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Case Study: Smart Sukuk**

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# Abstract

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Over the past few years, the fourth industrial revolution had had a significant shift on the financial industry, through the integration of financial technology innovations into the financial sector. One of these innovations is Blockchain Technology, which has the ability to change the financial industry in general, concerning the way transactions transact and businesses conduct. Islamic financial industry, in turn, had to keep pace with these changes and innovations by integrating blockchain technology into its products, giving birth to a new generation of sukuk, which is Smart Sukuk. This research presents a conceptual study of the potential of blockchain technology in revolutionizing the existing financial business applications, in which it focuses on the industry of smart sukuk in the Islamic financial market. Therefore, it aims to address the issue of using blockchain technology in the development of the Islamic financial market by digitizing the structuring, trading, and settlement process of sukuk through smart contracts, as well as to evaluate their efficiency using different smart sukuk platform experiences (Blossom Finance, HLC, Wethaq Capital Markets) based on both descriptive and analytical approaches. The descriptive approach is used to review the basic concepts of blockchain technology, and its working mechanism, as well as its main applications in the financial industry. However, the analytical approach is used to evaluate the leading smart sukuk experiences, and the most prominent challenges facing its application, noting also the potential application of smart sukuk in Algeria. This study concluded that blockchain technology contributes significantly to the digitization of the Islamic financial market by automating the structure of blockchain-based sukuk, which results in eliminating financial intermediation, reducing costs, increasing the security level, increasing the earning of contractors, and improving their competitiveness on the market.

**Keywords:** Blockchain Technology, Smart Contracts, Smart Sukuk, Islamic Financial Market

## Résumé

Au cours des dernières années, la quatrième révolution industrielle a profondément modifié le secteur financier, grâce à l'intégration des innovations technologiques financières dans le secteur financier. L'une de ces innovations est la technologie Blockchain, qui a la capacité de changer le secteur financier en général, en ce qui concerne la manière dont les transactions sont effectuées et le comportement des entreprises. L'industrie financière Islamique, à son tour, a dû suivre le rythme de ces changements et innovations en intégrant la technologie blockchain dans ses produits, donnant ainsi naissance à une nouvelle génération de sukuk, les Sukuk Intelligents. Cette recherche présente une étude conceptuelle du le potentiel de la technologie blockchain pour révolutionner les applications commerciales financières existantes, dans laquelle elle se concentre sur l'industrie des sukuk intelligents sur le marché financier islamique. Par conséquent, il vise à résoudre le problème de l'utilisation de la technologie blockchain dans le développement du marché financier Islamique en numérisant le processus de structuration, de négociation et de règlement des sukuk via des contrats intelligents, ainsi qu'à évaluer leur efficacité à l'aide de différentes expériences de les plateformes de sukuk intelligentes ( Blossom Finance, HLC, Wethaq Capital Markets) basée sur des approches à la fois descriptives et analytiques. L'approche descriptive est utilisée pour passer en revue les concepts de base de la technologie blockchain et son mécanisme de fonctionnement, ainsi que ses principales applications dans le secteur financier. Cependant, l'approche analytique est utilisée pour évaluer les principales expériences de sukuk intelligents et les défis les plus importants auxquels est confrontée leur application, notant également l'application potentielle des smart sukuk intelligents en Algérie. Cette étude a conclu que la technologie blockchain contribue de manière significative à la numérisation du marché financier Islamique en automatisant la structure des sukuk basés sur la blockchain, ce qui entraîne l'élimination de l'intermédiation financière, la

# Abstract

réduction des coûts, l'augmentation du niveau de sécurité, l'augmentation des revenus des entrepreneurs et améliorer leur compétitivité sur le marché.

**Mots-clés :** Technologie Blockchain, contrats intelligents, Sukuk intelligent, marché financier islamique

## الملخص

أحدثت الثورة الصناعية الرابعة تحولاً كبيراً في الصناعة المالية خلال الأعوام القليلة الماضية من خلال دمج ابتكارات التكنولوجيا المالية في القطاع المالي، حيث تجلت إحدى هذه الابتكارات في تقنية البلوكشين (سلاسل الكتل) والتي لديها القدرة على تغيير الصناعة المالية بشكل عام من خلال طريقة تنفيذ المعاملات وسير الأعمال. ولهذا كان حتمياً على الصناعة المالية الإسلامية بدورها مواكبة هذه التغييرات والابتكارات من خلال دمج تقنيات البلوكشين في منتجاتها، وهو ما تولد عنه جيل جديد للـصكوك، معبراً عنه بالصكوك الذكية. لذلك يقدم هذا البحث دراسة نظرية لإمكانات تقنية البلوكشين في إحداث ثورة في تطبيقات الأعمال المالية الحالية حيث يركز على صناعة الصكوك الذكية في السوق المالية الإسلامية. لذا تهدف هذه الدراسة إلى معالجة مسألة استخدام تقنية البلوكشين في تطوير السوق المالية الإسلامية من خلال رقمنة هيكلية، تداول، وتسوية الصكوك باستخدام العقود الذكية، وكذلك تقييم كفاءتها استناداً لتجارب منصات صكوك ذكية مختلفة تتمثل في منصة "بلوسوم فاينانس الإندونيسية"، منصة "بنك الهلال الإماراتية"، ومنصة "وثاق للأسواق المالية السعودية"، وذلك بناءً على المنهج الوصفي والتحليلي. تم استخدام المنهج الوصفي لاستعراض المفاهيم الأساسية المتعلقة بتقنية البلوكشين وكذا آلية عملها، بالإضافة إلى أهم استخداماتها في الصناعة المالية، أما المنهج التحليلي فقد استخدم لتقييم التجارب الرائدة للصكوك الذكية وكذا تحديات تطبيقها الرئيسية، مع الإشارة إلى إمكانية تطبيق الصكوك الذكية في الجزائر، وقد خلصت هذه الدراسة إلى أن تقنية البلوكشين تساهم بشكل كبير في رقمنة السوق المالية الإسلامية من خلال أتمتة هيكل الصكوك المبنية على البلوكشين، مما يؤدي إلى القضاء على الوساطة المالية، خفض التكاليف، زيادة مستوى الأمان بين المستخدمين، زيادة مكاسب المتعاقدين، وتحسين قدرتهم التنافسية في السوق.

**الكلمات المفتاحية:** تكنولوجيا البلوكشين، العقود الذكية، الصكوك الذكية، السوق المالية الإسلامية.

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# List of Acronyms and Abbreviations



# List of Acronyms and Abbreviations

Acronyms/ Abbreviations	Title	Page
AAOIFI	The Accounting and Auditing Organization for Islamic Financial Institutions	69
ABT	Asset Backed Tokens	124
ADGM	Abu Dhabi Global Market	124
ATM	Automated Teller Machine	45
B2B	Business-to-Business	12
BMT	Baitulmal wa Tamwil	115
BOTs	Build–operate–transfer projects	110
BTC	Bitcoin	38
CAAR	The Algerian Insurance and reinsurance	138
CAAT	The Algerian Transport Insurance Company	138
CBDCs	Central Bank Digital Currencies	47
CCR	Central Reinsurance Company	138
COSOB	The Commission of the Organization and Supervision of Stock Exchange Operations	138
CMA	Capital Market Authority	128
DApps	Decentralized Applications	16
DFSA	Dubai Financial Services Authority	128
DIFC	Dubai International Financial Center	128
DLT	Distributed Ledger Technology	10
EIG	Economic Interest Grouping	138
E-money	Electronic Money	37
ETH	Ethereum	40
FinLab	Financial Laboratory	138
Fintech	Financial Technology	B
GBD	Gross Domestic Product	27
GGC	The Gulf Cooperation Council Countries	123
HLC	Al Hilal Bank Platform	124
ID	Identity	30
IDs	Identities	22
IIRA	Islamic International Rating Agency	73
KLIFF	Kuala Lumpur Islamic Finance Forum	115
LTC	Litecoin	40
MENA	Middle East and North Africa Countries	126
P2P	A Peer-to-Peer	16
PoS	Proof of Stake	18
PoW	Proof of Work	19
RAM	Malaysian Rating Agency	73
Rp	Indonesian Rupiah	122
SAA	The Algerian Insurance Company	138
SMEs	Small and Medium-Sized Companies	112
SPV	Special Purpose Vehicle	72
SWIFT	Worldwide Interbank Financial Telecommunication	56
US\$	American Dollar	26
XRP	Ripple	25

# Introduction

# Introduction

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The financial sector has seen a considerable change over the past few years as a result of the Fourth Industrial Revolution, also known as Industry 4.0. This expressed through the integration of financial technology (Fintech) innovations into the financial sector. One of these innovations is Blockchain Technology, which has the potential to dramatically change the world of business, concerning the way transactions transact, and businesses conduct. It is a technology that transfers data and assets in a digital manner based on an automated and encrypted decentralized database. This leads to the creation of digital financial transactions based on the most important blockchain applications, whether through cryptocurrencies or smart contracts. Moreover, due to its key characteristics, including decentralization, immutability, transparency, privacy, and auditability; blockchain has the potential to fundamentally alter the way that traditional financial services are structured, enabling financial operations to be faster, cheaper, safer, more transparent and accessible than ever before, which prompted different economies to adopt it.

The Islamic industry, in turn, had to keep pace with these changes and innovations by the integration of blockchain technologies into its services and transactions. One of these innovations was presented through sukuk industry, which gives birth to the emergence of Blockchain Sukuk, or what they call Smart Sukuk. This new generation of sukuk has the potential to reshape the framework of the Islamic financial market by restructuring and automating the entire sukuk life cycle. This structural process expressed through the automated issuance, trading, execution and settlement of sukuk based on blockchain smart contracts, which are a set of encrypted rules rules that are connected to a sophisticated electronic system; and this system automatically implements the contract's conditions regarding ownership transfer and payments upon receiving orders. Thus in turn makes sukuk market more attractive than ever before, which leads to the Islamic financial market development, shifting from a traditional working mechanism to a modern working mechanism, which aims to increase the scape and efficiency of sukuk market.

## **The problematic:**

Blockchain technology is regarded as a key component of the fourth industrial revolution that has changed the structure of the global economy while increasing opportunities for development, innovations, and improving business quality. Therefore, this innovation has received extensive international attention due to the structural changes it has introduced to the global economy in general, and the Islamic financial market in particular, based on its ability to improve financial products and services. On this basis, the main problem that this study seeks to address is:

### **What is the role of blockchain technology in enhancing the function of the issuing, trading and settlement processes of sukuk in the Islamic financial market in Indonesia, the UAE, and Saudi Arabia?**

In order to address the main problem, the following sub-questions are posed:

- What are the main characteristics of blockchain, and how does this technology work?
- How does blockchain technology reshape the financial industry framework?
- How does blockchain technology automate the Islamic financial market, concerning the industry of sukuk?
- Which successful blockchain sukuk experiences exist in this field?

# Introduction

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**Hypotheses:** To answer the main question and sub-questions, the following hypotheses are adopted:

- Blockchain technology is one of the modern financial technologies with multiple characteristics and benefits;
- Blockchain technology has changed the working mechanisms of many financial services and transactions by reducing costs and increasing the scope of trust between dealers;
- Automating the stages of securitization process makes sukuk processing easier, more flexible, and less expensive;
- Blossom Finance, HLC, and Wethaq Capital Markets platforms have proven their influence in developing the industry of sukuk, which in turn develop the working mechanisms of the Islamic financial market.

**Importance of the Study:** Considering the nature of the current sukuk settlement process and the financial market ecosystem, the importance of this study lies in assessing the extent to which blockchain technology can be applied in the processes of issuing, trading and settling sukuk in the current regulatory environment of the Islamic financial market, which increases the size of the sukuk market, and increases the Islamic financial market effectiveness, which mainly depends on the sukuk industry.

**Objectives of the Study:** This research aims to achieve the following points:

- To investigate blockchain technology basics and its core functions;
- To identify the potential implementation of blockchain technology in the financial sector;
- To examine the current Islamic financial market infrastructure;
- To illustrate the impact of digital transformation on the Islamic financial industry;
- To identify the benefits of blockchain structure in sukuk life cycle;
- To evaluate the using of blockchain technology in sukuk market and its efficiency using different smart sukuk platforms (Blossom Finance, Wethaq Capital, HLC), as well as to identify the different challenges facing blockchain applications;
- To address the possibility of applying smart sukuk in the Algerian financial market.

**Reasons for Choosing the Topic:** There are numerous motives behind choosing this topic, the most important of which are:

- The Self-desire and personal passion to study the possibility of linking Islamic finance to the digital economy;
- The topic is new and there are not many previous studies conducted in it;
- Financial technology techniques, especially blockchain, are considered one of the most important technologies applied in reshaping the financial sector, which increase the researcher's passion to conduct such topics.

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**Research Methodology:** The nature and characteristics of the topic necessitated reliance on descriptive and analytical approaches. The descriptive approach is used to reviewing the basic concepts of blockchain technology and clarifying its role in shaping the new generation of sukuk industry. However, the analytical approach is used for the applied chapter, as it relies on a case study, which evaluates the experiences of smart sukuk platforms in Indonesia, the UAE, and Saudi Arabia, as they consider the first smart sukuk platforms in this field. Concerning data collection, this study is relied on several books, which related to the topic matter, in addition to researches and studies published in periodicals or presented in the form of research papers in scientific journals, conferences and researches published on the internet and also it depends on various platforms' websites and reports.

**Study Limitations:** The limitations of the study are:

- **Time limits:** Due to the recent trend towards financial technology technologies, including blockchain technology, the study covered a short period starting from 2018 to the present day, as the first application of smart sukuk was in the late of 2018;
- **Spatial limits:** The subject of the study concerned the spatial borders of Indonesia, the United Arab Emirates, and Saudi Arabia, noting the possibility of applying smart sukuk in our country, Algeria.

**Study Difficulties:** During the study's preparation phase, we faced a number of difficulties, the most important of which are:

- The novelty of the subject matter of blockchain and its connection to modern and complex technological techniques, which requires the researcher to be familiar with its technical side before its financial applications, as it is difficult to understand even for specialists in the field of programming and computer science;
- The lack of many previous studies on the researched topic made it difficult to know all its details, especially in light of the novelty of its application;
- Many of the free and electronic sources and references in international digital libraries or through the SINDL portal are superficial studies, while studies that have a real scientific value and address the subject of the study with sufficient accuracy are in exchange for payment in foreign currency, especially in light of our inability to obtaining the rights to fund the thesis from the laboratory to which we belong.

**Literature of Previous Studies:** In the past few years, the application of blockchain technology to various financial applications has been discussed in the research and financial industry, as a number of articles discuss the possibility of applying blockchain technology in different areas, such as the banking and financial services and the financial market. In fact, for the previous studies, most of them are articles, and this is due to the topic's newness and the continuous researches on it, as among of them, this study reported the following:

❖ **Local studies:**

1. **Babas Mounira**, a study entitled “**Blockchain Technology Applications in the Islamic Financial Industry -The Smart Sukuk of Blossom Finance's Platform in Indonesia Model**”, **Economic Sciences, Management and Commercial Sciences Review, Vol.13, No.2, 2020**. This study examines the uses of blockchain technology in the Islamic financial sector through an analysis of smart sukuk in

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Indonesia, which is based on Blossom Finance blockchain platform. Blossom smart sukuk consider as the first technological application, which has a crucial role in microfinance cooperatives' financing in Indonesia. According to the study's findings, the application of blockchain in Islamic banking have improved the industry's transparency and effectiveness in a number of ways, especially in the areas of smart contracts and smart sukuk, Waqf management, cloud data storage, Takaful, and Zakat collection.

2. **Benalkama Malika**, a study entitled “**Sukuk Tokenization: Successful Experiences**”, **Journal of Studies in Economics and Management, Vol.4, No.1, 2021**. This research paper aims to shed light on the significance of applying blockchain technology to the market. Given that sukuk is the most popular and rapidly expanding financial product in the Islamic financial sector. Which could reduce intermediaries costs based on the digitalization of sukuk life cycle, as well as, it presents the case studies of Blossom Finance, Wethaq Capital and HLC platforms experiences. The study concludes that the application of this technology in the industry of sukuk helps in standardizing sukuk issuance and reduces the challenges associated with its structuring.

