. *Journal of Social Computing*, *3*(3), 219–230. https://doi.org/10.23919/JSC.2022.0011

Lin, Z., & Chen, C. H. (2023). The influence of dynamic page interaction and multimodal operation feedback on the user experience of central bank digital currency. *Displays*, *80*(May), 102516. https://doi.org/10.1016/j.displa.2023.102516

Liu, F. H. M., & Lai, K. P. Y. (2021). Ecologies of green finance: Green sukuk and development of green Islamic finance in Malaysia. *Environment and Planning A*, *53*(8), 1896–1914. https://doi.org/10.1177/0308518X211038349

Liu, X., Wang, Q., Wu, G., & Zhang, C. (2022). Determinants of individuals' intentions to use central bank digital currency: evidence from China. *Technology Analysis and Strategic Management*, 1–15. https://doi.org/10.1080/09537325.2022.2131517

Liu, Y., Li, J., Qu, T., & Dai, Z. (2023). CBDC-PUF: A Novel Physical Unclonable

Function Design Framework Utilizing Configurable Butterfly Delay Chain Against Modeling Attack. *ACM Transactions on Design Automation of Electronic Systems*, *28*(5), 1–17. https://doi.org/10.1145/3588435

Lloyd, M. (2022). The Future of Money: Central Bank Digital Currencies. *Atlantic Economic Journal*, *50*(3–4), 85–98. https://doi.org/10.1007/s11293-022-09748-3

Luu, H. N., Do, D. D., Pham, T., Ho, V. X., & Dinh, Q. A. (2023). Cultural values and the adoption of central bank digital currency. *Applied Economics Letters*, *30*(15), 2024–2029. https://doi.org/10.1080/13504851.2022.2089342

Luu, H. N., Nguyen, C. P., & Nasir, M. A. (2023). Implications of central bank digital currency for financial stability: Evidence from the global banking sector. *Journal of International Financial Markets, Institutions and Money*, *89*(December 2022), 101864. https://doi.org/10.1016/j.intfin.2023.101864

Ma, C., Jin, Z., Mei, Z., Zhou, F., She, X., Huang, J., & Liu, D. (2022). Internet of Things Background: An Empirical Study on the Payment Intention of Central Bank Digital Currency Design. *Mobile Information Systems*, *2022*. https://doi.org/10.1155/2022/4846372

MacArthur, E., & others. (2013). Towards the circular economy. *Journal of Industrial Ecology*, *2*(1), 23–44.

Maruo, Y., & Sugino, S. (2023a). Balancing privacy and data use: The potential impact of large online platforms and central bank digital currencies. *Journal of Payments Strategy and Systems*, *17*(2), 142–150. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85163581701&partnerID=40&md5=621abba0945df1c3326995afd454cd0b

Maruo, Y., & Sugino, S. (2023b). Balancing privacy and data use: The potential impact of large online platforms and central bank digital currencies. *Journal of Payments Strategy and Systems*, *17*(2), 142–150.

Maryaningsih, N., Nazara, S., Kacaribu, F. N., & Juhro, S. M. (2022). Central Bank Digital Currency: What Factors Determine Its Adoption? *Buletin Ekonomi Moneter Dan Perbankan*, *25*(2), 1–24. https://doi.org/10.21098/bemp.v25i1.1979

Mavlutova, I., Volkova, T., Natrins, A., Spilbergs, A., Arefjevs, I., & Miahkykh, I.

(2021). Financial Sector Transformation In The Era Of Digitalization. *Estudios de Economia Aplicada*, *38*. https://doi.org/10.25115/EEA.V38I4.4055

Meaning, J., Dyson, B., Barker, J., & Clayton, E. (2021). Broadening narrow money: Monetary policy with a central bank digital currency. *International Journal of Central Banking*, *17*(2), 1–42. https://doi.org/10.2139/ssrn.3180720

Mićić, L. (2017). Digital Transformation and Its Influence on GDP. *ECONOMICS - Innovative and Economics Research Journal*, *5*(2), 135–147. https://doi.org/10.1515/eoik-2017-0028

Miller, L. (2015). Value Creation: Role of values in improving organizational performance. *Leon Miller ERUDITIO*, *1*(6), 55–67.

Mir, A. A., & Bhat, A. (2022). Green banking and sustainability – a review. *Arab Gulf Journal of Scientific Research*. https://doi.org/10.1108/agjsr-04-2022-0017

Miroshnichenko, O. S., & Brand, N. A. (2021). Banks financing the green economy: A review of current research. *Finance: Theory and Practice*, *25*(2), 76–95. https://doi.org/10.26794/2587-5671-2021-25-2-76-95

Mohammed, M. A., De-Pablos-Heredero, C., & Montes Botella, J. L. (2023). Exploring the Factors Affecting Countries' Adoption of Blockchain-Enabled Central Bank Digital Currencies. *Future Internet*, *15*(10), 1–14. https://doi.org/10.3390/fi15100321

Mondejar, M., Avtar, R., Diaz, H. L. B., Dubey, R., Esteban, J., Gómez-Morales, A., Hallam, B., Mbungu, N. T., Okolo, C., Prasad, K. A., She, Q., & Garcia-Segura, S. (2021). Digitalization to achieve sustainable development goals: Steps towards a Smart Green Planet. *The Science of the Total Environment*, *794*, 148539. https://doi.org/10.1016/j.scitotenv.2021.148539

Mooij, A. M. (2023). A digital euro for everyone: Can the European System of Central Banks introduce general purpose CBDC as part of its economic mandate? *Journal of Banking Regulation*, *24*(1), 89–104. https://doi.org/10.1057/s41261-021-00186-w

Morales-Resendiz, R., Ponce, J., Picardo, P., Velasco, A., Chen, B., Sanz, L., Guiborg, G., Segendorff, B., Vasquez, J. L., Arroyo, J., Aguirre, I., Haynes, N., Panton, N., Griffiths, M., Pieterz, C., & Hodge, A. (2021). Implementing a retail CBDC:

Lessons learned and key insights. *Latin American Journal of Central Banking*, *2*(1), 100022. https://doi.org/10.1016/j.latcb.2021.100022

Morgan, J. (2022). Systemic stablecoin and the defensive case for Central Bank Digital Currency: A critique of the Bank of England's framing. *Research in International Business and Finance*, *62*, 101716. https://doi.org/10.1016/j.ribaf.2022.101716

Msamula, J., Vanhaverbeke, W., & Tutuba, N. B. (2018). Influence of institutions on value creation activities of micro and small enterprises in rural Tanzania. *Afrika Focus*, *31*(1), 187–211. https://doi.org/10.21825/af.v31i1.9046

Mukesh, D., Sangeetha, S., & Latha, A. (2023). Sentimental Analysis of CBDC Tweets Using Machine Learning and Deep Learning Techniques. *2nd International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation, ICAECA 2023*, 1–6. https://doi.org/10.1109/ICAECA56562.2023.10199561

Murshed, M., Alam, R., & Ansarin, A. (2021). The environmental Kuznets curve hypothesis for Bangladesh: the importance of natural gas, liquefied petroleum gas, and hydropower consumption. *Environmental Science and Pollution Research*, *28*(14), 17208–17227.

Murshed, M., Ali, S. R., Haseeb, M., & Nathaniel, S. P. (2021). Modelling the public moral hazard problem of international remittance inflows in Bangladesh. *International Journal of Sustainable Economy*, *13*(2), 166–196.

Mzoughi, H., Benkraiem, R., & Guesmi, K. (2022). The bitcoin market reaction to the launch of central bank digital currencies. *Research in International Business and Finance*, *63*, 101800. https://doi.org/10.1016/j.ribaf.2022.101800

Nabilou, H. (2020). Testing the waters of the Rubicon: the European Central Bank and central bank digital currencies. *Journal of Banking Regulation*, *21*(4), 299–314. https://doi.org/10.1057/s41261-019-00112-1

Nathaniel, S., Anyanwu, O., & Shah, M. (2020). Renewable energy, urbanization, and ecological footprint in the Middle East and North Africa region. *Environmental Science and Pollution Research*, *27*, 14601–14613.

Nathaniel, S., Nwodo, O., Sharma, G., & Shah, M. (2020). Renewable energy, urbanization, and ecological footprint linkage in CIVETS. *Environmental*

Science and Pollution Research, *27*, 19616–19629.

Nathaniel, S. P. (2021). Ecological footprint and human well-being nexus: accounting for broad-based financial development, globalization, and natural resources in the Next-11 countries. *Future Business Journal*, *7*(1), 1–18.

Ngo, V. M., Van Nguyen, P., Nguyen, H. H., Thi Tram, H. X., & Hoang, L. C. (2023). Governance and monetary policy impacts on public acceptance of CBDC adoption. *Research in International Business and Finance*, *64*(December 2022), 101865. https://doi.org/10.1016/j.ribaf.2022.101865

Nguyen, D. T., Nguyen, M. N., & Duong, K. T. (2023). The impact of CBDC adoption on bank liquidity risk: evidence from the global banking sector. *Applied Economics Letters*, *00*(00), 1–6. https://doi.org/10.1080/13504851.2023.2259595

Niepelt, D. (2020). Reserves for all? Central bank digital currency, deposits, and their (non)-equivalence. *International Journal of Central Banking*, *16*(3), 211–238. https://doi.org/10.2139/ssrn.3254206

Oberer, B. J., & Erkollar, A. (2023). Industry 5.0: Guidelines to Digital Transformation as a Strategy for Sustainability. *Strengthening Resilience by Sustainable Economy and Business - towards the SDGs*. https://doi.org/10.18690/um.epf.3.2023.34

Oberle, B., Bringezu, S., Hatfield-Dodds, S., Hellweg, S., Schandl, H., & Clement, J. (2019). *Global resources outlook: 2019*. International Resource Panel, United Nations Envio, Paris, France.

Oh, E. Y., & Zhang, S. (2022). Informal economy and central bank digital currency. *Economic Inquiry*, *60*(4), 1520–1539. https://doi.org/10.1111/ecin.13105

Ohri, N., & Dayal, S. (2023). *India central bank plans to widen use of digital currency*. https://www.reuters.com/world/india/india-cenbank-planning-introduce-wholesale-digital-currency-2023-09-05/

Opare, E. A., & Kim, K. (2020). A Compendium of Practices for Central Bank Digital Currencies for Multinational Financial Infrastructures. *IEEE Access*, *8*, 110810–110847. https://doi.org/10.1109/ACCESS.2020.3001970

Outlook Money Team. (2022). Jamaica Launches “Jam-Dex”, Becomes First Nation

To Legalise Digital Currency. *Outlook Money Team*. https://business.outlookindia.com/news/jamaica-launches-jam-dex-becomes-first-nation-to-legalise-digital-currency-news-201592

Ozili, P. K. (2022). Circular Economy and Central Bank Digital Currency. *Circular Economy and Sustainability*, *2*(4), 1501–1516. https://doi.org/10.1007/s43615-022-00170-0

Ozili, P. K. (2023a). CBDC, Fintech and cryptocurrency for financial inclusion and financial stability. *Digital Policy, Regulation and Governance* , *25*(1), 40–57. https://doi.org/10.1108/DPRG-04-2022-0033

Ozili, P. K. (2023b). Central bank digital currency and bank earnings management using loan loss provisions. *Digital Policy, Regulation and Governance* , *25*(3), 206–220. https://doi.org/10.1108/DPRG-11-2022-0139

Ozili, P. K. (2023c). Central bank digital currency in India: The case for a digital Rupee. In *Revolutionizing Financial Services and Markets Through FinTech and Blockchain* (pp. 1–14). IGI Global. https://doi.org/10.4018/978-1-6684-8624-5.ch001

Ozturkcan, S., Senel, K., & Ozdinc, M. (2022). Framing the Central Bank Digital Currency (CBDC) revolution. *Technology Analysis and Strategic Management*, *0*(0), 1–18. https://doi.org/10.1080/09537325.2022.2099261

Panwar, P., & Agarwal, S. (2023). Central Bank Digital Currency Engagement Research Based on Project Index and Use of Distributed Ledger Technology To Enable Digital Currency. *Journal of Theoretical and Applied Information Technology*, *101*(4), 1194–1204.

Peruffo, L., Cunha, A. M., & Ferrari Haines, A. E. (2023). China's central bank digital currency (CBDC): an assessment of money and power relations. *New Political Economy*, *28*(6), 881–896. https://doi.org/10.1080/13563467.2023.2196064

Pocher, N., & Zichichi, M. (2022). Towards CBDC-based machine-to-machine payments in consumer IoT. *Proceedings of the ACM Symposium on Applied Computing*, 308–315. https://doi.org/10.1145/3477314.3507078

Pousttchi, K., Gleiss, A., Buzzi, B., & Kohlhagen, M. (2019). Technology Impact Types for Digital Transformation. *2019 IEEE 21st Conference on Business*

Informatics (CBI), *01*, 487–494. https://doi.org/10.1109/CBI.2019.00063

Qian, Y. (2019). Central Bank Digital Currency: optimization of the currency system and its issuance design. *China Economic Journal*, *12*(1), 1–15. https://doi.org/10.1080/17538963.2018.1560526

Radic, A., Quan, W., Koo, B., Chua, B. L., Kim, J. J., & Han, H. (2022). Central bank digital currency as a payment method for tourists: application of the theory of planned behavior to digital Yuan/Won/Dollar choice. *Journal of Travel and Tourism Marketing*, *39*(2), 152–172. https://doi.org/10.1080/10548408.2022.2061677

Raymond, M. I., Almajali, D., Abu-AlSondos, I., Alkhwaldi, A., & Al-Gasaymeh, A. (2023). Digital Transformation and its Impact on Operational Efficiency and Competitive Advantage in Islamic Banks. *2023 International Conference on Business Analytics for Technology and Security (ICBATS)*, 1–6. https://doi.org/10.1109/ICBATS57792.2023.10111266

Rehman, M. A., Irfan, M., Naeem, M. A., Lucey, B. M., & Karim, S. (2023). Macro-financial implications of central bank digital currencies. *Research in International Business and Finance*, *64*(April 2022), 101892. https://doi.org/10.1016/j.ribaf.2023.101892

Ren, D., Guo, H., & Jiang, T. (2023). Managed anonymity of CBDC, social welfare and taxation: A new monetarist perspective. *Applied Economics*, *55*(42), 4990–5011. https://doi.org/10.1080/00036846.2022.2133896

Rennie, E., & Steele, S. (2021). Privacy and Emergency Payments in a Pandemic: How to Think about Privacy and a Central Bank Digital Currency. *Law, Technology and Humans*, *3*(1), 6–17. https://doi.org/10.5204/lthj.1745

Rösl, G., & Seitz, F. (2022). Central Bank Digital Currency and Cash in the Euro Area: Current Developments and one Specific Proposal. *Credit and Capital Markets*, *55*(4), 523–551. https://doi.org/10.3790/ccm.55.4.523

Rupeika-Apoga, R., & Petrovska, K. (2022). Barriers to Sustainable Digital Transformation in Micro-, Small-, and Medium-Sized Enterprises. *Sustainability*. https://doi.org/10.3390/su142013558

Sahabuddin, M., Muhammad, J., Yahya, M. H., Shah, S. M., & Kausar Alam, M.