## ❖ Foreign studies:

1. **Binghui Wu and Tingting Duan**, a study entitled “**The Application of Blockchain Technology in Financial markets**”, **Journal of Physics: Conference Series, Vol.1176, No.04, 2018**. This study explores the potential application of blockchain technology in financial note, cross-border payment and asset-backed securitization based on a descriptive approach, which reviews several research papers related to the possible applications of blockchain. The study concludes that this technology has a great advantage in the aspect of information transaction, such as decentralization, openness, autonomy, tamper-resistant information and anonymity. Although blockchain technology is based on asymmetric cryptography, distributed consensus and intelligent contract, the application of blockchain technology is still at the starting stage. Thus, it can be further applied in financial fields and financial products in the near future.
2. **Evans Olaniyi**, a study entitled “**Blockchain Technology and the Financial Market: An Empirical Analysis**”, **School of Management & Social Sciences, 2018**. The aim of this study is to investigate the relationship between blockchain technology and the financial market, which used descriptive and analytical approach. The case study takes place in the USA and China between the periods of (2008-2016). The results of this study show that blockchain technology has a positive and significant relationship with the financial market in the USA and China. The presence of blockchain innovation in financial markets promotes the financial development. The findings also indicate that the adoption of blockchain in these economies has a significant and positive relationship to financial development in terms of increasing GDP rate and trade openness.

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3. **Sarah Iftikhar and Irum Saba**, a study entitled “**Blockchain Based Smart Sukuk as Sharia Compliant Investment Avenues for Islamic Financial Institutions in Pakistan**”, *Journal of Finance & Economics Research*, Vol.05, 2020. The aim of this study is to highlight financial instability, lack of financial education and absence of political will being the main reasons for low sukuk issuance in Pakistan. This study, which based on descriptive and analytical approach, proposes a low-cost smart sukuk structure to address the liquidity problem of the Islamic banking industry in Pakistan. It finds that smart sukuk issuing and transaction fees are much lower than the conventional sukuk issuances, and they are expected to be more secure and marketable internationally, as blockchain-based smart sukuk are practicable to solve the problem of the standardization and huge issuance and maintenance costs of sukuk industry.
4. **Osama Hamza**, a study entitled “**Smart Sukuk Structure from Sharia Perspective and Financing Benefits: Proposed Application of Smart Sukuk through Blockchain Technology in Islamic Banks within Turkey**”, *European Journal of Islamic Finance*, 2020. This study introduces the new generation of sukuk, that their structure is based on blockchain, which allow more investors in both retail and corporate sectors to participate in sukuk issuance, it also presents a smart sukuk model as a proposed application of smart sukuk through blockchain technology in Islamic banks within Turkey. The research findings indicate that from the Sharia perspective there are some issues in some applicable of sukuk models, such as the issue of capital guarantees. The use of blockchain technology in smart sukuk structuring reflects several benefits on the financing markets, as it gives an access capacity to more investors and markets, faster processing capability, transparency, invariance, and low transaction costs.
5. **Sherin Kunhibava and Zakariya Mustapha**: study entitled “**Sukuk on blockchain: a legal, regulatory and Sharia review**”, *ISRA International Journal of Islamic Finance*, 2021. This article attempts to investigate legal and Sharia (Islamic law) concerns related to sukuk (Islamic bonds) on blockchain. Based on descriptive and analytical approach, the paper presents analyses on the practice of conventional sukuk and blockchain sukuk by discussing its legal, Sharia and regulatory issues. This paper reveals that digitizing sukuk issuance through blockchain remedies certain inefficiencies associated with sukuk transactions. Structuring sukuk on blockchain platform can increase transparency of underlying sukuk assets and cash flows in addition to reducing costs and the number of intermediaries in sukuk transactions. The paper likewise brings to light legal, regulatory, Shariah and cyber risks associated with blockchain sukuk, confronting investors, practitioners and regulators. Which calls for a deeper collaboration in research among Sharia scholars, lawyers, regulators and information technology experts.
6. **Nida Khan and others**, a study entitled “**Tokenization of sukuk: Ethereum case study**”, *Global Finance Journal*, Vol.51, 2022. This research paper, which is based on a descriptive and analytical approach, seeks to introduce sukuk tokenization’s case study by implementing basic smart contracts for Murabaha sukuk on Ethereum. It highlights at first the costs resulting from the process of issuing sukuk, as well as the high financing costs for small and medium-sized companies, and the main challenges involved in sukuk issuing process. On other hand, it shows the possibility of blockchain technology in reducing the cost incurred by converting sukuk into encrypted codes. The

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study concludes that the process of automating sukuk stages helps to reduce the issuing and trading of Murabaha sukuk based on Ethereum platform.

From the studies mentioned above, we find that there are many similarities and differences between them and ours. As for the points of similarities, they particularly represent in the theoretical aspect of the basics of blockchain applications in the financial sector through: firstly, its use in the financial market as a technology that enhances the financial services and transactions dealing with smart contracts and cryptocurrencies, and secondly, its use in the Islamic financial market through the tokenization of sukuk or what it calls smart sukuk, giving the advantages associated with its adoption in term of reducing intermediaries and costs, and ensuring trust and data in exchanging all kind of financial transaction. However, this study differs from its predecessors in terms of its novelty and its depth in the applications of blockchain technology using smart contracts and cryptocurrencies in the financial industry, presenting their main use areas. It also examines their applications in the Islamic financial market using smart sukuk and demonstrates the main mechanisms of sukuk tokenization based on smart contracts, as well as, highlights the first blockchain platforms for the issuing, distributing and trading process around the world. Although the study of both Babas Mounira and Benalkama Malika address these platforms, but this study goes more deeper into their procedures and processing mechanism, as well as their significance in developing the Islamic financial market.

**The Structure of the Study:** In order to understand the subject of the study from all its aspects and to gain accurate and detailed knowledge about its problematic, this study covers four chapters, and its outline is organized as follow:

- **The first chapter** elaborates a literature about blockchain technology from the concept to the execution, and it also presents its global adoption over the world. Additionally, its main advantages and the obstacles of its implementation;
- **The second chapter** introduces the main application of blockchain technology in the financial sector, which based on cryptocurrencies and smart contracts. This two main applications used by blockchain to expand the reach of financial technology in the financial sector in different financial area;
- **The third chapter** provides a general overview about sukuk and expresses the role of sukuk in the development of Islamic financial market, as well as its main challenges that face its growth. Finally, it demonstrates the adoption of blockchain technology in sukuk industry, giving birth to smart sukuk, which used for easier sukuk issuance, trading, and settlement. It also addresses its applicability in financing economic development;
- **The fourth chapter** presents and analyzes the most important pioneering experiences in smart sukuk industry taking place in Indonesia, the UAE, and Saudi Arabia, demonstrating their advantages that modernize the Islamic financial market, as well as the most important challenges facing their application such as regulatory and legal, Sharia, cyber risks, and technological infrastructure. It also addresses the ways of integrating smart sukuk into the Algiers stock exchange based on these experiences.



# Chapter One

# **Chapter One: Theoretical Framework of Blockchain Technology**

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## **Preface**

One of the most significant technological advancements of the twenty-first century is blockchain. It is a digital ledger based technology developed to change the perspective of the digital transactions, or specifically, to replace them. The collection of cryptography, data management, networking, and incentive mechanisms supports the checking, execution, and recording of the transactions between all parties, as the system does not require any central authority, or any single trusted third party. Nowadays, this technology gets a wide attention, especially in the financial world, as it allows users to record and share a common view of a system's state across a distributed network and makes the online transactions more secure and safer than the traditional one. Therefore, this chapter provides a general overview of blockchain technology fundamentals and its working system. Moreover, it discusses the use of this technology over the world, as well as its benefits and the limitations that face its adoption. Thus, this chapter is divided as follows:

## **Section One: Introduction to Blockchain Technology**

## **Section Two: Blockchain Structure and Framework**

## **Section Three: Blockchain: Global adoption, Benefits and Limitations**

# Chapter One: Theoretical Framework of Blockchain Technology

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## Section one: Introduction to Blockchain Technology

This section presents an overview about blockchain technology, including its history and its different key features, as well as its generations from blockchain 1.0 to blockchain 3.0.

### 1. Historical Background of Blockchain

Blockchain technology did not appear suddenly, but it was the result of the development of the financial technology, and virtual currencies that occurred over decades. In fact, blockchain is the original technology that underlies cryptocurrency, the most famous of which is “Bitcoin”, and the one for which blockchain technology was invented. As it was developed as the underlying infrastructure and database of recording and executing transactions for the digital currency bitcoin<sup>1</sup>. The concept of blockchain was first fully conceived as an enabling technology for the bitcoin cryptosystem, as introduced in 2008 by a pseudonymous individual or group known as “Satoshi Nakamoto” in a research paper titled “Bitcoin: A Peer-to-Peer Electronic Cash System”<sup>2</sup>. Where he provides a peer-to-peer electronic cash system based on proof rather than trust party, allowing any two parties to transact and interact directly with each other without any third trust party such as bank. In this regard, cryptographic proof stands for the encrypted process of reaching validation, or what they have called consensus, through a proof of work system between the participants. That eliminates the need of any intermediary in which they trusted in<sup>3</sup>. Moreover, this technology comes as a solution of the double spending problem associated with digital currency that arises when one party sends the same digital currency (token) to several different parties, creating new tokens, one for each different party, and essentially spending the same digital cash more than once<sup>4</sup>.

### 2. The Concept of Blockchain Technology

#### 2.1. Blockchain Definition

While there are numerous definitions of blockchain technology, it is crucial to distinguish and clarify the fundamental ideas involved. A few of these definitions are as follows:

- ❖ “Blockchain technology is a novel innovation that relies on mathematical, cryptographic, and economic concepts to maintain databases among many individuals without the involvement of a third party or a central authority. It is a secure shared data base, where, the transaction can be checked by the involved parties, in which each collection of transactions is sent to a block”<sup>5</sup>;
- ❖ “A blockchain is a ledger that works on the internet in a decentralized manner by an indefinite number of participants”<sup>6</sup>;

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<sup>1</sup>- Hossein Kakavand, Nicolette Kost De Sevres: The blockchain Revolution: An Analysis of Regulation and Technology Related to Distributed Ledger Technologies, Luther Systems, n.d, p 04.

<sup>2</sup>-Belaj Badr: Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger, Packt Publishing, Birmingham, United Kingdom, 2018, p 26.

<sup>3</sup>-Marina Niforos: Blockchain in Development— A New Mechanism of ‘Trust’?, The International Finance Corporation report: Blockchain Opportunities for Private Enterprises in Emerging Markets, 2019, p 10.

<sup>4</sup>- S. Nakamoto: Bitcoin: A Peer-to-Peer Electronic Cash System, Tech. Rep, 2008, p 03.

<sup>5</sup>- Abhishek Gupta, Stuti Gupta: Blockchain Technology Application in India Banking Sector, Delhi Business Review, Vol.19, No.02, 2018, p 76.

<sup>6</sup>-Yano Makoto et al.: Blockchain and Crypt Currency, Springer, Singapore, 2020, p 03.

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- ❖ According to Deloitte report (2017): “A Blockchain is a digital, immutable, distributed ledger that chronologically records transactions in a real time. The condition for each subsequent transaction to be added to the ledger is the consensus of the network participants (called nodes), thereby creating a continuous mechanism of monitoring regarding manipulation, faults, and data quality”<sup>1</sup>.

Accordingly, and through the aforementioned definitions, blockchain can be defined as: a digital distributed database in which transactions simultaneously are recorded and shared among all network parties (nodes) and all data are stored in fixed structures called “blocks” after getting the participants' consensus (validation), as it is a protocol for exchanging value on the internet without any intermediary. Considering that blockchain is a new and somehow a complex technology, this part provides some clarifications regarding the conceptual meaning of blockchain through the following paragraphs.

Blockchain technology is an online platform that chronologically records transactions and tracks assets through distributed ledgers in a network. Furthermore, it enables tracking the ownership of assets and money movements everywhere. Simply put, anything of value can be recorded, tracked, and exchanged on a blockchain platform and the duplicate records of these transactions are simultaneously shared with participating agents in the network (nodes). The records are further protected with cryptographic keys to ensure their security<sup>2</sup>. Each of these transactions is verified by the consensus of a majority of the participants in the system, making fraudulent transactions unable to pass the collective verification. Once a record is created and accepted by the blockchain network, it can never be altered. As it has been described as both a network and a database, equipped with built-in security and internal integrity<sup>3</sup>. Moreover, from a theoretical perspective, blockchain technology has the potential to replace transactions rooted in trust with those based on rules that are defined mathematically and shared digitally<sup>4</sup>. In fact, blockchain is also known as “Shared Ledger”, as it chronologically shares databases, which are spread through many computer devices, in which each computer independently updates itself, if one of the transaction procedures changes, which ensures secure money movements<sup>5</sup>.

On blockchain platform, there is no need for a central authority to administrate and to validate a transaction. Instead, the platform is decentralized, and transactions are executed and licensed by blockchain platform's members (network) via cryptographic signatures, making duplicate copies of the transactions, which are distributed to the network members<sup>6</sup>. In the process of transaction verification, each check and collect of information occurred for 10 minutes is called a bloc, and conceptually, it is called blockchain as blocks are connected and sequenced in a form of a chain. Where all the network members collectively record, check and register transaction data, in which they can guarantee the accuracy of transaction records without being informed by a "trusted third party" as a central bank or any administrative agency. Moreover, it is a highly secure platform because it is updated all the time; whenever transactions

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<sup>1</sup> - Deloitte Report: Blockchain technology in India: Opportunities and challenges, 2017, p 10.

<sup>2</sup>-Pierluigi Martino: Blockchain and Banking how Technological Innovations are shaping the Banking Industry, Springer Nature, Switzerland, 2021, p 10.

<sup>3</sup> - J. Leon Zhao et al.: Overview of business innovations and research opportunities in blockchain and introduction to the special issue, Financial Innovation, 2016, pp 3,4.

<sup>4</sup>-Vincenzo Morabito: Business Innovation through Blockchain-The B<sup>3</sup> Perspective, Springer Nature, Switzerland, 2017, P 04.

<sup>5</sup>- S. Nakamoto, Op.cit, p 03.

<sup>6</sup>- Tarik Dogru et al.: Blockchain Technology and its Implications for the Hospitality Industry, Boston hospitality review, 2018, pp. 2-4.

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occur, all the members' nodes/ledgers are simultaneously updated. For instance, a person (A) transfers money to person (B). It is usually performed with the help of a third trusted party as bank. The work of the bank is described as follows: (A) sends the money to the third party and the third party identifies (B) as the right person to transfer the money to his account. Typically, this process takes 3-4 days. However, blockchain avoids the third party (bank) intervention and performs the transaction faster and cheaper than the traditional way<sup>1</sup>. Furthermore, the blockchain cannot be faked or hacked, because it is only faked when more than 51% of the participants are synchronized by recording the transaction details in the dispersal ledger<sup>2</sup>. Also, this technology enables the tracking of assets ownership in which anything of value could be registered, traced, and exchanged on blockchain, making a duplicated copy and shared over all the network nodes. The data are protected with cryptographic keys, or mathematically configured to ensure the security of the system. As the main goal of this platform kind is to create a decentralized, secure, faster, economic and less prone to error environment where no need to a third party involvement to control and manager the transaction's data<sup>3</sup>. Therefore, it could be the best choice for business-to-business (B2B) collaboration to raise their productivity<sup>4</sup>.

Any system can follow two architectural structures, representing in distributed and centralized system. Blockchain in turn follows the distributed structure, where there are several nodes (computers) linked to each other without a central node of control<sup>5</sup>. There, each computer is indirectly connected, i.e., no single computer is directly connected to all other network computers<sup>6</sup>. In contrast, in a centralized system, all computers are directly connected to a central node. In fact, the distributed systems are preferred than centralized systems because of their faster calculation, reduced maintenance costs, greater stability, and easier upgrades<sup>7</sup>. Therefore, the blockchain is a new type of distributed ledger that enables multiple participants to share the database and to modify that in a secure and safe manner, even if they do not trust each other<sup>8</sup>. In short, it is worth to be noted that all blockchain platforms are distributed ledgers but not all distributed ledgers are blockchains, as they might not have the underlying structure presented in blockchain platforms. Blockchain allows multiple parties to securely interact without the need of a trusted third party intermediary, and it allows all the participants to see

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<sup>1</sup>- Shiho Kim, Ganesh Chandra Deka: *Advanced Applications of Blockchain Technology*, Springer Nature, Singapore, 2020, p 02.

<sup>2</sup>- Soonduck Yoo: *Blockchain based financial case analysis and its implications*, the Asia Pacific Journal of Innovation and Entrepreneurship, Vol.11, No.03, 2017, p 313.

<sup>3</sup>- Tarik Dogru et al. *Op.cit*, p 02.

<sup>4</sup>- Lennart Ante et al.: *Blockchain-Based ICOs: Pure Hype or the Dawn of a New Era of Startup Financing?* , Journal of Risk and Financial Management, 2018, p 06.

<sup>5</sup>- Janvi Dattani, Harsh Sheth: *Overview of Blockchain Technology*, Asian Journal of Convergence in Technology, Vol.07, No. 1, n.d, p 01.

<sup>6</sup>- Ali Ihsan Ozdemir et al.: *Assessment of blockchain applications in travel and tourism industry*, Quality and Quantity: International Journal of Methodology, Vol.54, No.05, 2020, p 1551.

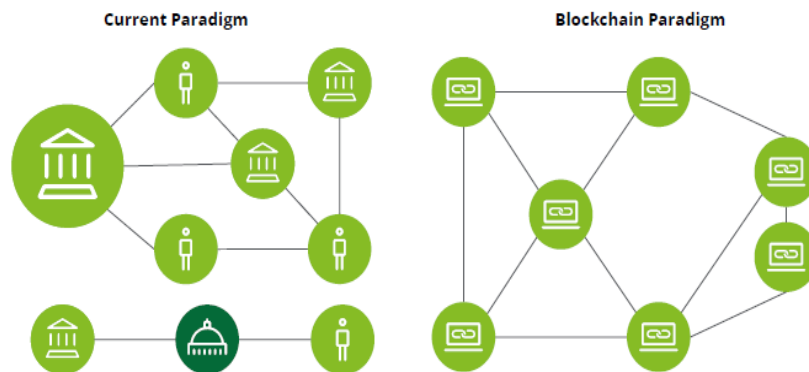
<sup>7</sup>-Taehyun KO and al.: *Blockchain Technology and Manufacturing Industry: Real-Time Transparency and Cost Savings*, Journal of Sustainability, Vol.10, 2018, p 05.

<sup>8</sup> - Garrick Hileman, Michel Rauchs: *Globaliz Block chain Benchmarking Study*, Cambridge Centre for Alternative Finance, United Kingdom, 2017, p 13.

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all the transactions where and how are taking place<sup>1</sup>. The difference between a blockchain database and traditional database is shown in figure (I-1).

**Figure (I-1): Traditional Database vs. Blockchain Database**



**Source:** Deloitte Report: Blockchain technology in India Opportunities and challenges, India, 2017, p 10.

From figure (I-1), the two databases could be compared as follow<sup>2</sup>:

In the **traditional model**, we find:

- Transferring data among the different parties is the responsibility of the central authority;
- To facilitate the transfer of data (assets), multiple intermediaries are required to create trust.

Hoever on the **blockchain model**, we find:

- Distributed computers (nodes) that keep up a shared data source;
- The encrypted algorithms allow confidence.

## 2.2. Features of Blockchain Technology

Blockchain technologies consist of six main characteristics as discussed below:

**a. Decentralization:** it is the core characteristic of blockchain, and it means that blockchain does not use any centralized nodes to process data, as the data is registered, stored, and updated in a decentralized system. This feature eliminates many risks that are associated to a centralized database<sup>3</sup>. The distributed system does not provide a central target that attackers could exploit it. Likewise, it does not have any central point of failure that can stop the system if it is compromised. On Blockchain, identical copies of the database are owned by all nodes in the network, as when a new block is added to the chain, a mutual consent is required from all participants<sup>4</sup>. This is done through a consensus algorithm, which ensures the integrity of all the distributed copies across the network. All parties based on the consensus protocol verify the new transaction block that is added and all nodes update their own copies of the blockchain. The consensus algorithm also defends against attacks trying to fork the chain<sup>5</sup>. Thus, the consensus algorithm is responsible for maintaining the legitimacy of all blocks being added to

<sup>1</sup>- Nida Khan et al.: Tokenization of Sukuk: Ethereum Case Study, Preprint submitted to Global Finance Journal, 2020, p 08.

<sup>2</sup>- Deloitte Report, Op.cit, p 10

<sup>3</sup>-Raqiya Ahmed Al Hilali1, Hothefa Shaker: Blockchain Technology's Status of Implementation in Oman: Empirical Study, International Journal of Computing and Digital Systems, Vol.01, 2021, p 01.

<sup>4</sup>- Imran Bashir: Mastering Blockchain, Packt Publishing, Birmingham, United Kingdom, 2018, p 29.

<sup>5</sup>- Sean Stein Smith: Blockchain, Artificial Intelligence and Financial Services: Implications and Applications For Finance and Accounting Professionals, Springer Nature, Switzerland, 2020, p 44.

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the chain. It also defends against attacks that attempt to break the chain. Therefore, the consensus algorithm is responsible for maintaining the validity of all blocks that are added to the chain<sup>1</sup>.

**b. A Distributed Ledger:** Distributed" refers to the possibility for each participant to share a ledger that is concurrently added to and updated each time a transaction occurs, as well as they have access to the information in a real time. In fact, there is a unique version of the ledger and every network user owns the same version of the ledger with a full and updated copy. Every modification in the ledger made by a network participant is thereby distributed to all nodes, once it is verified, and it is added to the chain. Hence, the transparency is ensured in blockchain as all participants on the network store the complete history of the transactions, and the modification is always visible to everyone who has a getting access to the system<sup>2</sup>.

**c. Immutability:** One of the notable features of blockchain is immutability, as no one can modify the distributed ledger using any means. The blockchain remains irreversible as no transaction can be changed, erased, or reversed unless more than 51% of the users agrees with the modification. This would require the attackers to take control of more than half of the nodes, which is highly unlikely. However, although hacking the immutability of a blockchain is considered unlikely and complex, it is practically possible if significant amount of resources are available<sup>3</sup>.

**d. Consensus Mechanism:** A transaction can be defined as an exchange of assets between the parties involved. On blockchain, each transaction must be verified and checked for its validity and authenticity. The present traditional transaction systems use a trusted party to perform these validations. For instance, the case of transferring money between two persons could be performed by a bank, as it is responsible for verifying the two parties' identity and ensuring the funds reception. Here the bank acts as a trusted intermediary in this system. Blockchain technology eliminates the need for a third party to perform as a trusted intermediary to mediate transactions. Rather than, the working of blockchain is governed by its principal implementations and the consensus of the network system, as its system allows participants to carry out transactions without the need of any central authority. Technically, the process of the verification and authentication of the transferred assets in a decentralized system as blockchain is the responsibility of the agreed upon algorithm, as it defines the rules that make a transaction valid and prevents the double spending errors<sup>4</sup>. Consensus is used to maintain agreement between nodes in the network. As when the network expands, the number of nodes increases and it is very difficult to achieve the agreement and to ensure that all nodes in the system have the same exact copy. The process of achieving consensus in a blockchain network is called mining. Mining is important, because it ensures that all the added blocks to the ledger are immutable and secure<sup>5</sup>. Among the popular consensus algorithms, there are two main categories of consensus algorithms, namely Proof of Work, Proof of Stake<sup>6</sup>. Proof of Work is a consensus mechanism used in the cryptocurrency network. It requires complex calculations and electricity

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<sup>1</sup>-Shiho Kim, Ganesh Chandra Deka, Op.cit, pp. 131-135.

<sup>2</sup>-Pierluigi Martino, Op.cit, pp. 11-13

<sup>3</sup>-Bahareh Lashkari, Peter Musilek: A Comprehensive Review of Blockchain Consensus Mechanisms, IEEE Access, Vol.04, 2016, p 03.

<sup>4</sup>- Shiho Kim, Ganesh Chandra Deka, Op.cit, p 132.

<sup>5</sup>- Md Nazmus Saadat et al.: Blockchain based Crowdfunding systems, Indonesian Journal of Electrical Engineering and Computer Science, Vol.15, No.1, 2019, p 410.

<sup>6</sup>- Bahareh Lashkari, Peter Musilek, Op.cit, p 03.

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in the authentication process. The idea behind the proof of work consensus algorithm is that each participant or miner within the network tries to solve a computationally demanding task as quickly as possible. However, Proof of Stake is an energy-efficient alternative of proof of work that requires people to prove ownership of a quantity of currency<sup>1</sup>.

**e. Accessibility:** In terms of accessibility, blockchain can be categorized into two classes, permissionless (public) and permissioned (private). The public blockchain network is open to everyone and anyone can join it either as a participant or a consensus authority (miner). In contrast, the private blockchain has certain restrictions that determine who can participate in the network, as he/she must obtain a permission from the party that owns the platform before getting access to the network<sup>2</sup>.

**f. Transparency:** Transparency has become a very important feature for completing any transaction securely, which blockchain technology can provide without the need for the system to have a specific supervisory authority<sup>3</sup>. In a blockchain network, each block consists of information and is provided with a hash address, so that any single and simple change in the block reflects everyone in the distributed network<sup>4</sup>. Blockchain application are not just one technology but it includes cryptography, algorithms, mathematics, economic models, integrating peer-to-peer networks, and using distributed consensus mechanisms to solve traditional distributed data base synchronization issues and ensure transparency between all participants nodes<sup>5</sup>.

### 3. Blockchain's Generations

Blockchain could also be classified into three different generation. Each version is unique due to its different features and applications. This classification helps to identify the features where blockchain improves each area. Thus, depending on its development and the sophistication of its applications, there are different categories of blockchain technology: Blockchain 1.0 is used for cryptocurrency currency, Blockchain 2.0 associated with digital finance, and Blockchain 3.0 for digital society<sup>6</sup>.

**a. Blockchain 1.0:** It is the type known by cryptocurrency “bitcoin”; it represents the first application of technology introduced by “Nakamoto” in 2008 that used to exchange bitcoins in a secure and digital manner. This type of blockchain facilitates digital transfer of money transactions based on cryptocurrencies that are associated with internet. Mostly, this kind of blockchain is public in which every user could get access to blockchain platform without getting a permission<sup>7</sup>.

**b. Blockchain 2.0:** Blockchain 2.0 stands for a wide range of financial and economic uses that extend beyond cryptocurrencies and the settlement of payments in 2015. While blockchain 1.0 looks to a decentralize money system and payments, blockchain 2.0 generally looks to

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<sup>1</sup> - Zibin Zheng, et al.: Blockchain challenges and opportunities: a survey, Journal Web and Grid Services, Vol.14, No.04, 2018, p 360.

<sup>2</sup>-Shiho Kim, Ganesh Chandra Deka, Op.cit, p 134.

<sup>3</sup>- J. Leon Zhao et al., Op.cit, pp. 3-4.

<sup>4</sup> - Fatima Alsubaei: Blockchain Adoption in the Gulf States, Middle East Institute, 2019, p 02.

<sup>5</sup> - Shaik V. Akram et al.: Adoption of blockchain technology in various realms: Opportunities and Challenges, Wiley, 2020, P 2.

<sup>6</sup> - J. Leon Zhao et al., Op.cit, p 01.

<sup>7</sup> - Shaik V. Akram et al., Op.cit, p 03.



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decentralize markets and assets movements using an online platform<sup>1</sup>. Applications in these areas include traditional banking instruments such as loans and mortgages, complex financial market instruments such as stocks, bonds, futures and derivatives, and other assets and property, which can be converted, into liquidity. This kind of blockchain is specifically worked with smart contracts protocol, as it is a preprogramed system that works when specific conditions are met. In short, blockchain 2.0 is a platform that provides a working mechanism to run different transaction types in the financial sector beyond cryptocurrency<sup>2</sup>.

**c. Blockchain 3.0:** The term "Blockchain 3.0" describes a broad category of blockchain applications unrelated to commerce, money, financial markets, or any other type of economic activity that occurred after 2015. These applications involve health, art, identity, science, education, governance, public goods, and various aspects of culture and society. However, the majority of these applications are in their early stages of development or even at the "pilot stage"<sup>3</sup>. Generally, blockchain 3.0 used to operate the Decentralized Applications (DApp)<sup>4</sup>. As, these decentralized applications operate on a network in a distributed manner while securely protecting participants' information and executing operations across decentralized network nodes, while traditional applications use centralized servers to serve this purpose<sup>5</sup>.

## Section Two: Blockchain Structure and Framework Mechanism

The underling work of blockchain is to record transactions in a secure and less cost manner, as it considers as an open and distributed database based on a peer-to-peer (P2P) network. In which any one could interact and transact any financial operations using a platform that provide transparent, secure, less cost mechanism to easily link different participants through cryptographic techniques based on chain of blocks. Therefore, this section demonstrates the elements of each block and illustrates the framework of blockchain technology. Moreover, it discusses the three blockchain's types; public, private and hybrid.

### 1. Blockchain System Elements

Blockchain represents a building of blocks, as its basic component is the block, which is a collection of activities and operations to be executed, or processed inside the chain, such as recording data of transferring money or following up proprieties. Typically, each block holds a defined amount of transactions and operations, as it does not handle or accept more than its specific quantity until it completes; and once the chain creates and add a new block, it must attach it to the previous block. This procedure is carried out to prevent any fraudulent transactions from occurring within the block, which could cause the chain to pause or stop recording and terminating transactions<sup>6</sup>. Principally, as in figure (I-2), each block in the chain includes two main elements: a header and body. The header consists of the Hash of the previous

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<sup>1</sup>- Pierluigi Martino, Op.cit, p 19.

<sup>2</sup>- Ibid, p 19.

<sup>3</sup>- Kyle Burgess, Joe Colangelo: Promise of Bitcoin and the Blockchain, Consumers' Research, Washington, USA, 2015, p 16.

<sup>4</sup> مصطفى بوعقل: التوجه الحديث للعولمة المالية في ظل تكنولوجيا سلسلة الكتل، مجلة الاقتصاد الدولي والعولمة، المجلد 02، العدد 04، 2019، ص 32.

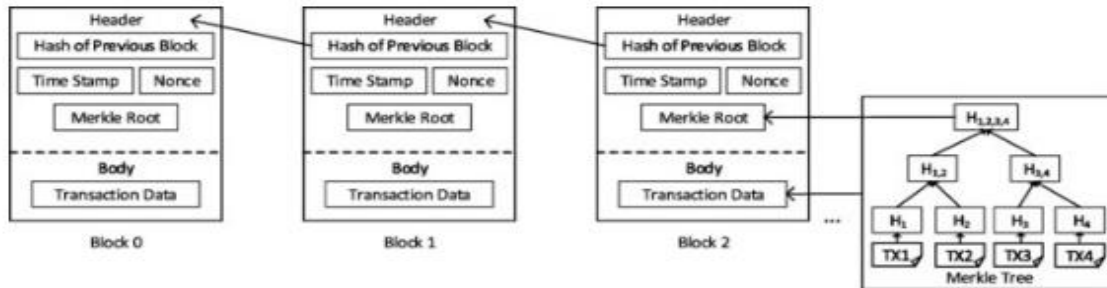
<sup>5</sup>- Shaik V. Akram et al., Op.cit, p 03.

<sup>6</sup>- Babas Mounira: Blockchain Technology Applications in the Islamic Financial Industry-The Smart Sukuk of Blossom Finance's Platform in Indonesia Model-, Economic Sciences, Management and Commercial Sciences Review, Vol.13, No.02, p 312.

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block, time stamp, Nonce and the Merkle tree root. However, the body contains the transaction in which the data is registered<sup>1</sup>.