(2019). Digitalization, Innovation and Sustainable Development: An Evidence of Islamic Finance Perspective. *International Journal of Asian Social Science*, *9*(12), 651–656. https://doi.org/10.18488/journal.1.2019.912.651.656

Sakharov, D. M. (2021). Central bank digital currencies: Key aspects and impact on the financial system. *Finance: Theory and Practice*, *25*(5), 133–149. https://doi.org/10.26794/2587-5671-2021-25-5-133-149

Salmony, M. (2023). Chief Executive Officer, Payments Innovation Consulting, Germany. *Journal of Payments Strategy & Systems*, *17*(1), 8–25.

Sandhu, K., Dayanandan, A., & Kuntluru, S. (2023). India's CBDC for digital public infrastructure. *Economics Letters*, *231*, 111302. https://doi.org/10.1016/j.econlet.2023.111302

Sarmiento, A. (2022). Seven lessons from the e-Peso pilot plan: The possibility of a Central Bank Digital Currency. *Latin American Journal of Central Banking*, *3*(2), 100062. https://doi.org/10.1016/j.latcb.2022.100062

Scarcella, L. (2021). The implications of adopting a European Central Bank Digital Currency: A Tax Policy Perspective. *EC Tax Review*, *30*(4), 177–188. https://doi.org/10.54648/ecta2021019

Scardovi, C. (2017). Digital transformation in financial services. In *Digital Transformation in Financial Services* (pp. 1–236). https://doi.org/10.1007/978-3-319-66945-8

Sekaran, U., & Bougie, R. (1993). Research methods for business: A skill building approach. In *Long Range Planning* (Vol. 26, Issue 2). john wiley \& sons. https://doi.org/10.1016/0024-6301(93)90168-f

Sendjaja, T., Zainal, V. R., Imaningsih, E. S., Nawangsari, L. C., & Lo, S. J. (2012). Digital Bank Transformation: Sustainable Innovation in Financial Institutions. *Journal of World Science*. https://doi.org/10.58344/jws.v1i12.136

Sethaput, V., & Innet, S. (2023). Blockchain application for central bank digital currencies (CBDC). *Cluster Computing*, *26*(4), 2183–2197. https://doi.org/10.1007/s10586-022-03962-z

Sharon B, M. (2009). Qualitative research: A guide to design and implementation. In *The JosseyBass higher and adult education series* (Vol. 22, Issue 1). John Wiley

\& Sons. http://acc.aacnjournals.org/cgi/doi/10.1097/NCI.0b013e3181edd9b1

Shen, W., & Hou, L. (2021). China's central bank digital currency and its impacts on monetary policy and payment competition: Game changer or regulatory toolkit? *Computer Law and Security Review*, *41*, 105577. https://doi.org/10.1016/j.clsr.2021.105577

Shyriaieva, N., & Adamkevych, A. (2021). THE CONCEPT OF DIGITALIZATION AND USAGE IT SOLUTIONS IN FINANCIAL SECTOR. *Market Infrastructure*. https://doi.org/10.32843/infrastruct60-29

Simonyan, A. S., & Solntsev, A. M. (2010). The International renewable energy agency (IRENA). *Международное Право*, *43*(3), 61a--61a.

Singh, S., Gupta, S., Kaur, S., Sapra, S., Kumar, V., & Sharma, M. (2023). The quest for CBDC: indentifying and prioritising the motivations for launching central bank digital currencies in emerging countries. *Quality and Quantity*, *57*(5), 4493–4508. https://doi.org/10.1007/s11135-022-01558-8

Siu, R. C. S. (2023). Social, Political, and Economic Dimensions of the Instituted Process of Central Bank Digital Currency: The Case of the Digital Yuan. *Journal of Economic Issues*, *57*(2), 458–465. https://doi.org/10.1080/00213624.2023.2201610

Solberg Söilen, K., & Benhayoun, L. (2022). Household acceptance of central bank digital currency: the role of institutional trust. *International Journal of Bank Marketing*, *40*(1), 172–196. https://doi.org/10.1108/IJBM-04-2021-0156

Son, J., Ryu, D., & Webb, R. I. (2023). Central bank digital currency: Payment choices and commercial bank profitability. *International Review of Financial Analysis*, *90*(March), 102874. https://doi.org/10.1016/j.irfa.2023.102874

Souissi, S. Ben, & Nabi, M. S. (2023). Could the Issuance of CBDC Reduce the Likelihood of Banking Panic?1. *Journal of Central Banking Theory and Practice*, *12*(2), 83–101. https://doi.org/10.2478/jcbtp-2023-0015

Stake, R. E. (2005). *Qualitative case studies.*

Syarifuddin, F., & Bakhtiar, T. (2022). The Macroeconomic Effects of an Interest-Bearing CBDC: A DSGE Model. *Mathematics*, *10*(10), 1–33. https://doi.org/10.3390/math10101671

Taka, M. E., & Bayarçelik, E. B. (2023). Sustainable digital transformation of financial institutions. *Business & Management Studies: An International Journal*. https://doi.org/10.15295/bmij.v11i1.2181

Takaragi, K., Kubota, T., Wohlgemuth, S., Umezawa, K., & Koyanagi, H. (2023). Secure Revocation Features in eKYC - Privacy Protection in Central Bank Digital Currency. *IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences*, *106 EA*(3), 325–332. https://doi.org/10.1587/transfun.2022CIP0008

Tang, D., Chen, W., Zhang, Q., & Zhang, J. (2023). Impact of Digital Finance on Green Technology Innovation: The Mediating Effect of Financial Constraints. *Sustainability*, *15*(4), 3393.

Tata, F. (2023). Proposing an interval design feature to Central Bank Digital Currencies. *Research in International Business and Finance*, *64*, 101898. https://doi.org/10.1016/j.ribaf.2023.101898

Tate, W. L., & Bals, L. (2018). Achieving Shared Triple Bottom Line (TBL) Value Creation: Toward a Social Resource-Based View (SRBV) of the Firm. *Journal of Business Ethics*, *152*(3), 803–826. https://doi.org/10.1007/s10551-016-3344-y

Team, S. (2023). *How AI Facilitates More Fair and Accurate Credit Scoring*.

Tercero-Lucas, D. (2023). Central bank digital currencies and financial stability in a modern monetary system. *Journal of Financial Stability*, *69*. https://doi.org/10.1016/j.jfs.2023.101188

Terták, E., & Kovács, L. (2022). The Motives for Issuing Central Bank Digital Currency and the Challenges of Introduction Thereof. *Public Finance Quarterly*, *67*(4), 491–505. https://doi.org/10.35551/PFQ_2022_4_1

The Edge Markets. (2009). Sustaining Trust and Confidence in Our Capital Market. In *The Edge*. https://www.theedgemarkets.com/article/special-focus-sustaining-confidence-and-trust-ourcapital-market

Themistocleous, M., Rupino da Cunha, P., Tabakis, E., & Papadaki, M. (2023). Towards cross-border CBDC interoperability: insights from a multivocal literature review. *Journal of Enterprise Information Management*, *36*(5), 1296–1318. https://doi.org/10.1108/JEIM-11-2022-0411

Tian, S., Zhao, B., & Olivares, R. O. (2023). Cybersecurity risks and central banks' sentiment on central bank digital currency: Evidence from global cyberattacks. *Finance Research Letters*, *53*(December 2022), 103609. https://doi.org/10.1016/j.frl.2022.103609

Tiron-Tudor, A., Donțu, A., & Bresfelean, V. (2022). Emerging Technologies' Contribution to the Digital Transformation in Accountancy Firms. *Electronics*. https://doi.org/10.3390/electronics11223818