**Figure (I-2): Block Structure**



**Source:** Ying Chang Liang: Blockchain for Dynamic Spectrum Management, Springer, 2020, p 04.

The following are the different elements of **block header**:

**a. Hash:** Also referred to as a cryptographic fingerprint, it works like a digital fingerprint; it is unique and specific to each piece of data on blockchain. Technically, the hash performs the function of converting input numbers and letters into fixed length encrypted output of 256 bits. Users put information about their transaction (the name of the receiver, sender, and the transferred amount) into a cryptographic hash algorithm - a complex mathematical formula - and receive a set of letters and numbers specific to that transaction<sup>2</sup>. Whenever, the entered input unchanged, it will always produce exactly the same hash. However, if any part of the entered data is changed or tampered with, the hash will change to a completely different set of characters and make it incompatible with the rest of the chain. Therefore, even without seeing the details of the transaction, nodes (computer users) could quickly tell that the data inside the block has been tampered with and quickly spread the warning among the blockchain network (members), and then they reject this version of the ledger<sup>3</sup>. This makes the blockchain ledger more trustworthy and immutable through the reliability and security of the encryption feature

**b. Timestamp:** This refers to the fixed time at which each activity occurs in the chain, as it is required to verify and store a transaction on blockchain in a sequential manner<sup>4</sup>.

**c. Nonce:** It is a 4-byte random number generated to determine a valid block hash, usually it starts with zero (0), and it increases for each hash calculation. Nonce can be considered a form of action to create a new block, as the success of finding a Nonce is the evidence of the work, which is done by a single node<sup>5</sup>.

**d. Merkle tree root:** It is the hash of all transactions in the chain as shown in figure (I-2) above, where each pair of transaction hashes are merged together until a single hash of all transactions is reached, which is called “Root Hash” or “Merkle Root”. For example, the hashes of transaction TX1 is (H1) and transaction TX2 is (H2) are merged together to create a new hash

<sup>1</sup>-Ying Chang Liang: Blockchain for Dynamic Spectrum Management, Springer, 2020, p 04.

<sup>2</sup>-Ibid, p 05.

<sup>3</sup>- Ibid, p 05.

<sup>4</sup>- Marina Niforos, Op.cit, p 12.

<sup>5</sup>- Ibid, p 12.

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called Hash (H1,2); the same process is performed with transactions TX3 and TX4; finally, the root hash (H1,2,3,4) is generated by merging the hash of all transactions TX1, TX2, TX3, TX4<sup>1</sup>.

**e. Transaction:** It represents the second component in the block, which is the body. In a peer-to-peer network, a transaction is composed of a message containing data of a sender, receiver and the asset to be transferred, which is secured using an encryption codes. It is the first step where the sender creates a transaction that holds data about the receiver's public address ( it identifies every device connected to the internet), the value of the transaction and a cryptographic digital signature that verify the transaction's validity and authenticity<sup>2</sup>. Blockchain contains several blocks; each block contains many transactions, as the block size defines the transaction numbers that could hold them. The maximum number of transactions, which each block could contain, depends on the size of the block itself and the size of each transaction<sup>3</sup>. The creation and the addition of a new block on blockchain structure are based on the mining process, as blockchain network relies on miners to collect valid transactions into blocks and link them to the chain, then the new blocks are broadcast across the entire network, so that each full node contains an exact copy of the entire ledger<sup>4</sup>.

## 2. Blockchain Framework

In blockchain platform, a transaction commences when an individual sends a message to the network regarding the terms and circumstances that apply to their transaction. Subsequently, the other member notifies the network of their acceptance, which virtually triggers a request for network participants to interact, verify, and authenticate the transaction. This mechanism helps in building trust among the stakeholders involved using a decentralized public ledger, as well as cryptographic algorithms that can ensure that the approved transactions are not changed after validation. Accordingly, the following paragraphs summarize the framework of blockchain technology:

Each block in blockchain is related to the previous block, and it is digitally processed by the miner using a hash algorithm (Merkle root hash). The hash function is used to identify every individual input to a specific hash value to ensure there is no duplicate hash. Every block composes of data and hash of the previous block to remove any changes or tampering with the blockchain. Each member of the network will receive any new blocks that are created<sup>5</sup>. Thus, every miner (node) will check that block ensuring either it is genuine or tempered. After verification, the new block that is recently created and verified by each node will be added to their copy in the chain. An agreement is then created by all nodes in the network, which is expressed by consensus, that is, the emphasis on the validity and invalidity of the block. Once blocks are created and sequenced, transaction records cannot be changed or removed from the blockchain, nor can the sequence of blocks be changed. This offers tamper-proof and immutable data management systems<sup>6</sup>. In simple words, transfers must go through a mining process in order to add new blocks to the ledger. As mining is a method of adding transaction data using blocks onto a blockchain, and miners are nodes in the network that ensure block's validity. Members of the network function as authenticators that protect the transaction against double

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<sup>1</sup>- Burgess. K, Colangelo. J: The Promise of Bitcoin and the Blockchain; Consumers' Research, Washington, USA, 2015, P 25.

<sup>2</sup>- Vincenzo Morabito, Op.cit, p 24.

<sup>3</sup>- Zibin Zheng et al., Op.cit, p 356.

<sup>4</sup>- Xiwei Xu et al.: Architecture for Blockchain Applications, Springer Nature, Switzer land, 2019, p15.

<sup>5</sup>- Haider Dhia Zubaydi et al., Op.cit, P 03.

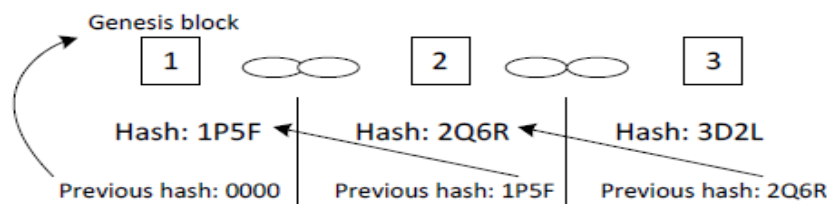
<sup>6</sup>- Vincenzo Morabito, Op.cit, P 02.

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registration and spending through hash system. As if the block is valid, it will automatically be added. However, if it is not valid or tampered with, it will automatically be rejected by all miners (nodes)<sup>1</sup>. The mining process in turn is based on two main algorithms: Proof of Work (PoW) and/or Proof of Stake (PoS) to calculate the hash system<sup>2</sup>. For instance, (PoW) needs a computing power to process and calculate the validity of block's hash, as if a miner has more computing power, the hash will quickly be calculated. The block creation time depends on the application and security mechanisms used. For example, it takes 10 minutes for a Bitcoin transaction to add a block, while it takes 10 to 20 seconds for Ethereum, using the (PoW) algorithms<sup>3</sup>.

Each block in the chain consists of data, a hash of that specific data, and a previous hash. The data recorded in a blockchain depends on the blockchain type. If it is linked to a Bitcoin exchange, it will store transaction's data, sender information, receiver and Bitcoin's amount in the public blockchain. However, if the blockchain is private, it will only allow specific network members to get access. Generally, each single block in the chain has a hash value that can be compared to a digital fingerprint<sup>4</sup>. When a new block is created, the hash of that specific block will also be generated. The block hash will change with the modifications made in the block. Therefore, the important factor while making changes is the hash value, as if the hash value of any block is changed, it will not be considered to be in the same block. In addition to the current hash, the block also has the hash of the previous block, which helps in linking the previous block to the current one. In fact, these features make the blockchain more secure for users' information<sup>5</sup>. Think about a chain with three blocks, for instance as shown in figure (I-3), each block is composed of the hash value of the previous block and the current block. In the figure, the second block points towards the first block, and the third block is linked to the second block using the previous hash. The previous hash of the first block is 0000, because it is a special block that does not refer and link to any block. This block is called the **Genesis** block. Now suppose someone wants to tamper and change the second block, so the hash value of that block will be also changed. In this case, the third block and the subsequent blocks connected in the chain will be invalid, as currently there is no valid hash at that moment<sup>6</sup>. Therefore, tampering with one block in the chain will invalidate all the subsequent blocks.

**Figure (I-3): The Structure of a Blockchain**



**Source:** Shiho Kim, Ganesh Chandra Deka: *Advanced Applications of Blockchain Technology*, Springer Nature, Singapore, 2020, p 03.

<sup>1</sup>- Shiho Kim, Ganesh Chandra Deka, *Op.cit*, p 57.

<sup>2</sup>- Haider Dhia Zubaydi et al., *Op.cit*, P 03.

<sup>3</sup>- Karl J. O'Dwyer, David Malone: *Bitcoin Mining and its Energy Footprint*, The 25th International Conference on Information and Communications Technologies, Limerick, Ireland, 26–27 June 2014, P 04.

<sup>4</sup>- Shiho Kim, Ganesh Chandra Deka, *Op.cit*, p 03.

<sup>5</sup>- *Ibid*, p 03.

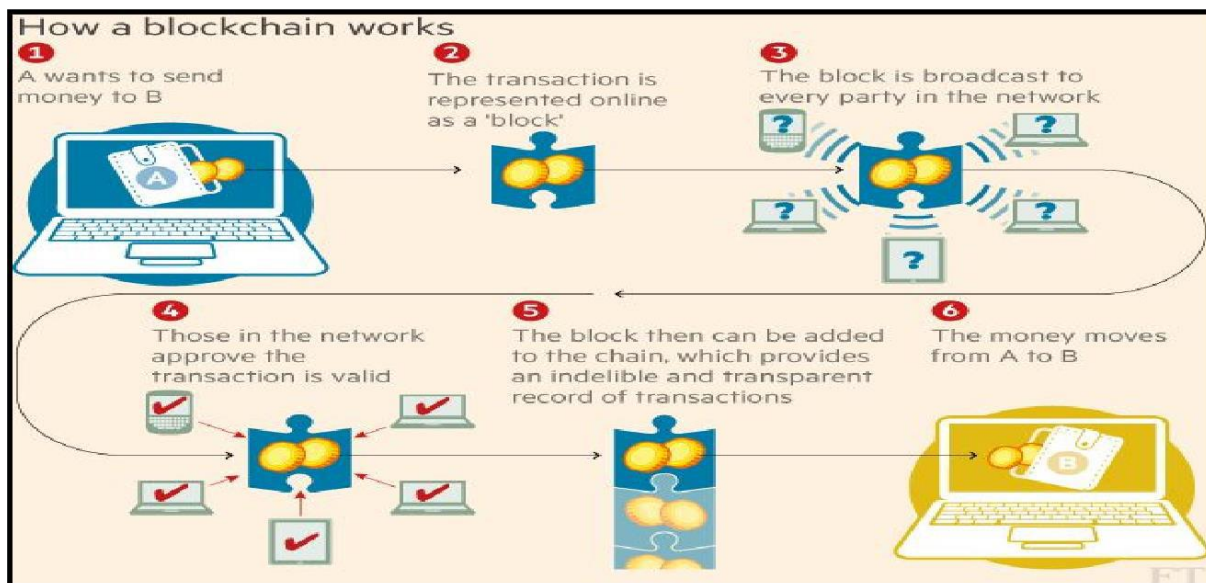
<sup>6</sup>- *Ibid*, p 03.

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As shown in figure (I-3), blockchain can be represented as a traditional public ledger, where a complete list of transaction records (Tx) is stored on a chain of blocks. Every single block contains a reference to the previous block which is known as the parent block (i.e., the genesis block is the parent block of block 1, and block 1 is the parent block of block 2). The first block of the blockchain is called the **genesis** block, and the hash value of the genesis block is straight zeros (0000), because it does not contain any parent block. The interconnectedness of hashes over the entire length of the blockchain makes it impossible for the data within the blocks to be tampered with. As it said before, one of the main features of a perfect cryptographic hash function is that even the smallest changes in the input, such as changing a single character or adding or removing a space, result in a completely different hash. Obviously, the sequence of blocks is not physical, but depends on the cryptographic hash.

While most well-known blockchains, associated with cryptocurrencies, are open source and can be accessed by anyone with a connected computer, blockchains do not have to be public. For instance, the Bitcoin blockchain is public, and transaction records are openly public while keeping participants conducting transactions anonymously. However, a commercial blockchain can be private and does not require any cryptocurrency, as bitcoin, Ethereum, and Litecoin do, and may need a permission to get access and participate in the distributed ledger network. Permission degree can also vary between participants based on their role in the network or the blockchain type<sup>1</sup>. Therefore, once a new block is added to the chain, it exists forever in the exact form in which it is added and is immutable. The figure (I-4) shows an exact example of a bitcoin transaction being implemented on blockchain technology, as shown below.

**Figure (I-4): The Working Mechanism of Blockchain**



**Source:** Tejal Shah, Shailak Jani: Applications OF Blockchain Technology in Banking and Finance, Journal of Management Studies, Parul University, Vadodara, India, 2018, p 09.

<sup>1</sup>-Tejal Shah, Shailak Jani: Applications OF Blockchain Technology in Banking and Finance, Journal of Management Studies, Parul University, Vadodara, India, 2018, p 09.

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Let us consider five (5) users who are on a distributed and decentralized network: A, B, C, D, and E; they are participants in our blockchain. This blockchain example will implement a Bitcoin transaction on blockchain technology as follow<sup>1</sup>:

1. A wants to send 50 bitcoins to B;
2. This digital transaction of 50 bitcoins is represented as a block;
3. Then, this block is broadcasted to every participant in the network [C, D and E];
4. In this example, C, D and E will serve as the checkers and validators in blockchain network, which approve the transaction validity;
5. This transaction block is added to blockchain after being validated;
6. Finally, the 50 bitcoins are sent from A to B.

In step 4, miners C, D, and E implement the cryptographic algorithms and perform the evaluation and verification of the individual blockchain's history. If the evaluation proves that, the record and hash values are valid. Thus, the transaction is accepted. This process is known as a distributed consensus. However, if for some reason C, D and E cannot validate the data on blockchain, so the block input is rejected, and the entire block is not added to the blockchain<sup>2</sup>. Another point is worthy to be noted here, in a blockchain, the length of the blockchain does not refer to the number of blocks but the combined blocks' difficulty. It is said that blockchain is valid if<sup>3</sup>:

- All the blocks in the chain are valid;
- All the transaction existed in the blocks are valid;
- The blockchain starts with the block.

### 3. Blockchain's Types and its Main Platforms

This part demonstrates the various types of blockchain technology, as well as its leading platforms to date.

#### 3.1. Types of Blockchain

Depending on the nature of the ledger and access mechanisms, blockchains can be classified into three categories, namely public, private, and consortium blockchains; each of which has its own characteristics in terms of the consensus determination, write/read permission and degree of decentralization.

**a. Public Blockchain (Permissionless):** In a permissionless or public ecosystem, every member at any time, from anywhere, having a computing device, could act as a participating node, accessing and leaving the network at his/her own. Transaction on public blockchain and network participants' identities are anonymous. Each node in the system has the same copy of the ledger, which is created by a distributed consensus mechanism. A node, wishing to participate, must install a small prototype that defines consensus and other relevant rules. Usually, all nodes have a read and write access. However, nodes may choose to be a "full node," which is a node that maintains a copy of the full ledger. Public blockchain is completely decentralized and has no single owner. Furthermore, no central authority approval is required

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<sup>1</sup>- Tejal Shah, Shailak Jani, Op.cit, p 09.

<sup>2</sup>- Ibid, p 09.

<sup>3</sup>- Ibid, p 09.

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to join the network<sup>1</sup>. Thus, any participant may be able to get access to data and conduct transactions on blockchain, as well as participate in the consensus process. The generated transaction blocks are transparent to all participants; however, participant IDs can be pseudonymized or anonymous. Bitcoin and Ethereum are two of the best-known public blockchain examples. In a public blockchain system, anyone can join a peer-to-peer network without requiring an invitation<sup>2</sup>. All participants have the same permissions access; they can all read everything from the blockchain network and can send transactions to the blockchain network. Public blockchains are entirely open and can contain corrupt or collusive players that try, for example, to overwrite/delete prior transactions or change a piece of data, in contrast to private blockchains, where all nodes are presumed to be trustworthy. Public blockchain systems provide financial incentives for ethical conduct and financial punishments for dishonest activity as a means of discouraging it<sup>3</sup>.