Tong, W., & Jiayou, C. (2021). A study of the economic impact of central bank digital currency under global competition. *China Economic Journal*, *14*(1), 78–101. https://doi.org/10.1080/17538963.2020.1870282

Trenerry, B., Chng, S., Wang, Y., Suhaila, Z. S., Lim, S. S., Lu, H. Y., & Oh, P. H. (2021). Preparing Workplaces for Digital Transformation: An Integrative Review and Framework of Multi-Level Factors. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.620766

Tronnier, F., Harborth, D., & Biker, P. (2023). Applying the extended attitude formation theory to central bank digital currencies. *Electronic Markets*, *33*(1). https://doi.org/10.1007/s12525-023-00638-3

UNDP. (2019). *Islamic finance's answer to SDGs and climate change*. https://www.undp.org/blog/islamic-finances-answer-sdgs-and-climate-change

van Oordt, M. R. C. (2022). Discussion of "Central bank digital currency: Stability and information." *Journal of Economic Dynamics and Control*, *142*, 104503. https://doi.org/10.1016/j.jedc.2022.104503

Vergara, C. C., & Agudo, L. F. (2021). Fintech and Sustainability: Do They Affect Each Other? *Sustainability*. https://doi.org/10.3390/su13137012

Viñuela, C., Sapena, J., & Wandosell, G. (2020). The future of money and the central bank digital currency dilemma. *Sustainability (Switzerland)*, *12*(22), 1–21. https://doi.org/10.3390/su12229697

Wang, G., & Hausken, K. (2022). A game between central banks and households involving central bank digital currencies, other digital currencies and negative interest rates. *Cogent Economics and Finance*, *10*(1). https://doi.org/10.1080/23322039.2022.2114178

Wang, H. (2023). How to understand China's approach to central bank digital currency? *Computer Law and Security Review*, *50*, 1–39. https://doi.org/10.1016/j.clsr.2022.105788

Wang, H., & Gao, S. (2023). The future of the international financial system: The emerging CBDC network and its impact on regulation. *Regulation and Governance*, *April*. https://doi.org/10.1111/rego.12520

Wang, Y., Lucey, B. M., Vigne, S. A., & Yarovaya, L. (2022). The Effects of Central Bank Digital Currencies News on Financial Markets. *Technological Forecasting and Social Change*, *180*(November 2021), 121715. https://doi.org/10.1016/j.techfore.2022.121715

Wang, Y. R., Ma, C. Q., & Ren, Y. S. (2022). A model for CBDC audits based on blockchain technology: Learning from the DCEP. *Research in International Business and Finance*, *63*(September), 101781. https://doi.org/10.1016/j.ribaf.2022.101781

Wang, Y., Wei, Y., Lucey, B. M., & Su, Y. (2023). Return spillover analysis across central bank digital currency attention and cryptocurrency markets. *Research in International Business and Finance*, *64*, 101896. https://doi.org/10.1016/j.ribaf.2023.101896

Wang, Z. (2023). Money laundering and the privacy design of central bank digital currency. *Review of Economic Dynamics*, *1*(2018), 1–29. https://doi.org/10.1016/j.red.2023.06.004

Wang, Z. ao, Samuel, R. N., Chen, X. qian, Xu, B., & Huang, W. lun. (2023). Central bank digital currencies: Consumer data-driven sustainable operation management policy. *Technological Forecasting and Social Change*, *196*(July 2022), 122867. https://doi.org/10.1016/j.techfore.2023.122867

White, S. (2023). *The Role of Artificial Intelligence and Machine Learning in Credit Scoring*.

Wilkins, C. A. (2022). Discussion of "designing central bank digital currency" by Agur, Ari and Dell'Ariccia. *Journal of Monetary Economics*, *125*, 80–84. https://doi.org/10.1016/j.jmoneco.2021.09.009

Williamson, S. (2022). Central Bank Digital Currency: Welfare and Policy

Implications. *Journal of Political Economy*, *130*(11), 2829–2861. https://doi.org/10.1086/720457

Wolf, M., Semm, A., & Erfurth, C. (2018). Digital transformation in companies – challenges and success factors. *Communications in Computer and Information Science*, *863*, 178–193. https://doi.org/10.1007/978-3-319-93408-2_13

World Bank. (2020). *Pioneering the green Sukuk: three years on*. World Bank.

Xin, B., & Jiang, K. (2023a). Central bank digital currency and the effectiveness of negative interest rate policy: A DSGE analysis. *Research in International Business and Finance*, *64*, 101901. https://doi.org/10.1016/j.ribaf.2023.101901

Xin, B., & Jiang, K. (2023b). Economic uncertainty, central bank digital currency, and negative interest rate policy. *Journal of Management Science and Engineering*, *8*(4), 430–452. https://doi.org/10.1016/j.jmse.2023.04.001

Xu, X., Jing, R., Shahzad, U., & Xiao, F. (2023). Sustainable Innovation in Small and Medium-Sized Enterprises: Environmental Regulations and Digitalization as Catalyst. *The Journal of Environment & Development*, *32*, 413–443. https://doi.org/10.1177/10704965231211585

Yang, J., & Zhou, G. (2022). A study on the influence mechanism of CBDC on monetary policy: An analysis based on e-CNY. *PLoS ONE*, *17*(7 July), 1–27. https://doi.org/10.1371/journal.pone.0268471

Yang, Q., Zheng, M., & Wang, Y. (2023). The Role of CBDC in Green Finance and Sustainable Development. *Emerging Markets Finance and Trade*, *00*(00), 1–16. https://doi.org/10.1080/1540496X.2023.2185096

Yousaf, I., & Goodell, J. W. (2023). Linkages between CBDC and cryptocurrency uncertainties, and digital payment stocks. *Finance Research Letters*, *54*(March), 103765. https://doi.org/10.1016/j.frl.2023.103765

Yousufzai, S. F., Hayat, A., & Abbas, M. H. (2021). Digital transformation of value-based intermediation-a risk-based perspective. *Journal of Contemporary Business and Islamic Finance (JCBIF)*, *1*(1), 23–31.

Yuan, Y., & Li, D. (2023). Urban Economic Efficiency, Environmental Factors, and Digital Finance: Impacts on Sustainable Development in Chinese Cities. *Sustainability*. https://doi.org/10.3390/su151813319

Zams, B. M., Indrastuti, R., Pangersa, A. G., Hasniawati, N. A., Zahra, F. A., & Fauziah, I. A. (2020). Designing central bank digital currency for Indonesia: The delphi-analytic network process. *Buletin Ekonomi Moneter Dan Perbankan*, *23*(3), 411–438. https://doi.org/10.21098/BEMP.V23I3.1351

Zhang, C., Chen, P., & Hao, Y. (2022). The impact of digital transformation on corporate sustainability- new evidence from Chinese listed companies. *Frontiers in Environmental Science*, *10*. https://doi.org/10.3389/fenvs.2022.1047418

Zhang, J., Tian, R., Cao, Y., Yuan, X., Yu, Z., Yan, X., & Zhang, X. (2021). A Hybrid Model for Central Bank Digital Currency Based on Blockchain. *IEEE Access*, *9*, 53589–53601. https://doi.org/10.1109/ACCESS.2021.3071033

Zhang, Q., Yang, D., & Qin, J. (2023). Multi-Party Evolutionary Game Analysis of Accounts Receivable Financing under the Application of Central Bank Digital Currency. *Journal of Theoretical and Applied Electronic Commerce Research*, *18*(1), 394–415. https://doi.org/10.3390/jtaer18010021

Zhang, T., & Huang, Z. (2022). Blockchain and central bank digital currency. *ICT Express*, *8*(2), 264–270. https://doi.org/10.1016/j.icte.2021.09.014

Zhou, C. (2023). Evaluating the effectiveness of monetary policy for retail central bank digital currency. *Latin American Journal of Central Banking*, *January*, 100111. https://doi.org/10.1016/j.latcb.2023.100111

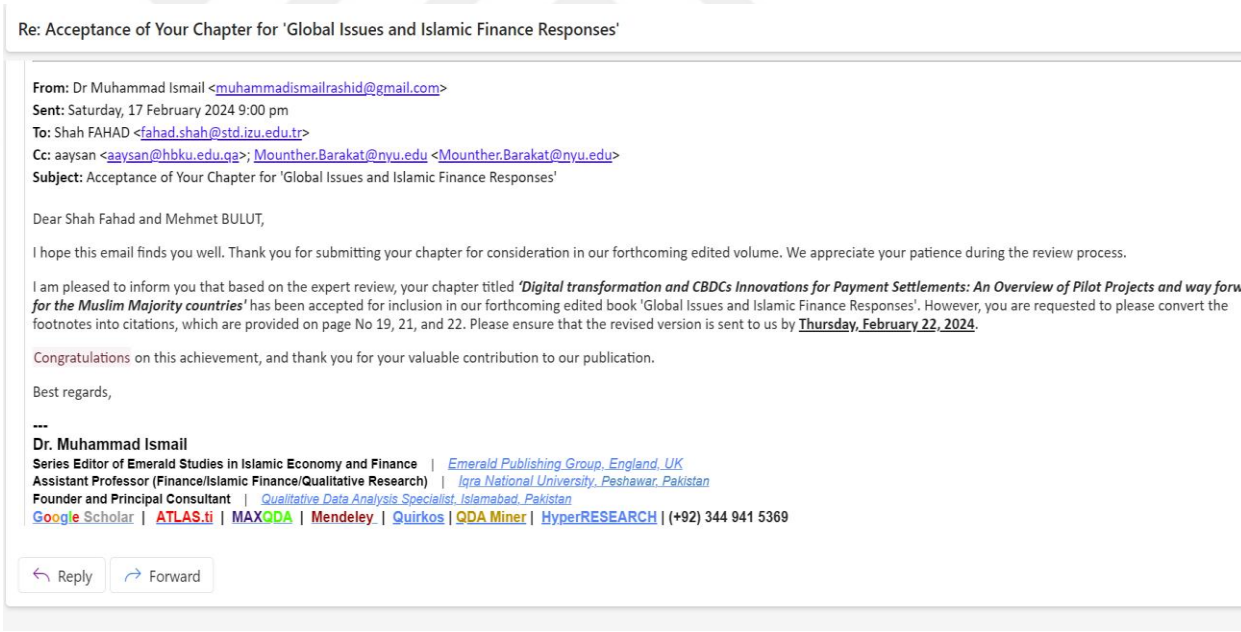
List of Published Papers

Chapter	DOI Number	Publisher	Reference
V	https://doi.org/10.1108/AJB-12-2023-0210	American Journal of Business; Emerald Publishing Limited	Fahad, S. and Bulut, M. (2024), "Central bank digital currencies: a comprehensive systematic literature review on worldwide research emergence and methods used. *American Journal of Business, Vol. 39 No. 3, pp. 137-157.*

List of accepted paper in a book but awaited the publication

Chapter IV.

Digital transformation and CBDCs Innovations for Payment Settlements: An Overview of Pilot Projects and way forward for the Muslim Majority countries



Re: Acceptance of Your Chapter for 'Global Issues and Islamic Finance Responses'

From: Dr Muhammad Ismail <muhammadismailrashid@gmail.com>
Sent: Saturday, 17 February 2024 9:00 pm
To: Shah FAHAD <fahad.shah@std.izu.edu.tr>
Cc: aaysan <aaysan@hbku.edu.qa>; Mounther.Barakat@nyu.edu <Mounther.Barakat@nyu.edu>
Subject: Acceptance of Your Chapter for 'Global Issues and Islamic Finance Responses'

Dear Shah Fahad and Mehmet BULUT,

I hope this email finds you well. Thank you for submitting your chapter for consideration in our forthcoming edited volume. We appreciate your patience during the review process.

I am pleased to inform you that based on the expert review, your chapter titled ***'Digital transformation and CBDCs Innovations for Payment Settlements: An Overview of Pilot Projects and way forw for the Muslim Majority countries'*** has been accepted for inclusion in our forthcoming edited book 'Global Issues and Islamic Finance Responses'. However, you are requested to please convert the footnotes into citations, which are provided on page No 19, 21, and 22. Please ensure that the revised version is sent to us by **Thursday, February 22, 2024**.

Congratulations on this achievement, and thank you for your valuable contribution to our publication.

Best regards,

Dr. Muhammad Ismail
Series Editor of Emerald Studies in Islamic Economy and Finance | *Emerald Publishing Group, England, UK*
Assistant Professor (Finance/Islamic Finance/Qualitative Research) | *Iqra National University, Peshawar, Pakistan*
Founder and Principal Consultant | *Qualitative Data Analysis Specialist, Islamabad, Pakistan*
Google Scholar | ATLAS.ti | MAXQDA | Mendeley | Quirkos | QDA Miner | HyperRESEARCH | (+92) 344 941 5369

Reply Forward

Chapter VI.

Cryptocurrencies', Fintech, Defi-Blockchain, CBDCs (Central Bank Digital Currencies), and structural transformation in the financial system in U.S., China, Japan and European countries, A lesson for the Muslim World

Acceptance of Your Chapter for 'Global Issues and Islamic Finance Responses'

DI

Dr Muhammad Ismail<muhammadismailrashid@gmail.com>

To: Shah FAHAD

Cc: aaysan; Mounther.Barakat@nyu.edu

Sat 17/02/2024 8:58 PM

Dear Shah Fahad and Mehmet BULUT,

I hope this email finds you well. Thank you for submitting your chapter for consideration in our forthcoming edited volume. We appreciate your patience during the review process.