**b. Private Blockchain ( Permissioned):** A platform that is run by a single, centralized entity is known as a private blockchain, and which has a limited nodes number. It is based on concessions that control who can read and write on blockchain ledger. Consensus and mining algorithms are usually not required since a single entity has ownership and controls of block creation. Technically, it is used for efficiency, security, and fraud problems within traditional organization. However, the most important advantage of decentralization ledger is not available in a private blockchain, as it is centralized with specific restrictions<sup>4</sup>. In a permissioned or private blockchain ecosystem, only “invited” or “permitted” nodes could participate in the network. Usually, these worthy trusted members have a read and write access. For example, consider a large company that is building a private blockchain for its manufacturing supply chain, every participant of the supplychain will be penalized for running a node in this network; no one else will be able to do this<sup>5</sup>. Therefore, it can be seen that interested parties recognize (if not trust), and require a more relaxed mechanism to achieve consensus or make modifications to the database. In this situation, this blockchain is consider permissioned, as it has a full control concerning who could get access to the platform, and have the right to read and write on the network. The administrator or owner is the responsible to set rules that organize the network, as well as to control the entire blockchain and set who can participate. Therefore, only users with permissions within an organization, or group of organizations could operate on blockchain, as prior permission from a central authority is required to participate on the network. The most prominent permissioned blockchain examples including “Ripple” and “Corda”, which are a private blockchain that conduct several digital financial transactions and services<sup>6</sup>. In general, while public blockchains are the ones on which cryptocurrencies operate, private blockchains are used for particular use cases, such as financial applications. Particularly, by restricting the participants' number and the consensus scope, requiring a less computational power and lower costs to operate than public blockchains are required. Therefore, private blockchains can achieve a better scalability and processing speed, ensuring more efficiency. In a private blockchain, a single organization controls the blockchain by setting network rules and access

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<sup>1</sup>- Nafis Alam et al: Fintech and Islamic Finance: Digitalization, Development, and Disruption, Springer Nature, Switzerland, 2019, p 83.

<sup>2</sup>- Pierluigi Martino, Op.cit, p 17.

<sup>3</sup>- Kumar Arnab et al: Blockchain, The India Strategy Report, India, 2020, p 59.

<sup>4</sup>- Hussein Elasrag: Blockchains for Islamic finance: Obstacles Challenges, Munich Personal RePEc Archive, 2019, p 04.

<sup>5</sup>-Shiho Kim, Ganesh Chandra Deka, Op.cit, p 147.

<sup>6</sup>- Pierluigi Martino, Op.cit, p 19.

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permissions<sup>1</sup>. In short, the architecture of private blockchain is more suitable for businesses or government applications. As a lot of blockchain-based private applications are being implemented in financial services. NASDAQ, Bank of America, JP Morgan, the New York Stock Exchange, and Fidelity Investments are testing proprietary blockchain technology as an alternative to paper and manual transaction processing<sup>2</sup>.

**c. Consortium Blockchain (Hybrid/Federated):** Any blockchain that has a private architecture or a combination of public and private architecture is referred to as "hybrid" or "federated". A consortium blockchain is a federation of several institutions, where transaction's verification and authentication is granted access only to those institution members, which are part of the institution. This type is particularly valuable to the industrial and financial sectors. Only the consortium members will have access to view, add, delete and audit blocks. The consensus mechanism is controlled and owned by a pre-determined group to process the block that meets the interest of the entire network<sup>3</sup>. This enables consortium to leverage on blockchain technology with required transparency and without sacrificing the data security and privacy. These blockchains have best of both, i.e., public and private. It operates under the control of a specific group of organizations, which are allowed to perform the role of full nodes. This helps in maintaining the necessary transparency and protecting users' privacy and data. As, this kind has the best of both public and private blockchain features<sup>4</sup>, such as restricted permissions, multiple control powers. Which allow controlled data to be shared between different stakeholders. Therefore, it considers the best blockchain model for industrial and financial organizations, as it is similar to private blockchain, providing more efficient and higher transaction privacy than public blockchains<sup>5</sup>. In this regard, table (I-1) below distinguishes the features of the three blockchain types.

**Table (I-1): Blockchain Classification according to Access Mechanisms**

	Public	Private	Consortium
Network Structure	Decentralized	Centralized	Partially decentralized
Participants	Anonymous	Trusted entity (blockchain owner)	Predetermined group of network participants
Read/Write Permission	Permissionless	Permissioned	Permissioned
Efficiency	Low	High	Medium
Energy Consumption	High	Low	Low
Security	Higher due to distribution	Lower due to distribution	Average due to partial distribution

<sup>1</sup>- Pierluigi Martino, Op.cit, p 19.

<sup>2</sup>- Mohsen Attaran Angappa Gunasekaran: Applications of Blockchain Technology in Business Challenges and Opportunities, Springer Nature, Switzerland, 2019, p 16.

<sup>3</sup>- Shaik V. Akram et al, Op.cit, p 02.

<sup>4</sup> - Hussein Elasrag, Op.cit, p 04.

<sup>5</sup>- Natalia Dashkevich et al.: Blockchain Application for Central Banks: A Systematic Mapping?, IEEE, Vol. 08, 2020, p 139922.



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Privacy	Low, as all transactions are transparent	High access to data is controlled by the trusted entity	Medium access to data is controlled by a group of network participants
Use Case Examples	Cryptocurrency, Bitcoin, Ethereum, Litecoin, etc.	Company owned blockchains, governments applications such as NASDAQ, Bank of America, JPMorgan bank, the New York Stock Exchange, Ripple, Corda.	Consortium of multiple institutions such as: Quorum, R 3 Corda.

**Source:** Ahmed Afif Monrat et al.: A survey of blockchain from the perspectives of applications, challenges, and opportunities, IEEE Journal, 2019, p 117139.

## 3.2. Leading Blockchain Platforms

Some of the most prominent and the leading blockchain platforms, including Bitcoin, Ethereum, Hyper ledger, Quorum, Corda and Ripple are introduced through This part.

**a. Bitcoin:** It is the first practical blockchain platform; it was presented in 2008 by a pseudonymous person known as "Satoshi Nakamoto". It is a public permissionless blockchain that uses peer-to-peer platform to conduct financial transactions and transferring money based on a cryptocurrency (bitcoin) without a central authority or banks. It is the first blockchain platform to be widely used, as its success is largely attributable to the creative use of the peer-to-peer network to implement every stage of the currency's life cycle, from creation to transfer<sup>1</sup>. Whereas enabling global transactions to be completed at the same pace as local transactions and providing a transaction history. It is worthy to be noted that Bitcoin with capital "B" stands for the peer-to-peer network. However, bitcoin with a little "b" stands for the cryptocurrency unit<sup>2</sup>.

**b. Ethereum:** It is a programmable, open-source blockchain platform, with no possibility of censorship, fraud, downtime, or third party interference. It is a public blockchain with no permissions that may be used to build decentralized applications in a variety of sectors. Applications on Ethereum operate on a special created blockchain network, a distributed global infrastructure that could transfer value and denote ownership of property. This makes it possible for developers to establish marketplaces, keep track of obligations or pledges, and transfer money in accordance with instructions from the past or futures contracts without taking on intermediary or counterparty risks<sup>3</sup>. It is backed by its own cryptocurrency, called "ether", as every user can sign up for the platform to create an Ethereum account. Ethereum platform has the ability to develop smart contracts, which is a computer code that allows for the creation of network-interactive applications. This allows blockchain to be used outside of cryptocurrency as a business management solution, as the platform is not owned or under the direction of a

<sup>1</sup>-Xiwei Xu et al., Op.cit, P 27.

<sup>2</sup>- Cosmin Novac: A brief introduction to Bitcoin, Independently Published, Germany, 2019, p 14.

<sup>3</sup>- Dattani Janvi, Sheth Harsh: Overview of Blockchain Technology, Asian Journal of Convergence in Technology, 2019, p 02.

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single organization, and it is run by peers who oversee Ethereum nodes<sup>1</sup>. (More explanations about Ethereum-based smart contracts will be explained in Chapter 2, Section 2)

**c. Hyperledger:** This platform is designed for enterprise in 2015. It is based on group of businesses, which are collaborating to create common blockchain protocols. The project seeks to provide a kind of open protocols and standards by establishing a uniform framework for running smart contracts that accommodates many components for different uses<sup>2</sup>. It makes use of a permissioned distributed ledger, and it is the first distributed ledger that enables the creation of smart contracts using standard programming languages, so organizations do not need additional training to learn domain-specific languages. The main feature of this platform is the support of pluggable consensus that permit the platform to be more efficient for a particular uses<sup>3</sup>.

**d. Quorum:** It is a consortium permissioned ledger built on blockchain platform that is created by JP Morgan from the Ethereum database. It marks the start of the use of blockchain in the financial industry and related use cases. It seeks to offer record confidentiality, which is the main objective of financial institutions. Its security is based on a proof-of-work consensus algorithm, and the “Ether” is its internal cryptocurrency<sup>4</sup>. The proof-of-work consensus algorithm intentionally adds cryptographic difficulty to prevent hacks in the Ethereum blockchain. Therefore, it considers one of the well-known secure blockchain platform, as in Ethereum, every full node in the network verifies every transaction<sup>5</sup>.

**e. Corda:** It is a permissioned blockchain platform based on smart contract, which programmed to register, manage, and digitalize the legal agreements between business networks since 2016. Corda's design has benefited from collaboration between a global and diverse coalition of organizations representing many industries. It was initially created for regulating the financial institutions, but it turned out to be suitable for much broader scale<sup>6</sup>. Consensus in Corda is reached at the level of transaction by involving only parties. The validity and the uniqueness of the transaction are subject to consensus. Corda transaction's validity is ensured by executing the smart contracts code linked to a transaction, as well as confirming the necessary signatures and making sure any transactions that have been reported are likewise valid<sup>7</sup>.

**f. Ripple:** It is an open source protocol created to facilitate quick and inexpensive financial transactions. It employs a shared ledger that is controlled by an interconnected system of autonomous nodes. It is regarded as one of the most cutting-edge platforms for distributed ledger technology (DLT), as only focuses on using blockchain for payments and remittance

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<sup>1</sup>- Arshdeep Bahga, Vijay K. Madiseti: Blockchain Platform for Industrial Internet of Things, Journal of Software Engineering and Applications , Vol.09, No.10, 2016, p 04.

<sup>2</sup>- Christian Cachin: Architecture of the Hyperledger Blockchain Fabric, IBM Journal, 2016, p 02.

<sup>3</sup>- Qassim Nasir: Performance Analysis of Hyperledger Fabric Platforms, Security and Communication Networks Journal, 2018, p 02.

<sup>4</sup>- Dattani Janvi, Sheth Harsh, Op.cit, p 02.

<sup>5</sup>- Arati Baliga et al: Performance Evaluation of the Quorum Blockchain Platform, Persistent Systems journal, 2018, p 02.

<sup>6</sup>-Mubashar Iqbal, Raimundas Matulevicius: Corda Security Ontology: Example of Post-Trade Matching and Confirmation, Baltic J. Modern Computing, 2020, p 641.

<sup>7</sup>- Martin Valenta, Philipp Sandner: Comparison of Ethereum, Hyperledger Fabric and Corda, Frankfurt School Blockchain Center, 2017, p 04.

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sector. It has been implemented by a growing number of financial organizations to offer alternative transfer options to users<sup>1</sup>. Even more, the New York State Department of Financial Services granted Ripple a license for the virtual currency “XRP”, allowing businesses, banks, and regular consumers to send and receive money internationally. As it is considered the basic settlement infrastructure for interbank transactions by linking the various interoperation ledgers and payment networks of banks and non-financial services companies by integrating the Ripple platform into their own systems<sup>2</sup>, and thus allowing its customers to use its settlement services such as direct and immediate transfer of money between two parties; any form of money, including Dollars, Euros, Yen, and Gold, can be exchanged; similar to Bitcoin, Ripple also uses its own type of virtual money to enable low-cost money transfers between financial institutions, as one of XRP's unique uses is as a bridge currency, which may be required if two currencies cannot be exchanged directly at a given moment<sup>3</sup>.

## **Section Three: Blockchain: Global adoption, Benefits and Limitations**

Basically, blockchain distributes trust between network nodes by sharing the transaction database among network members. Using the blockchain system, these nodes function as a single unit to analyze and store the encrypted sequences of the transaction record as a single sequential unit, or block. This feature considers one of the main blockchain features, as it allows parties to conduct deals and transactions without the need for an intermediary to provide trust between dealers and verify the validity of transactions, which helps save costs and increase efficiency and privacy. These features and advantages have prompted many countries, including their individuals and institutions, to accelerate the adoption of this technology to improve their services to obtain a competitive advantage and enhance their position in the international market. However, while blockchain technology is highly regarded for its ability to provide solutions to a wide range of problems, this technology faces many difficulties due to the principles on which it relies. Therefore, this section examines how this technology is being adopted globally, as well as the key benefits and obstacles to its implementation.

### **1. Blockchain Adoption over the World**

The modern world economy is changing from an industrial economy to one that is dominated by a new set of technologies, including digital and nanotechnology. Blockchain in turn is one of the most recent digitization trends that builds trust and assurance between partners, particularly when cryptocurrency is used for payments. This trust helps in decreasing fraud, increasing financial inclusion, and reducing costs<sup>4</sup>. One of the benefits of an electronic ledger is that it is tamper-evident and can be updated online due to its nature as a decentralized system shared across many devices, making it easy to verify the data and users' identity. Therefore, blockchain is a powerful part of the world of digital transformation, as the value of the global blockchain market reached US\$7 billion in 2021, and is expected to reach US\$1,431.54 billion by 2030<sup>5</sup>. As open data access, which is made possible by blockchain

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<sup>1</sup>- Joseph J. Bambara, Paul R. Allen: Blockchain- A Practical Guide to Developing Business, Law, and Technology Solutions-, McGraw-Hill Education, The United States of America, 2018, p 23.

<sup>2</sup>- Ibid, p 23.

<sup>3</sup>-Ibid, p 23.

<sup>4</sup>- Deloitte Report, 2021, p 02.

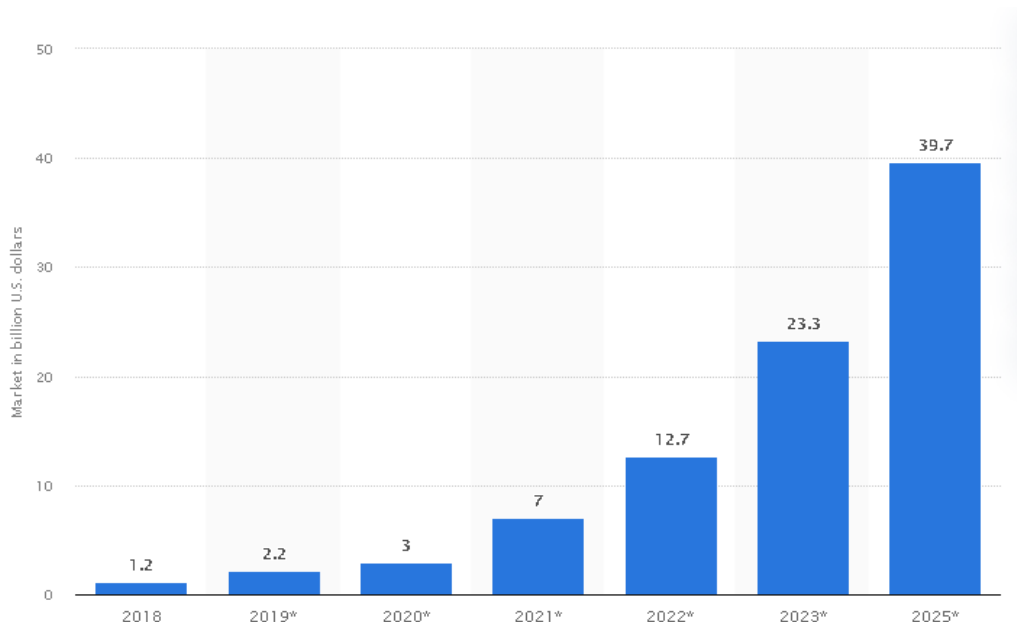
<sup>5</sup>-Ibid, p 02.