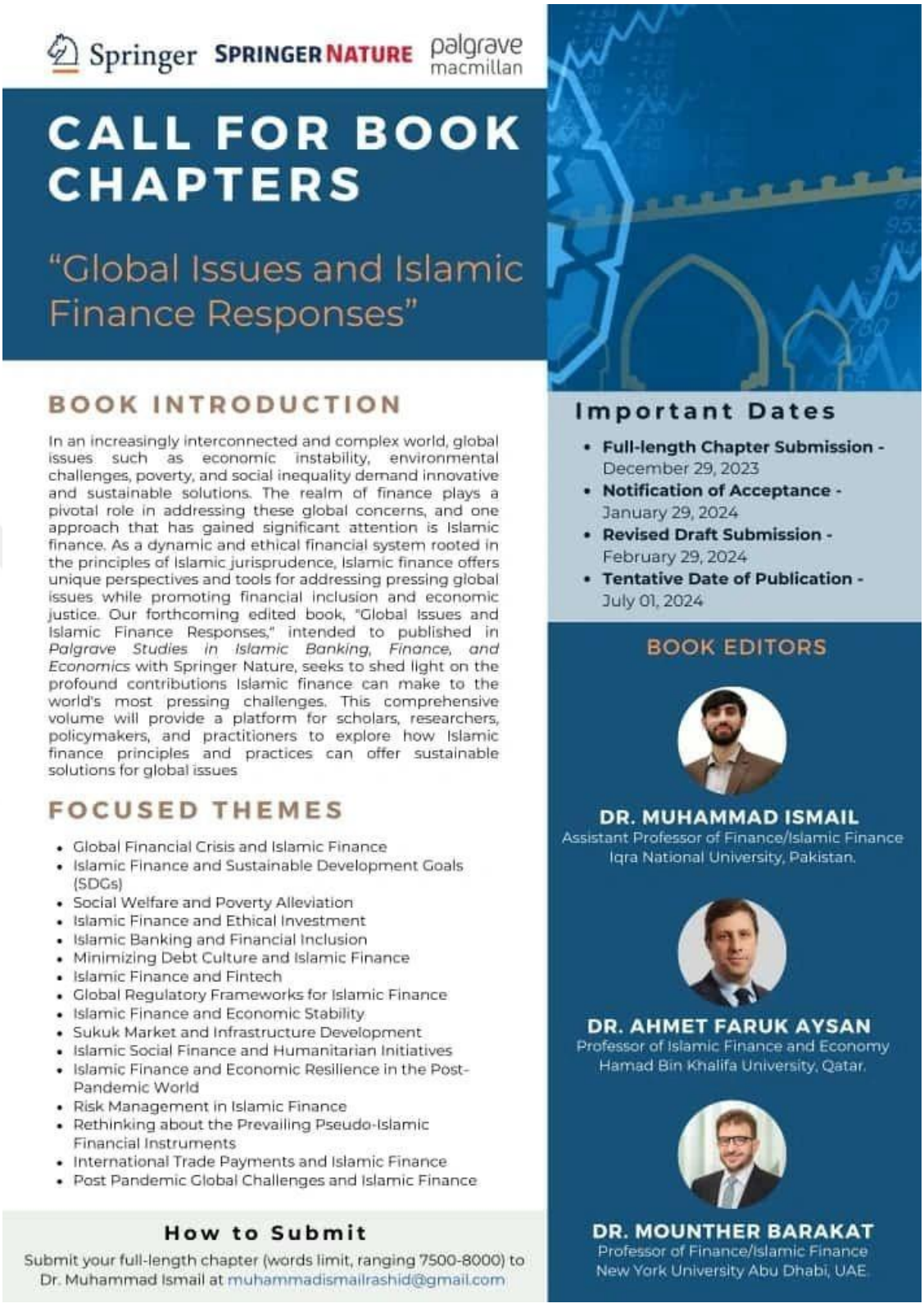
I am pleased to inform you that based on the expert review, your chapter titled ***'Cryptocurrencies, Fintech, DeFi-Blockchain, CBDCs, and Structural Transformation in the Financial System in U.S., China, Japan, and European Countries: A Lesson for the Muslim World'*** has been accepted for inclusion in our forthcoming edited book 'Global Issues and Islamic Finance Responses'.

Congratulations on this achievement, and thank you for your valuable contribution to our publication.

Best regards,

Dr. Muhammad Ismail
Series Editor of Emerald Studies in Islamic Economy and Finance | *Emerald Publishing Group, England, UK*
Assistant Professor (Finance/Islamic Finance/Qualitative Research) | *Iqra National University, Peshawar, Pakistan*
Founder and Principal Consultant | *Qualitative Data Analysis Specialist, Islamabad, Pakistan*
Google Scholar | ATLAS.ti | MAXQDA | Mendeley | Quirkos | QDA Miner | HyperRESEARCH | **(+92) 344 941 5369**

Reply Reply all Forward



The above both articles are accepted as thesis chapters for publication in "Global issues and Islamic Finance responses" springer nature and publishing by Palgrave Macmillan. To be published soon.

Shah Fahad Yousufzai Contact # +90 5342139547 email: shahfahad303@hotmail.com

Experience – 18+ years

Chief Business Officer – Tibet Sltanlar Holdings Türkiye

Dy. Director General EMEA region and CEO – Islamic Banking and Digital transformation at Bait al Tamweel al Dawli – International fund house, Istanbul, Turkey

Regional Director MENA – Veefin Solution Private Ltd. (A fintech financing smart solution company)

Former-Vice President Islamic Bank of Thailand

Former-Vice President I MCB Islamic Bank, Head office, Lahore

Former-VP – Corporate financing at Eco energy group of company, Bangkok

Former-SEVP -Chief of Islamic Banking at Bakhtar Bank, Afghanistan

Former-EVP -Head Islamic Banking window at Ghazanfar Bank, Afghanistan

Professional experience:

(Aug 2024 to date) Chief Business Officer – Corporate strategy and transformation at Sltanlar Holdings Türkiye.

(Oct 2022-Aug 2024) Dy. Director General Europe and Middle East (EMEA region)

Islamic Banking at Bait AL Tamweel Al Dawli BTD -International Fund House.

(March 2022-till Oct 2022) Regional Director MENA – Veefin Solution Private Ltd.

(May 2018 to Jan 2021) Vice President - Department Head Product Management and Sharia structuring at MCB Islamic Bank, Head office, Lahore

(September 2016-to April 2018) Vice President at Eco energy group co. Ltd Bangkok, Thailand.

(December 2014 – June 2016) Chief Head–Islamic Banking, Bakhtar Bank, Afghanistan &

Project Manager –Conversion of Conventional Bank into Full-fledged Islamic Bank

(September 2013 –30th September 2014) Vice President & Specialist – Sharia'h & Product development department, Islamic Bank of Thailand

(March 2011 – September 2013) Vice President/Head of Strategic Marketing & Product Development, Islamic Bank of Thailand

(June 2009 – Feb. 2011) Country Head- Islamic Banking window, Ghazanfar Bank Afghanistan

(Sep. 2006 – June 2009) Senior Sharia Compliance officer, Askari Bank-Islamic Banking

(June 2006 – Sep. 2006) Vigilance officer, Citi Bank NA Islamabad, Pakistan

Education:

Ph.D.	**Islamic Economics and Finance**	**Istanbul Sabahattin Zaim University**	**2020-2024**	**Thesis final stage**
MS/M.Phil	**Islamic Banking & Finance**	**The University of Management Technology,Lahore**	**2018-2020**	**3.80/4.00**
B.Sc (Hons) **(4 YEARS)** **Equiv. To Masters**	**Islamic Economics, Finance, Statistics, Business Management, Accounting**	**International Islamic University, Islamabad.**	**2006**	**1st Div.**
HSSC	**Science Group**	**Govt. College, Thana**	**2002**	**1st Div.**
SSC	**Science Group**	**GHS**	**1999**	**1st Div.**

Career Track:

Deputy Director General - Europe, Middle east and Africa (EMEA) and

Chief Executive officer (CEO) Islamic Banking, Turkiye

At BTD (Bait Al Tamweel Al Dawli) International fund House –Head office Istanbul Turkiye.

Responsibilities included:

Managing and monitoring the financial performance, profitability, asset quality, liquidity and capital adequacy

Strategic and business direction for short and long term

Corporate governance, implementing effective company governance structures and processes to ensure compliance with laws, rules, and ethical standards is referred to as corporate governance

Risk Management, ensuring that the bank has adequate risk management frameworks and controls in place to detect, assess, and mitigate risks.

Regulatory compliance, ensuring that the bank conforms to all applicable laws, rules, and industry standards. Changes in regulations and making sure the bank's operations comply.

Board Member, Management committee member, Strategy committee head

Digital transformation and Fintech projects head

Overseeing the Profit and loss of the entities under my supervision

Overall strategic and Business planning for the group in different countries

Private Digital Currency development and platform development

RFP development for different projects

Sukuk structuring and marketing

Conversion plan for a financial institution to convert it into a fully-fledged Islamic Bank in Iraq

Digital platform development and integration

BPM and change management head

Enterprise risk management (ERM) and internal control, COSO framework

ESG management and policy implementation

Digital valet Debit card project liaison

Management for SUKUK distribution

Communication with team for strategic plan implementation in different countries

Research and Development

Market positioning, credit, Treasury, HR, Operations, etc. teams' recruitment and development and performance management

Representing my organization in National and international events

Managing Banking matters and Fintech transformation (Islamic Digitalization of products and processes, smart contracts, and innovative payment settlements, among other things) at BTD (Bait Al Tamweel Al Dawli) - International Fund House group in Iraq, Luxembourg, Austria, Spain, UK, UAE, and Turkey.