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technologies, will be a key factor in this industry's growth. Additionally, it pushes market participants to work harder to enhance their offerings in order to stand out from the competition and strengthen their position in the global market. Therefore, many countries around the world have started adopting blockchain technology for its advantages. As nowadays, 61% of companies place digital transformation initiatives at the top of their list of growth priorities to achieve a better level of security and transparency in the business world<sup>1</sup>. The key aspects driving the growth of the global blockchain market are the following<sup>2</sup>:

- Tracking the products and services - or their source - which has emerged as a new priority for many companies' supply chains especially during the Coronavirus (COVID-19) pandemic, and which has the highest economic potential, reaching US\$962 billion in 2021;
- Financial inclusion by supporting payments and financial services, including the exchange of digital currencies across borders, as the total payments and financial services in 2021 reached US\$433 billion;
- Identity management, which includes personal identifiers, credentials, and certificates, in order to prevent fraud and identity theft, given that US\$224 billion was spent on identity management in total in 2021;
- The use of blockchain in contracts, dispute settlement, and customer involvement reached US\$73 billion in 2021, and client engagement, which also amounted to US\$54 billion throughout that time including the use of blockchain in loyalty programs, which expands the possibilities of applying blockchain into a wider scale of public and private industry sectors. As figure (I-5) below shows the size of worldwide blockchain technology market in the period of (2018-2025).

**Figure (I-5): Worldwide Blockchain Technology Market Size in the Period (2018-2025)**



**Source:** The official website of Statista, available at: [www.statista.com](http://www.statista.com), consulted on 24/08/2022.

<sup>1</sup>- Deloitte Report, 2021, p 02.

<sup>2</sup>- The auditing and consulting firm (PwC) Report: "Time for Trust", 2022, p 14.

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From the figure (I-5) above and according to Statista, the blockchain market reached to US\$1.2 billion in 2020, and it increased significantly in 2021, reaching US\$12.7 in 2022. Expectations also indicate that global blockchain technology revenues will witness tremendous growth in the coming years, as the market size is expected to rise to more than US\$39 billion by 2025.

Based on Statista data, numerous markets could significantly benefit from blockchain applications. However, currently the financial market portion represents 30% of the global blockchain market, as of 2020 taken by the banking sector<sup>1</sup>; it has been one of the fastest financial sectors to invest in blockchain. As, since 2015 to 2019, the United States has been the dominant region in terms of the amount of blockchain companies funding with 51% of the total funding worldwide<sup>2</sup>. China also was notable in terms of worldwide blockchain funding for businesses as accounted for 18% of all funding over the same timeframe. China as well as has a lot of potential that can be exploited through blockchain technology to create new jobs and financial growth, with a potential increase in GDP of US\$407 billion by 2030<sup>3</sup>. In this regard, table (I-2) below shows the contribution of blockchain revenues to the GDP around the world in 2021.

**Table (I-2): The Contribution of Blockchain Revenues to GDP around the World in 2021.**

Country	Blockchain based GDP ( \$ billion)	Country	Blockchain based GDP ( \$ billion)
China	46	Spain	3.5
France	7.5	Sweden	2.2
Germany	12.1	United Arab of Emirates	0.78
India	8.1	United Kingdom	8.5
Italy	3.9	The United States of America	48
Japan	9.2	Rest of the world	70.4
Luxembourg	0.23		

<sup>1</sup>- The official website of Statista, available at: [www.statista.com](http://www.statista.com), consulted on 22/08/2022.

<sup>2</sup>- Ibid.

<sup>3</sup>- The auditing and consulting firm (PwC) Report: "Time for Trust, Op.cit, p 15.

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**Source:** The official website PwC, available at: [www.pwc.com](http://www.pwc.com), consulted on 24/08/2022.

From table (I-2), we note that during 2021, the United States of America achieved the highest GDP based on blockchain revenues of US\$48 billion as a result of the increasing demand for blockchain, which is linked to the early adoption of cryptocurrencies, followed by China, which achieved US\$46 billion as a result of its reliance on blockchain in various industries, as for the rest of the European countries mentioned in the table, they have achieved significant blockchain revenues, ranging between US\$12.1 billion, as in the case of Germany, and US\$0.23 billion for Luxembourg. Which their investments have centered in the banking industry, cross-border payments, and commercial settlement transactions. The Asian countries in turn have achieved high numbers of GDP based on this technology, as in the case of Japan, which achieved US\$9.2 billion. The United Arab of Emirates in turn realized US\$0.78 billion, which is a small number compared to the income of the previous countries, as it achieved that number as a result of its new blockchain adoption Strategy, which aims to take advantage of blockchain technology to transfer 50% of government transactions to the blockchain platform by 2021. However, the revenues of the rest of the world are equaled to US\$70.4. In fact, the difference in revenues achieved from blockchain adoption in each country refers to the different benefits and the target purposes for this adoption, as manufacturing-focused economies such as China and Germany benefit more from provenance and traceability, while the United States will benefit more from its application in securitization and payments, as well as identity and credentials.

## 2. Benefits of Blockchain

The following items highlight the most important benefits that are brought by the blockchain:

- **Empowered users:** Blockchain gives individuals the power to manage both their information and transactions, which they take part in their treatments<sup>1</sup>.
- **Durability, reliability and longevity:** Blockchain does not rely on a centralized computing structure, and therefore it will not stop because of the downtime of this centralized computing structure<sup>2</sup>.
- **Cost effective:** Blockchain technology eliminates the need for an external intermediary for verification, and reduces the cost of processing transactions. For instance, traditional money transfers made through banks require fees due to the various involved intermediaries. In contrast, using blockchain for remittances does not require fees because they are directly made between the sender and the receiver, and there is only a small fee paid to the miner<sup>3</sup>, which is negligible compared to the fees paid for the traditional model. It also ensures that payment and settlement take place simultaneously resulting in lower cost of money management by the treasury. Blockchain applied in cross-border money transfers can help users to obtain the best exchange rates from the foreign exchange market due to almost real-time transaction processing<sup>4</sup>.
- **Reduced errors in manual data entry:** Blockchain allows for more customer focus, because employees will have more time to focus on customer needs, without being completely occupied with manual data entry<sup>5</sup>.

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<sup>1</sup> - Vincenzo Morabito, Op.cit, p 26.

<sup>2</sup> - Ibid, p 26.

<sup>3</sup> - Nafis Alam et al., Op.cit, p 95.

<sup>4</sup> - Ibid, p 95.

<sup>5</sup> - Ibid, p 95.

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- **Data archiving:** Blockchain provides decentralized and autonomous data archiving models, representing an alternative to centralized data storage solutions used by legacy enterprise systems. This technology will remove dependence on a central authority and allow for a reliable, distributed storage across blockchain network nodes. Most importantly, using blockchain as a data archive will allow any contract/member to verify the authenticity of archived data without relying on a central party<sup>1</sup>.
- **Security and privacy:** Transactions on blockchain can be viewed by all the network participants; also it can be limited to restricted members based on blockchain type. The ID of miner block is represented by a unique code known as public key, It can be a pseudonymous without be linked to the ID of the person. Therefore, it could be hard to be tampered with his personal information or identity details that provides a kind of privacy to blockchain network<sup>2</sup>.
- **Traceability and auditability:** All transactions carried out on the blockchain are auditable and the data and transaction history can be retrieved at any time. The tracking feature in the blockchain also allows tracking the block from the beginning of its creation until the last stage of its structure and linking it to the chain<sup>3</sup>.
- **Robust security:** Conducting transactions on blockchain does not take place unless they are agreed upon among the members of the network, as when they are approved by all nodes, they could be recorded, encrypted, and then linked to the chain. This link between the blocks makes it difficult to be hacked or tampered with the stored data, which differently ensures fraud prevention<sup>4</sup>.
- **Efficiency and speed:** Traditional transactions take longer as they must pass through an intermediary and some transactions procedures can be done using paper. However, transaction on blockchain allows for faster, more automated transaction processing without the need for a third party intermediary<sup>5</sup>.
- **Better cyber security resilience:** Thanks to the distributed nature of the blockchain ledger, blockchain technology may provide a more flexible system than traditional centralized databases, allowing for effective protection against various types of cyber-attacks. However, there are still a lot of technological and legal difficulties to be resolved as the technology is still in its early stages<sup>6</sup>.

### 3. Limitations of Blockchain

While blockchain technology is highly recommended for its ability to provide solutions to a wide range of issues, the adoption of the technology faces many challenges due to the principles on which is based. In this regard, the list below discusses some of the limitations that may hinder the implementation of blockchain technology:

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<sup>1</sup> Abhishek Gupta, Stuti Gupta, Op.cit, p 78.

<sup>2</sup> Ibid, p 78.

<sup>3</sup> Vincenzo Morabito, Op.cit, p 27.

<sup>4</sup> Ibid, p 27.

<sup>5</sup> Pierluigi Martino, Op.cit, p 17.

<sup>6</sup> Ibid, p 17.

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- **The rules governing regulatory status:** The currencies currently used in financial transactions are subject to their central banks, and in order for this blockchain technology to be widely adopted by financial institutions, whether with regard to cryptocurrencies or any other financial transactions, governments must reach an agreement to regulate the use of this technology to ensure monetary stability<sup>1</sup>.
- **Security and privacy concerns:** Although the blockchain security system is built on encryption algorithms to provide information security, Concerns about cyber security continue to be one of the key elements influencing users' decisions to share personal data via blockchain platforms. Moreover, users are concerned about hackers, identity theft, and money laundering. As the technology is still in its early stages, that is, the stage of experimentation and development<sup>2</sup>. In addition, making the network available to the public opens up the problem of not controlling data privacy, especially with the public blockchain, where anyone can view the data, unlike the private blockchain, which is considered more secure and private<sup>3</sup>.
- **Software Vulnerability:** Programs written by humans are always exposed to the possibility of error in the program codes, and as the complexity and interconnectedness of the programs increases the possibility of error, which leads to a decrease in the reliability of these programs. Therefore, blockchain developers and those in charge of it are people who are required to be constantly careful when designing the network's programming algorithms. Thus, the integrity of the programs and the network is one of the basics of evaluating blockchain as a technology worthy of trust among participants<sup>4</sup>.
- **Integration concerns:** Organizations that use new technologies to improve their operations confront a significant change management difficulty when integrating those new systems with their old systems. In this case, the adoption of blockchain technologies as one of the most important modern technologies does not differ, since the adoption of such projects imposes a large and difficult task of developing transformation strategy in the institutions<sup>5</sup>.
- **Operational risks:** The biggest risk related to blockchain is the problem of network operation, as there are only few people who have the ability to fully operate the network. This is due to the complexity of this technology, which does not allow a large number of people to be able to operate it in terms of writing programs and understanding the mechanism of its operation<sup>6</sup>.
- **Cultural acceptance:** The success of the blockchain implementation initiatives depends on the public's acceptance of the change brought by its adoption<sup>7</sup>.

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<sup>1</sup>- Vincenzo Morabito, Op.cit, p 27.

<sup>2</sup>- Ibid, p 27.

<sup>3</sup>- Lennart Ant et al, Op.cit, p 53.

<sup>4</sup> - Ibid, p 53.

<sup>5</sup>- Pierluigi Martino, Op.cit, P 16.

<sup>6</sup>- Aarti Patki, Vinod Sople: Indian banking sector: blockchain implementation, challenges and way forward, Journal of Banking and Financial Technology, 2020, p 69.

<sup>7</sup>- Ibid, p 69.



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- **The initial cost of deployment:** Blockchain usage is inspiring because of the savings it promises. Still, it is impossible to overlook the significance of the first implementation expenses, as its adoption requires a significant computing and electrical power<sup>1</sup>.
- **Environmental issues:** Blockchain technology may have environmental problems when employing proof of work (PoW) as a consensus method because mining requires enormous computer processing power and regular hardware updates, both of which result in significant electricity costs<sup>2</sup>.
- **Interoperability:** The technology does not have an international standard for competing blockchain systems. Therefore, a great interoperability is needed to make the blockchain suitable with the wider web and to integrate them into existing practices and processes. As, operational feasibility can be attained if parties are on the same blockchain network and interact with each other. Thus, the increasing number of competing blockchain networks also increases the issues of interoperability among these networks<sup>3</sup>.
- **Encryption:** There are many problems related to encrypting of blockchain data. If the encryption codes are made public, anyone can access the encrypted data, which allows the encryption used in blockchain technology to be broken through vulnerabilities in the system where people may discover new ways to steal data or misuse it<sup>4</sup>.
- **Scalability:** Compared with conventional systems, blockchain (particularly public blockchain) faces issues related to scalability, in terms of both the volume of the transaction and the verification speed. For instance, while public blockchain (on which cryptocurrency operates) could only process between four and seven transactions per second because the block size is limited to 01megabyte, traditional banking systems currently carry out thousands of operations per second<sup>5</sup>.

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<sup>1</sup>-Vijaya Kittu et al.: Status Check on Blockchain Implementations in India, International Conference on Technological Innovations in Management Ecosystem, Visakhapatnam, 2018, p 05.

<sup>2</sup>- Vijaya Kittu et al, Op.cit, p 05.

<sup>3</sup>-G. Sankaranarayanan, kamal kumar rajagopalan: Usage of Blockchain Technology in Banking Sector and its Implication on Indian Economy, Alochana Chakra Journal, 2020, p 73388.

<sup>4</sup>- Ibid, p 73388.

<sup>5</sup>- Pierluigi Martino, Op.cit, p 17.

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## **Summary**

Blockchain is an online-decentralized database with a high computing power and a strong security system that allows millions of participants to exchange securely and anonymously any kind of property. It is well known using bitcoin, as it considers the first application of blockchain based on its key characteristics, namely: immutability, transparency, decentralization and security. The main idea behind blockchain is to distribute the validation authority of the transactions to a computing network to use the cryptographic techniques to guarantee the validity of the transactions. Blockchain can be classified into three different generations. Each version is unique due to its different applications and features, as Blockchain 1.0 is used for digital currency, Blockchain 2.0 associated with digital finance, and Blockchain 3.0 is used for digital society.

In blockchain, transactions are encoded in blocks, which are linked together in the form of chains, hence the name blockchain; blocks store transaction records in chronological order with timestamps and a unique reference number (i.e. hash) of the previous blocks. A transaction in a blockchain begins when a participant sends a message to the network about the terms and conditions governing transactions between participants. In order to add blocks to the ledger, transfers must go through the mining process. Mining is a way to add transaction records, via blocks, to the public ledger. Miners are nodes in the network that guarantee the validity of a transaction and protect the transaction from double spending through the validation system. This mechanism helps in building trust between the parties involved using a decentralized public ledger, as well as cryptographic algorithms that can ensure that approved transactions are not changed after their authenticity is verified.

Recently, blockchain has received increasing attention as a technology, which provides a type of an online payment more secure and safer than the traditional payment system. As it is highly regarded for its ability to provide solutions to a wide range of problems based on its basic features, which have prompted many countries, including their individuals and institutions, to accelerate the adoption of this technology to improve their services to obtain a competitive advantage and enhance their position in the international market. Blockchain has numerous benefits such as decentralization, cost effective, privacy and security, traceability and auditability, and better cyber security resilience. However, its implementation faces many difficulties due to the principles on which it relies such as: regulation rules, software vulnerability, operational risks, interoperability, encryption issues, and limited scalability.

# Chapter Two

## **Chapter Two: The Main Blockchain Applications in the Financial Sector**

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### **Preface**

The economic system has changed due to the rapid development in the financial transaction system, which has become based on the Internet and modern technologies, which is nowadays known as the digital economy. This has become clear through the acceleration of individuals and institutions in conducting their transactions via the internet or mobile phone applications, especially for individuals. Among the most important technology that has changed the structure of the financial sector is blockchain technology, which has recently witnessed a great adoption by many countries, exploiting its most important main mechanisms, representing in cryptocurrencies and smart contracts. Based on that, this chapter provides an overview of the basics of cryptocurrency and smart contracts, as well as their working mechanism, as these two main mechanisms are used to expand the scope of financial technology in the financial sector. Moreover, it discusses the use of this technology in different financial fields. Therefore, this chapter is divided as follows:

### **Section One: Cryptocurrency Overview**

### **Section Two: Smart Contracts Overview**

### **Section Three: The Potential Applications of Blockchain Technology in the Financial Sector**

### Section One: Cryptocurrency Overview

With the current expansion and advancements in mobile technology and applications, the form of money has undergone different changes. Since money was not only seen as a form of physical giving, but it now includes digital currencies and mobile payment form. Therefore, one of the major developments in financial transactions is the non-monetary (non-cash) instruments, unlike the instruments that were previously used in the cash-based system. As it is a way to pay for services and goods that does not involve the exchange of money such as paper money, checks and credit cards. Over time, money has evolved well into its non-paper form and its latest form is cryptocurrency. Therefore, this section introduces an overview about cryptocurrency, concerning its concepts, regulatory framework and its legality in different countries.

#### 1. Basic Concepts about Cryptocurrency

The cryptocurrency market is one of the important innovations in the field of financial technology that facilitates transactions and plays an important role as an exchange medium. Due to its quick development and expansion, this virtual currency has earned a unique role in the world's financial area. Thus, this part presents the definition of cryptocurrency, as well as its main characteristics and types.

##### 1.1. Cryptocurrency Concept

###### 1.1.1. Definition of Cryptocurrency

Writers and scholars of cryptocurrency subject often use several terms and concepts interchangeably, namely: digital currencies, electronic currencies, virtual currencies, and in order to adjust the concept of cryptocurrency and get out of the circle of overlap and ambiguity in the use of these terms, it should differentiate between these concepts and terms.

- ❖ **Digital currency** is defined as “an intangible currency used both locally and abroad for electronic person-to-person payments, allowing parties to transfer money based on available technology (computers, the Internet, and smartphones”<sup>1</sup>.
- ❖ **Electronic money (E-money)** is defined as “an electronic representation of fiat money, which created by a central bank or a commercial bank, and it is formed on a technical device that stores monetary value and widely uses for making payments and exchanges, such as the money stored on a chip card or on a hard drive in a personal computer”<sup>2</sup>.
- ❖ In contrast, **Virtual Currency** is “a digital representation of value that can be traded digitally and serves as a store of value, unit of account, or medium of exchange. It is not issued by the government or central bank. It is not backed by the government and is typically not utilized or circulated as fiat currency, unlike actual coins or bills, which have legal tender status”<sup>3</sup>. Therefore, it differs from electronic money, which is a representation of fiat money that transfers value by electronic means, but it has

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<sup>1</sup>-Rosario Girasa: Regulation of cryptocurrencies and blockchain technologies: National and International Perspectives, Springer Nature, Switzerland, 2018, p 09.

<sup>2</sup>- Charles Kahn et al.: Digital Money and Central Bank Operations, IMF Working Paper, 2022, p 03.

<sup>3</sup>- بن معتوق صابر: تحديات التعامل بالعمولات المشفرة-البيبتكوين نموذجاً، المجلة الجزائرية للأبحاث الاقتصادية، المجلد 20، العدد 03، 2020، ص 86.

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the property of a legal tender. Virtual currency may be centralized or decentralized. A centralized virtual currency, such as web money, is one that has a central authority or administrator who sets the rules, issues the currency, maintains a central payment ledger, may redeem or withdraw the currency, and it is backed by assets such as gold. Decentralized virtual currency, which is cryptocurrency, in which there is no central authority could control it<sup>1</sup>.

- ❖ **Cryptocurrency** is defined by the bank of International Settlements as “an asset whose value is governed by the law of supply and demand; conceptually, it is comparable to commodities like gold. Distributed ledgers are used to manage them, eliminating the need for middlemen, and it is not run by any particular person or organization”<sup>2</sup>.
- ❖ In addition, the European Banking Authority defined it as “digital value representation that is not issued by a central bank or public authority and it is not necessarily linked to a fiat currency, but it is used by legal entity as an exchange means, and it might be traded, saved, or transferred digitally”<sup>3</sup>.
- ❖ However, the World Bank has distinguished cryptocurrency from electronic currency, which is essentially just a digital payment mechanism representing the fiat money. As It classified it as a subset of digital currencies that rely on encryption techniques during their creation. They are considered a digital representation of the value denominated in their own unit of account<sup>4</sup>.

From the different definitions mentioned above, it can be said that digital currencies are considered as the main umbrella that contains electronic currencies and virtual currencies. However, the cryptocurrency (decentralized virtual currency) and centralized virtual currency are subset of the virtual currencies, as summarized in the figure (II-1) below:

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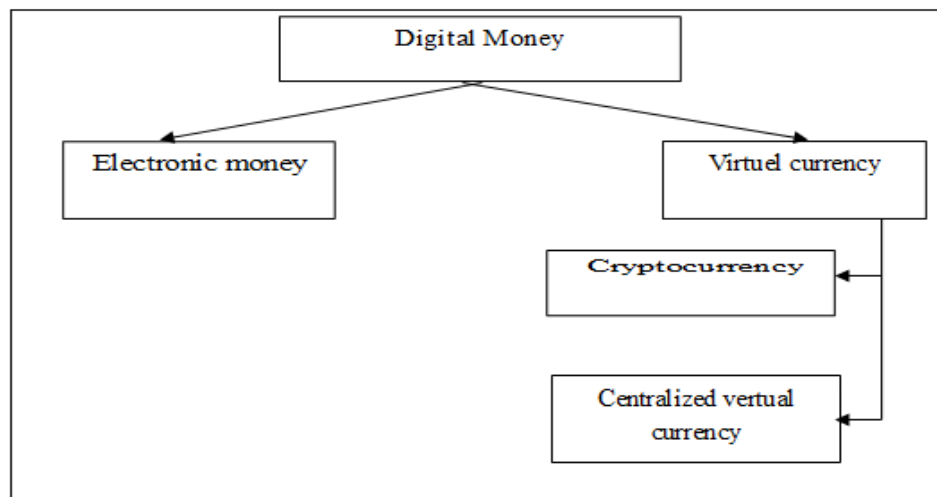
<sup>1</sup>- بن معتوق صابر: تحديات التعامل بالعمولات المشفرة-البيتكوين نموذجا، المجلة الجزائرية للأبحاث الاقتصادية، المجلد 20، العدد 03، 2020، ص86.

<sup>2</sup>-Gautam Vora, Op.cit, P 817.

<sup>3</sup>-Hazik Mohamed, Hassnian Ali: Blockchain, Fintech, and Islamic Finance, the Deutsche Nationalbibliothek, Berlin, 2019, p 54.

<sup>4</sup>-Ibid, p 54.

**Figure (II-1): Digital currency diagram**



**Source:** by the researcher based on the aforementioned data

For further illustration, the table (II-1) below summarizes the main differences between electronic and virtual money.

**Table (II-1): Electronic Money Versus Virtual currencies**

Money Type	Electronic Money	Virtual Currency
Format	Digital	Digital
Unit of account	Fiat currencies ( USD,EURO)	Mined/encrypted coins (bitcoin, Litecoin)
User	Well known person	Anonymous
Issuer	Electronic money institutions, controlled by central banks	Miners
Issuance manner	Digital representation based on fiat money	Mined, encrypted on blockchain
Super vision/ Control	Yes	No
Supply of money	Fixed and directed by central bank and financial institutions	Not fixed, it is based on miners' decisions
Risks' types	Operational	Legal, liquidity and operational

**Source:** European Central Bank report, 2012, p 16.

### 1.1.2. Cryptocurrency Characteristics

Cryptocurrency is a digital virtual decentralized currency, because it contains the features of decentralized virtual currency where there is no central bank or single administrator and no physical representation of the needed currency. It is transferred from peer to peer (P2P) without any intervention of government, banks or financial institutions. It uses cryptography mechanisms based on blockchain technology, as P2P network allows an online and direct cryptocurrency exchange between users without intermediary, and in order to classify any currency as a cryptocurrency, it must shares the following features:

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- a. Digital:** Cryptocurrency is a sort of digital money that does not exist as coins or banknotes<sup>1</sup>.
- b. Decentralized:** There is no central server or computer for cryptocurrencies. They are dispersed throughout a system of (usually) thousands of computers, as decentralized networks refer to networks without a central server<sup>2</sup>.
- c. Peer-to-peer:** In the digital world, cryptocurrencies are traded online. The lack of a third party in cryptocurrency transactions prevents users from transacting with one another through the banking system<sup>3</sup>.
- d. Anonymous:** Cryptocurrency transactions are private since no personal information is exchanged. No ID is necessary to open a wallet, and depending on the token you use, you can enjoy varying levels of anonymity, as there are no restrictions on who can use or own cryptocurrency<sup>4</sup>.
- e. Encrypted:** Each encrypted transaction is encrypted (hidden), and each user has unique codes that prevent other users from seeing his/her information. This process is known as cryptography, and it is virtually impossible to hack<sup>5</sup>.
- f. Irreversible:** Cryptocurrency transactions are irreversible, so users are unable to recover their cryptocurrencies after they have been transferred and confirmed by the network<sup>6</sup>.
- g. Global:** Cryptocurrency exchanges are immediately broadcasted across the network and are validated in a few minutes<sup>7</sup>.

### 1.2. Types of Cryptocurrency

There are several types of cryptocurrencies, which appeared besides bitcoin during the recent years, the most important of which are mentioned as follows:

- a. Bitcoin (BTC):** It is the first cryptocurrency introduced by Satoshi Nakamoto in October 2008. Based on his nine-page white paper, he begins with the words “It is an entirely peer-to-peer kind of electronic money that would enable online transfers of funds between parties without the need of a financial institution”<sup>8</sup>. He had determined the problem as well as introduced the solution; it is built on an entirely decentralized electronic cash system, meaning that neither the issuance of the currency, nor the settlement or validation of the

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<sup>1</sup>- Tareq Muhammad Aziz Elven: Cryptocurrency and Constituency: Understanding the Existence of Bitcoin and Its Regulation in Indonesia, International Program for Law and Sharia, Faculty of Law, University Muhammadiyah Yogyakarta, Daerah Istimewa Yogyakarta, Indonesia, 2019, p 04.

<sup>2</sup>- Ibid, p 04.

<sup>3</sup>- Andreas M. Antonopoulos, Op.cit, p 10.

<sup>4</sup>-Vijeta Banwari: Cryptocurrency-scope in India, International Research Journal of Management Sociology & Humanity, Vol.8, 2017, p 83.

<sup>5</sup>- Dennis NG, Griffin Paul: The wider impact of a national cryptocurrency, Global Policy, Research Collection Lee Kong Chian School Of Business, 2018, p 15.

<sup>6</sup>-Lee David Kuo Chuen et al.: Cryptocurrency: A new investment opportunity?, Journal of Alternative Investments, 2018, p 04.

<sup>7</sup>- Ibid, p 04.

<sup>8</sup>- Satoshi Nakamoto: Bitcoin: A Peer-to-Peer Electronic Cash System, White paper, 2008, p 3.



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transactions are handled by a central authority<sup>1</sup>. Bitcoins are created through a process known as mining, and they are neither controlled nor issued by a single entity. As, one of the fundamental ideas behind the bitcoin protocol is mining. In this system, acceptable transactions are gathered into blocks, and added to the ledger by connecting them to previously accepted blocks<sup>2</sup>. In short, bitcoin is a cryptocurrency-designed as a digital asset intended to function as a medium of exchange that protects its transactions, regulates the issuance of new units, and verifies the transfer of assets through the use of cryptography. The key innovation in bitcoin network was to use a distributed computation system (called a “proof-of-work” algorithm) to conduct a global “election” every 10 minutes, allowing the decentralized network to arrive at consensus (validation) about the state of transactions<sup>3</sup>.

**b. Litecoin (LTC):** It was introduced in 2011, and it is the second cryptocurrency that emerges after bitcoin. Its program is comparable to an open-source bitcoin protocol. However, there are two key distinctions between the two currencies. The first is in term of transaction speed; Litecoin transactions happen more quickly than bitcoin transactions. The second difference relates to the maximum currency supply, as the total number of Litecoin to be issued is 84 million, whereas they are far above the bitcoin cap of 21 million<sup>4</sup>.

**c. Ripple (XRP):** It is one of the most famous cryptocurrency in the world. It was launched as a currency in 2012; it is also a network that enables settlement of cross-border payments in short time, with great transparency and at lower costs. Ripple differs from other cryptocurrencies as it does not require mining, as all of Ripple's XRP coins were pre-mined before to debut, which implies that XRP does not generate over time; rather, it is simply added to and removed from the market in accordance with instructions from the network<sup>5</sup>.

**d. Ethereum (ETH):** It was created in 2013 by the programmer Vitalik Buterin. It is a cryptocurrency, and also it refers to a decentralized software platform that makes it possible to design and execute decentralized applications and smart contracts without interference from outside parties or from fraud or control. The applications on Ethereum platform are powered by the crypto coin “Ether”, which is a means of calculating and manipulating on this platform<sup>6</sup>.

According to Coin Market Cap data in the third quarter of 2023, there are more than 18921 cryptocurrencies in the market<sup>7</sup>, and in order to buy and sell in the crypto market, players need cryptocurrency exchange through a trading platform or crypto brokers who act

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<sup>1</sup>-Aries Wanlin Wang: *Crypto Economy: How Blockchain, Cryptocurrency and Token Economy are disrupting the Financial World*, Racehorse Publishing, United States of America, 2018, p 24.

<sup>2</sup> - نعاى صلاح الدين، بن سانية عبد الرحمان: العملة الافتراضية بيتكوين ومعنويات المستثمرين، أية علاقة؟، مجلة الإستراتيجية والتنمية، المجلد 10، العدد 01، 2020، ص 117.

<sup>3</sup>- Tareq Muhammad Aziz Elven: *Cryptocurrency and Constituency: Understanding the Existence of Bitcoin and Its Regulation in Indonesia*, International Program for Law and Sharia, Faculty of Law, Universitas Muhammadiyah Yogyakarta, Daerah Istimewa Yogyakarta, Indonesia, 2019, P 04.

<sup>4</sup>- Aries Wanlin Wang, Op.cit, p 24.

<sup>5</sup>- Ibid, p 24.

<sup>6</sup>- Vitalik Buterin: *A next generation smart contract & decentralized application platform*, White paper, 2013, p 13.

<sup>7</sup>-The official tracking cryptocurrency web site, available at: [www.coinmarketcap.com](http://www.coinmarketcap.com), consulted on 15/09/2023.

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similarly like a foreign exchange dealer. As, table (II-2) shows the top 10 cryptocurrencies with their market capitalizations\* at the third quarter of 2023.

**Table (II -2): Major Cryptocurrencies' Price**

	Currency	Price(\$)	Circulating supply (Unit)	Market capitalisation (\$)
01	Bitcoin	26, 342,53	19, 486,375	513, 320, 387,187
02	Ethereum	1, 620,18	120, 222,835	194, 782, 209,419
03	BNB	212,13	153, 848,429	32, 635, 762,624
04	Solona	18,86	411, 018,326	7, 754, 170,956
05	Tether	1.00	83, 043, 567,270	83, 039, 615,734
06	USD Coin	1.00	26, 050, 696,393	26, 051, 579,951
07	XRP	0.4937	53, 175, 400,720	26, 254, 141,939
08	Cardano	0.2477	33, 739, 028,516	31, 914, 150,240
09	Tron	0,08387	98, 199, 743,703	7, 481, 152,827
10	Dogecoin	0.06187	141, 018, 266,384	8, 724, 398,549

**Source:** The official tracking cryptocurrency web site, available at: [www.coinmarketcap.com](http://www.coinmarketcap.com), consulted on 15/09/2023.

According to Coin Market Cap data, the combined market of overall cryptocurrencies to date is valued at US\$269 billion. This rise is due to the acceptance of many major companies to deal with them, such as the Chinese company Paypal, as well as the spread of the use of the internet and mobile payment. As shown in the table above, bitcoin ranks first among all currencies, it reached to US\$26,342,53 a sixteen times over the second currency, Ethereum, with circulating supply of 19,486,375 BTC. The lowest price among the top 10 cryptocurrencies stands for Dogecoin, which reached US\$ 0.06187; this is due to the increase in the supply of this currency that reached 141,018,266,384 units.