Under my direction, BTD controls a financial institution in IRAQ that is being turned into a full-fledged Islamic bank. I am responsible for SUKUK structuring, Islamic Fund Management in Luxembourg, digital transformation of existing business and innovative technology-based smart solutions and platform integration, liaison with internationally renowned Shariah scholars as Shariah Supervisory board members and Islamic Finance advisory service providers for Shariah compliant transaction and structuring for retail product approval, and lead arranger and solicitor management in SUKUK.

(March 2022 till Oct 2022) Regional Director – MENA (the Middle East & North Africa) – Veefin –Supply Chain Financing-Fintech

Major responsibilities:

Supervision and management of the Islamic Product management - end to end

Managed the Supply Chain Financing (SCF Solution led to Deal) and implementation

Shariah-based structure development as per the demand of the clients/Banks

Managing the sales teams in different states in the MENA region

Liaison with technical and sales team

Meetings with Directors of different countries and Executives

Represented my company worldwide in different high-level events and conferences

Responsible for KPI and targets in the region under my supervision

(May 2018 to Jan2021) Department Head Product Management and Sharia structuring at MCB Islamic Bank, Head office, Lahore

Major responsibilities:

Supervised and managed the Product management process - end to end

Asset-based product development focusing on Retail, Microfinance, Agri & Staff Financing

Sharia-based structure development of the above products and programs

Supervision and vetting of the products and process flow from Shariah dept. and Sharia Board in Predevelopment phases

Liaison with Sharia Compliance Department and all other correspondent Groups

Day to Day Troubleshooting and updating the Product Manuals and process flows on regular basis as per requirement

(September 2016 – April 2018) Vice President – Head Corporate Finance at Eco Energy group of companies Pvt. Ltd. Bangkok, Thailand

Corporate financing deals

Islamic Financing strategy development

Business process Management BPM and KAIZEN lead

Structuring the products and projects

Supervision and Liason for feasibility studies of the projects with third pary

Liason with Sharia Compliance Department and all other correspondent Groups

Project financing and approvals from Board and management

(December 2014 –August 2016) Country Head Islamic Banking & Project Manager for Conversion of conventional Bank into full-fledged Islamic Bank, a project in collaboration with EY Islamic Financial Services Group

Major responsibilities:

Business plan developed in collaboration with external agency

Strategic Plan development Business process management(BPM) development

Conversion plan development and implementation

Financial projection of the project

Change Management (CM) implementation

Market analysis

Products manuals and general policy & procedure development

RFP development and software selection & implementation

Business analysis and product maping in system

Organogram development for Islmic Banking

Hiring and Capacity building of staff being member HR committee

Islamic Bank of Afghanistan (formerly Bakhtar Bank) As Senior Vice President/Chief Islamic Banking

1.6 years at Bakhtar Bank as Chief Islamic Banking and Project Manager for conversion of Bakhtar bank into fully fledged Islamic Bank (Islamic Bank of Afghanistan). Succefully converted.

Work Experience (s) at ISLAMIC BANK OF THAILAND, Ministry of Finance, Govt. of Thailand.

(*1st March-2011 –*September 2014) Vice President - Sharia'h & Product development department, Islamic Bank of Thailand

Major responsibilities:

Specialist & member of the Islamic Banking working committee

Product development (Asset side – Retail, SME & Post and Pre-Finance)

Product development (Liability Side-Retail Deposit)

Electronics services support

Portfolio Management Division

Business Partnership (Bankatakaful)

Islamic Bank of Thailand as Vice President – Head Product Development and Sharia

3.6 Years as VP- Head Product development and Sharia at Islamic Bank of Thailand, Deposit and Financing target as shadow KPI product-wise. Achieved 100%.

Head-Islamic Banking at Ghazanfar Bank, Kabul June 2009-Feb2011

As Head-Islamic Banking at Ghazanfar Bank Kabul, Afghanistan;

Major responsibilities include:

Products, Sharia framework and Policy & Development for Islamic Banking

Overall managing of all Islamic Banking Departments

Business and Strategic Planning

Risk Analysis and portfolio Management, diversification of Assets based financing

Managing Islamic Banking Staff

Daily Briefing regarding Islamic Products

Sharia Review of the transactions

Encouraging Various teams to enhance business with accurate documentations

Daily correspondence with all Branches

Delivering Lectures to All staff members regarding Islamic Banking after Banking hours

Answering queries of Individuals and corporate clients regarding Islamic Banking.

Business Analysis Supervision:

Veer Mati CBS – Customized and Developed parameters for Islamic Banking liability and asset side products at Ghazanfar Bank, Afghanistan.

Development of the parameters, mapping and business rules for system -All projects being owner at Islamic Bank of Thailand (Migration from Silverlake software to TNIS)

Ghazanfar Bank Afghanistan – Country Head – Islamic Banking 2 Years as Country Head Islamic Banking at Ghazanfar Bank- Islamic Banking window- Establishing Islamic Banking window, developed product, procedure, policy, strategic plan and training to staff along with new branch opening. Target deposit achieved $47m with $27m financing in 02 years. (Net profit of $1.8m)

Askari Bank Limited – Islamic Banking (AKBL-IB) Sep2006 – 20 June 2009

I have worked as a **Sharia compliance officer, Islamic Banking Services Division, Islamabad.**

Major responsibilities include:

Shariah Compliance. To Assist Shariah Executives and Conducting Shariah compliance of all Islamic banking branches, consumer centers and departments of Islamic Banking on quarterly basis all over Pakistan to ensure Shariah compliance in all areas of Islamic Banking. Issued required reports to CEO and RSBM.

Special assignment from CEO and RSBM time to time.

Askari Bank – Islamic Banking Officer Grade II

1 Year as Credit Analyst Consumer Financing – Consumer Car Ijarah Pre-approval analysis

Pioneer member of Askari Islamic Banking at Head office.

2 years as Shariah compliance officer – Sharia compliance of all Branches of Askari bank- Islamic Banking across the country

Citibank N.A **March2006- Sep 2006**

Credit Vigilance Officer

Analyzed Cases of Citibank Credit cards and Personal loan.

Evaluating Customer Financial status.

Coordination with CIU & Head office

Processing Unit Management

Checking all legal and required documents.

Analyzing customer credentials according to bank's internal Parameters.

Review of Rejected Cases.

Major Achievements:

Established Islamic Banking window in Afghanistan for the First time in banking history (in profit within 2 years)

Drafted the first ever Islamic Banking policy and Sharia governance framework in Afghanistan

Qualified the Central bank of Afghanistan interview and was selected as the Country Head for first ever Islamic Banking window in Afghanistan. Interview was conducted by Governor central Bank, Board of Directors and top management of the bank.

Customized VEER MATI (conventional) software for Islamic Banking deposit and assets products in Afghanistan.

Extra Mile Award on Best Performance in 2nd quarter 2006 at Citi Bank NA.

Achievement certificate from CEO Islamic Bank of Thailand on staff capacity building.

Trained the staff of Central bank of Nigeria, Stanbic IBTC and grassroot MFB for Islamic Banking at Lagos, Nigeria.

MS/MPhil Thesis topic was "Tourism and infrastructure development in the Northern areas of Pakistan through Islamic Finance"

Professional Trainings/Certificates

Special Trainings with RED MONEY IFN (Instructor Mr. Abdul Kadir Thomas);

Islamic Retail and SME banking

Islamic Treasury Management and Derivatives

NIBAF- Islamic Banking Certificate Course (IBCC)

Sharia Audit & compliance certificate from ACIE

Prudential regulations of the state bank of Pakistan at Asakari Bank Training Academy

New Performance Management system at Askari bank

Laws Related to Banking Transactions at Askari Bank

Branch Audit and Internal Control System: Preservation of Branch Documentation and Security.(Coso Model), At National Institute of Banking and Finance (NIBAF) Islamabad.

Prevention of Cheques Fraud at Askari Bank

Zakat Applications on remunerative Accounts at Askari Bank

Examination of Trade Documents at Askari Bank

International Trade Fraud Prevention at Askari Bank

CKAS at MCB Islamic Bank

Islamic Banking certificate at MCB Islamic BANK

Achievement certificate from the Australian center of Islamic Finance

GRID leadership training – Islamic Bank of Thailand

Kaizen trainings and workshops at Islamic Bank of Thailand

Personal Details

DOB:

Nationality

Marital Status

Publication, write-ups and conference papers

Google scholar profile
https://scholar.google.com/citations?user=64cpEWkAAAAJ&hl=en

Digital transformation of value-based intermediation-a risk-based perspective

SF Yousufzai, A Hayat, MH Abbas

Journal of Contemporary Business and Islamic Finance (JCBIF) 1 (1), 23-31 1
2021

https://journals.iub.edu.pk/index.php/jcbif/article/view/599

Global Financialization Effects and the Role of Islamic Finance Institutions

MH ABBAS, S FAHAD

International Journal of Islamic Economics and Governance 3 (2), 36-61, 2022

https://ojs.mul.edu.pk/index.php/IJIEG/article/view/280

Presented my paper at 5th World Islamic Finance Conference, Minhaj University, Lahore on "Enhancement of Financial Inclusion through Islamic Fintech with Value-Based intermediation, a proposed second phase for the Islamic Banking industry" and published.

SF YOUSUFZAI, A HAYAT, MH ABBAS

International Journal of Islamic Economics and Governance 2 (1), 13-32

https://ojs.mul.edu.pk/index.php/IJIEG/article/view/197

Presented my paper in Islamic Finance symposiyum at Australian National University on “Fintech, CBDCs (Central Bank Digital Currencies), Defi-Blockchain, and structural changes to the financial system in the United States, China, and Europe, a lesson for the Muslims majority countries

Australian National University Paper accptance.pdf

My paper entitled "Digital transformation and CBDCs Innovations for Payment Settlements: An Overview of Pilot Projects and way forward for the Muslim Majority countries" ID (GUICAF2023)_0046 is accepted at 2nd International Conference on Accounting and Finance organized by Gulf University with the collaboration of Universiti Utara Malaysia (Malaysia), Universiti Pendidikan Sultan Idris (Malaysia), Universitas Sumatera Utara (Indonesia), and AL-Zahra College (Oman).

Presented my paper on "The value-based economic system and its social impacts for a new sustainable world, A Maqasid Al Shariah perspective". Presented at Turin Islamic Economic Forum (TAIF). Will be published in the European Journal of Islamic Finance (EJIF).

"Evolution of Islamic Banking in Afghanistan, a way forward and Challenges for the new régime".

And "The Ottoman's Financial and Business model, a lesson for the present time",

At the 5th Assam Islamic union congress 2021, Istanbul, Turkey. 5'iNCİ Uluslararası ASSAM İSLAM BİRLİĞİ KONGRESİ (assamcongress.com) page no. 195 and 208.

Presented my paper at the 12th Foundation of Islamic Finance Conference (FIFC) 2022 at Istanbul Sabahhatin Zaim University, under the theme "Green Finance and Islamic Finance Challenges". The tile of our paper was " The value-based economic system and its social impacts for a new sustainable world, A Maqasid Al-Shari'ah perspective, and a proposed 2nd phase for the Islamic Banking system".

The below scientific research articles are under consideration for publication in Scopus, springer indexed journals and books.

CBDCs: A Comprehensive SLR on Worldwide Research Emergence and Methods Used

Accepted for publication in "American Journal of Business" emerald Publishing.

Digital transformation and CBDCs Innovations for Payment Settlements: An Overview of Pilot Projects and way forward for the Muslim Majority countries

Cryptocurrencies', Fintech, Defi-Blockchain, CBDCs (Central Bank Digital Currencies), and structural transformation in the financial system in U.S., China, Japan and European countries, A lesson for the Muslim World

The above both articles are accepted as thesis chapters for publication in "Global issues and Islamic Finance responses" springer nature and Palgrave Macmillan.

In the future, I hope to develop an innovative central bank digital currency CBDC model with sufficient regtech coverage and acceptability. I am eager to work on the digital transformation of value-based intermediation, a novel concept for the global banking and financial industry.

PhD thesis (Final stage):

Topic: **Digital transformation in the financial industry in the West and East: Lesson for the Muslim majority countries**

Proposal and first monitoring committee approved.

Final stage (Fall 2024)

Islamic Finance News (IFN) articles and features published

IFN - Digital transformation of value-based intermediation, a way forward for the Islamic finance industry (islamicfinancenews.com)

article was first published in IFN Volume 21 Issue 5 dated the 31st January 2024

https://www.islamicfinancenews.com/digital-transformation-of-value-based-intermediation-a-way-forward-for-the-islamic-finance-industry.html

https://www.islamicfinancenews.com/?s=SHAH+FAHAD

Non-performing financing and Bai Bil Wafa

Thursday, 29 Oct 2015 | Volume12.Issue44

IFN Reports

Critical analysis of Islamic banking

Tuesday, 21 Jul 2015 | Volume12.Issue29

Special Reports

Shariah compliant innovative products: Factoring and its mechanism

Wednesday, 22 Apr 2015 | Volume12.Issue16

Special Reports

Tools of the trade

Wednesday, 22 Apr 2015 | Volume12.Issue16

Editor`s Note

Focusing on SMEs

Wednesday, 02 Oct 2013 | Volume10.Issue39

IFN Reports

The commercialization of Islam through banking

Wednesday, 11 Sep 2013 | Volume10.Issue36

IFN Reports

Bringing together Musharakah venture capital and alternative energy

Wednesday, 21 Aug 2013 | Volume10.Issue33

IFN Reports

Islamic cooperatives and poverty alleviation

Tuesday, 23 Jul 2013 | Volume10.Issue29

IFN Reports

Commodity Murabahah and the liquidity mismatch in Islamic retail banking

Wednesday, 10 Jul 2013 | Volume10.Issue27

Features

Shah Fahad Yousufzai, Head of Islamic banking Ghazanfar Bank of Afghanistan

Wednesday, 03 Mar 2010 | Volume7.Issue09

Meet The Head

Academic experience:

(June 2021- to date) Visiting Instructor for training,awareness session, summer referesher courses, seminars and conferences on Islamic Banking and finance at Minhaj University Lahore **(June 2021- to date)**

(April 2022 -to date) Reviewer for peer reviewed journal "***International Journal of Islamic Economics and Governance***" (IJIEG), Minhaj University, Lahore. This journal covers the key areas of Islamic Economics, Islamic Banking, Fintech, Islamic Capital market, Shariah Governance, Monetary Policy and many**)**

Reviewer for Financial innovation journal

(October 2022 -Aug 2024) Islamic Banking, Sukuk structuring, ESG, digital transformation, strategy, risk management and AML/CFT etc. trainings session for employees at BTD -International Fund House. Turkey.