## 2. Cryptocurrency Framework

There are two main technical problems associated with the emergence of the digital asset, which are the verification of authenticity, and the issue of double spending; in which a single unit of currency can be used twice<sup>1</sup>. As digital assets, in contrast to physical assets, are just a computer file (sequence of bits), and simply like any digital file, they can be duplicated if a person sends the file and keeps a copy of it. This is refers to the double-spending issue, and in order to avoid it, every note must be compared to a central ledger online before being spent<sup>2</sup>. Therefore, it is necessary to have an authoritative record of every digital asset transaction. Thus, Nakamoto suggested a solution for these two issues depends on blockchain technology, and the miner validation system (the consensus method)<sup>3</sup>. As one of the most significant linkages between blockchain and cryptocurrency is without this technology, the cryptocurrency ecosystem would not exist<sup>4</sup>, and in order to get a full

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\*The overall value of a cryptocurrency is known as its crypto market capitalization. where the number of coins in circulation multiplied by the cryptocurrency's price determines the stock market capitalization. (Market capitalization= Circulating supply ×price).

<sup>1</sup>- Andreas M. Antonopoulos, Op.cit, p 03.

<sup>2</sup>- Karl J. O'Dwyer, David Malon, Op.cit, p 01.

<sup>3</sup>-Erik Hofmann, Op.cit, p 36.

<sup>4</sup>-Sean Stein Smith: Blockchain, Artificial Intelligence and Financial Services: Implications and Applications for Finance and Accounting Professionals, Springer Nature, Switzerland, 2020, p 38.

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understanding of the cryptocurrency concept, it is necessary to understand how to mine and transact cryptocurrencies on blockchain network, which will be presented in this part.

### 2.1. Cryptocurrency Mining

The technological architecture of cryptocurrencies such as bitcoin is based on blockchain, it is a distributed digital ledger with a list of blocks that keeps track of all cryptocurrency transactions made in the peer-to-peer (P2P) network and eliminates the issue of double spending<sup>1</sup>. In contrast to traditional currencies, cryptocurrencies are completely virtual, as there are no physical currency to be transferred. However, they digitally transfer value from sender to receiver. They are based on cryptography that has two critical functions: encryption and verification, which are achieved via coding and decoding<sup>2</sup>. Cryptocurrency users own public and private keys\*, that function as a proof of transactions ownership in the peer-to-peer network, as well as to unlock the value to be spend and transfer it to a new owner/receiver. Usually, these keys are stored in a digital wallet (a secure channel and software application for sending, receiving, and storing digital money.) on each user's node/computer, as spending cryptocurrency requires just having access to the key that unlocks a transaction.

Crypto units are created during mining, which is a process by which new cryptocurrency is added to the crypto money supply<sup>3</sup>. Mining also refers to guessing the solution to a mathematical puzzle (problem) that cannot be calculated directly. Since anyone with the installation of specialized software can mine a cryptographic unit as payment for resolving a challenging mathematical puzzle related to authenticating cryptocurrency-based transactions. Through the use of a computer that can do millions of guesses per second<sup>4</sup>. There is an expected average of guesses number, it will take to reach the right solution, and so the mining node has effectively proven that it has executed a number of guesses. This is why the mining process is known as Proof of Work (PoW). The mined block is shared between all the network nodes through the internet and each node will check all the transactions before accept it and link it to the chain. Finally, all the network nodes will have the same copy of the system state after the full agreement. In this way, it is not a distributed computer in the conventional sense, despite what one may believe. It functions similarly to a single computer that has several copies operating concurrently and storing identical data to prevent fraud.<sup>5</sup> Mining also secures the cryptocurrency system against fraudulent transactions and provides processing power to the cryptocurrency network in exchange for the opportunity to receive a reward in cryptocurrencies<sup>6</sup>. As a compensation for their mining efforts, miners earn both new currencies created with every block and transaction fees from

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<sup>1</sup>- Sarthak Gaurav: The Market for Cryptocurrencies an Ode to F A Hayek, Economic & Political Weekly, 2019, pp. 13, 14.

<sup>2</sup>-Aries Wanlin Wang, Op.cit, 2018, p 19.

\* Private keys are secret numbers that is used in cryptography, similar to a password. While, the public key is used to send cryptocurrency into a wallet; the private key is used to verify the transactions and confirm the ownership of blockchain address.

<sup>3</sup>-Imran Bashir, Op.cit, p 16.

<sup>4</sup>-Alexander Savelyev: Contract law 2.0: 'Smart' contracts as the beginning and the end of classic contract law, Information & Communications Technology Law, Vol.26, No.02, 2017, p 119.

<sup>5</sup>- Makoto Yano et al.: Blockchain and Crypt Currency Building a High Quality Marketplace for Crypt Data, Springer Nature, Singapore, 2020, p87.

<sup>6</sup>- Ibid, p 87.

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all of the transactions that are part of the block. In order to get this reward, miners must compete to find a solution to a challenging mathematical issue using a cryptographic hash method. The reward is considered a proof of work for putting in a lot of computational effort.<sup>1</sup> Therefore, it is obvious that fiat money absolutely differs from the cryptocurrency, as summarized in the table (II-3) below.

**Table (II-3): Differences between Fiat Money and Cryptocurrency**

	Fiat money	Cryptocurrency
Centralization	Yes	No
Physical appearance	Yes	No: virtual
Issuance	Central banks	Miners
Third party intervention	Yes: financial institution	No: peer to peer connection
Costs	High	Low
Transaction process' speed	Slow	Very fast

Source : بریش رابع، سنوساوي فاطنة: تأثير التعامل بالعملات الرقمية المشفرة على السياسة النقدية- البنكون نموذجاً، مجلة المقريزي للدراسات الاقتصادية والمالية، المجلد6، العدد02، 2022، ص 480

### 2.2. Cryptocurrency Transaction's Processing

Technically, a crypto transaction that has been mined and confirmed is considered a part of blockchain's block, thus the new cryptocurrency owners could safely spend their received cryptos. In fact, cryptocurrency mining includes two functions: adding a secured and verified transaction to the blockchain, as well as releasing a new currency<sup>2</sup>. Therefore, the cryptocurrency's mining process is explained in clear, step-by-step detail below<sup>3</sup>:

1. Typically, cryptocurrency is held in electronic wallets based on blockchain technology. From any location in the world, you can access these electronic wallets. As a first step, users who want to make transactions go to an online cryptocurrency exchange to purchase bitcoins or other cryptocurrencies using fiat money and then store them in a crypto wallet using public and private keys. Every time a blockchain transaction is made, the transaction data needs to be captured and added to a block;
2. For a block to be added to the chain, all network users must use encryption and security measures;
3. Miners must use a guess-and-check technique to crack a cryptographic puzzle in order to encrypt this block. The basic idea behind the guess and check process is to guess the answer to a problem and check whether the answer suits the given problem, and if it does not be fitted, then the guesswork can be repeated until the correct solution is reached and the appropriate cryptographic hash of the block is obtained;

<sup>1</sup>-Xiao Fan Liu et al.: Knowledge Discovery in Cryptocurrency Transactions: A Survey, IEEE Access, Vol.09, 2021, p 37231.

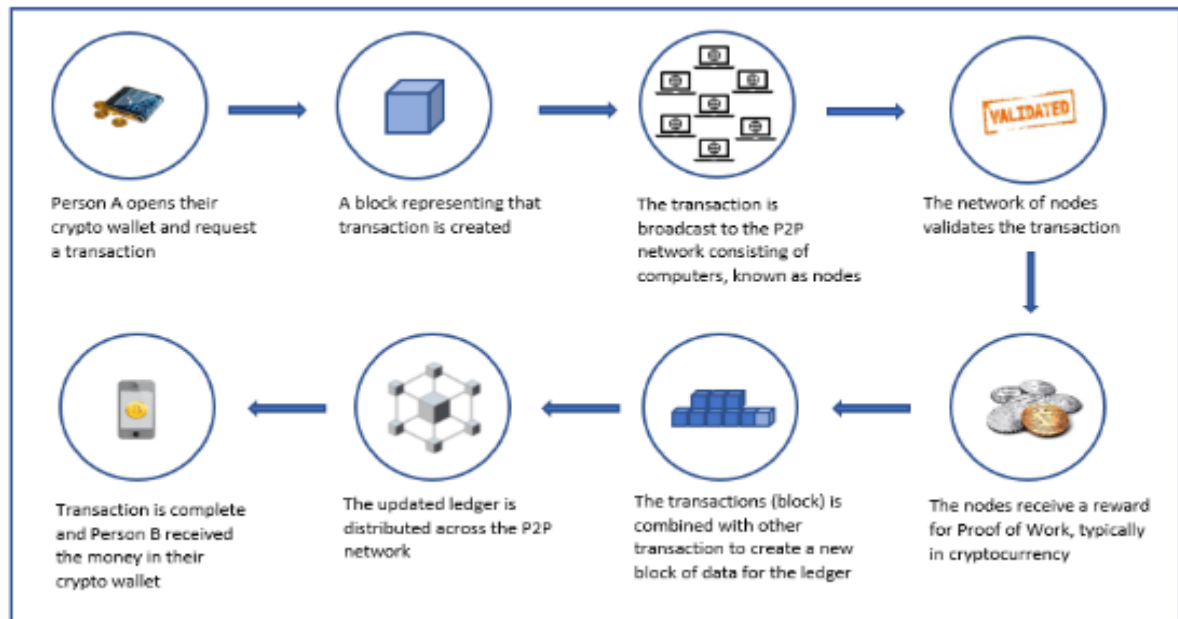
<sup>2</sup>- Ebelogu Christopher et al.: Cryptocurrency (Blockchain) Technology as a Means of Leveraging the Nigeria Economy, International Journal of Advances in Scientific Research and Engineering (IJASRE), Vol.5, 2019, p 144.

<sup>3</sup>-Nafis Alam et al.: Fintech and Islamic Finance: Digitalization, Development, and Disruption, Springer Nature, Switzerland, 2019, pp. 103-104.

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4. Once the miner has secured the block, it is added to the blockchain and needs to be validated by the other nodes (computers) on the network through a consensus process;
5. Verification typically takes ten minutes if a miner secures and confirms the block successfully. When data are verified, they are sent to all participants and the ledger is updated. As a result, the miner receives a newly produced coin as payment for the proof of work algorithm based on the mining process. The figure (II-2) below illustrates the steps of cryptocurrency transaction processing.

**Figure (II-2): Cryptocurrency and the Digital Transaction Process**



**Source:** United Nation Report: Harnessing blockchain for sustainable development: prospects and challenges, 2021, p 03.

### 2.3. Benefits and Risks of Cryptocurrencies

Cryptocurrency has several benefits as well as some risks that associated with its trading, as illustrated below.

#### 2.3.1. Benefits of Cryptocurrencies

Cryptocurrencies are created for a variety of benefits, some of which are listed below<sup>1</sup>:

- The elimination of intermediaries like banks from the payment procedures, which has resulted in a significant decrease in costs;
- The peer-to-peer network that facilitates faster money transfers has eliminated the need for clearing houses;
- lowering exposure hazards that could happen when trading bearer instruments;
- The accepted payments and transactions could be used to pay for property or real estate and personal charges;
- Lower cost money transfer, which could be used internationally to transfer money or similar purposes.

<sup>1</sup> Rosario Girasa, Op.cit, p 15.

### 2.3.2. Risks of Cryptocurrencies

Despite all the benefits listed above, there are some cryptocurrency risks, including<sup>1</sup>:

- When it comes to cryptocurrency trading, some institutions and merchants don't accept it or provide enough protection;
- Security concerns about its use by criminal elements such as drug traffickers, terrorists, and money launderers;
- Transactions and property may be lost if the payee's identity is revealed or lost due to mental illness or death;
- Uncertain future tax and the lack of regulatory policies;
- Threats of cyber such as hacking, loss, and theft.

### 3. The Regulatory Framework of Cryptocurrency and its Legality

In fact, there are many benefits of digital currency, yet it has potential uses for criminal activities such as money laundering, facilitating illegal goods transactions, the potential impact on national currencies, and the ramifications of its use in taxation; since the holders of cryptocurrencies are unknown, it is difficult to apply taxation on their crypto property. Therefore, many regulations have been issued by different countries to address the use of this type of currency, especially after its adoption in many financial services. Thus, this part highlights the regulatory framework and legality of cryptocurrencies from different perspectives. Furthermore, it discusses the Sharia perspective of cryptocurrencies.

#### 3.1. Cryptocurrency as a Legal Tender

The first opinion is that the cryptocurrency is a legal tender, and on this basis, many legal regulations have been issued by many countries to regulate its circulation, as it has been classified as either “regular money,” “property,” “commodity,” or “intangible assets.” Germany is one of the first countries to legalize bitcoin, and it calls it private money<sup>2</sup>. It considers it as a legal currency (a payment means and an alternative to traditional money), that is used for organized buying and selling operations. Also in Switzerland, cryptocurrency has been recognized as a legal means of exchange and payment, as Switzerland is considered one of the largest centers for cryptocurrencies, and the first bitcoin ATM was established four years ago in Zurich<sup>3</sup>. However, cryptocurrency exchanges in South Korea are used within banks in the form of virtual bank accounts, and regulations only allow cryptocurrencies to be traded from a real-name bank account rather than simply manipulated on the bank's platform. This process aims to limit the use of cryptocurrencies in illegal activities and businesses, as well as to reduce the risks of money laundering, tax evasion, and the manipulation and speculation of prices<sup>4</sup>. On the other hand, the United States, Japan, Russia, Singapore, and the United Kingdom recognize it as a new category of investment

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<sup>1</sup>-Mohammed Aatur Rahman et al.: Cryptocurrency Integration Challenges in Blockchain for Financial Institution, Asian Journal of Electrical and Electronic engineering, Vol.01, No.02, 2022, p 34.

<sup>2</sup>-Olena Bondarenko et al.: The possibilities of using investment tools based on cryptocurrency in the development of the national economy, Baltic Journal of Economic Studies, Vol.05, No.02, 2019, p 12.

<sup>3</sup>- Durgaha Moorthy: A study on rising effects of cryptocurrency in the regulations of Malaysian legal system, International Journal of Business, Economics and Law, Vol.15, No.04, 2018, p 38.

<sup>4</sup>-Wim Raymaekers: Cryptocurrency Bitcoin: Disruption, challenges and opportunities, Banking and Treasury Markets Journal, 2014, p 35.

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assets or a taxable asset, i.e., it is subjected to taxation to be used for federal tax purposes<sup>1</sup>. Canada and Australia in their turns considered it as a commodity rather than a currency or a property<sup>2</sup>.

### 3.2. Cryptocurrency as an Illegal Tender

In contrast to the first view, the second opinion recognized cryptocurrency as an illegal tender such as India, China, Malaysia, and Turkey, as these countries issue official statements not recognizing encrypted currency as a legal currency, and thus warn users of the risks associated with its use<sup>3</sup>. The central banks of these countries also disassociated themselves from using cryptocurrencies, especially with regard to technical and regulatory challenges compared to legal currency. Hence, cryptocurrencies in these countries are classified in a legal grey area, where they are not recognized, but they are not either prohibited, giving that many residents of these countries deal with it<sup>4</sup>. Also, Brazil, Australia, Norway, Denmark, the European Union, Hong Kong, the Netherlands, New Zealand, Russia, Estonia, and Indonesia have defined their national legal landscape with direct regulations of cryptocurrencies framework and have issued a warning regarding the risks associated with its use, such as purchasing, holding or trading cryptocurrencies, as consumers are at risk of losing their money and potentially being taxed for owning and using cryptocurrencies<sup>5</sup>. This process aims to provide a consumer protection, prevent money laundering, maintain the integrity of the financial system and prevent tax evasion<sup>6</sup>. However, Nigeria, Bolivia, Ecuador, Bangladesh<sup>7</sup>, and Algeria<sup>8</sup>; they set clear restrictions concerning the use of cryptocurrencies in their transactions and warn financial institutions against its using, holding, or trading them because they are illegal, and state that banks who trade in cryptocurrencies are at risk.

### 3.3. The Central Bank Digital Currencies

Facing the great controversy concerning the legality and the regulatory framework of cryptocurrency, as well as the fear of being used in suspicious operations such as money laundering and financing terrorist operations, the money of the Central Bank appeared as a key solution. This kind of cryptocurrency called “Central bank Digital Currency” (CBDCs). It has imposed because of the rapid digitization of several economies in terms of real-time

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<sup>1</sup>- Durgha Moorthy, Op.cit, p 38.

<sup>2</sup>- Mohd Ma'Sum Billah, Halal: Cryptocurrency Management, Springer Nature, Switzerland, 2019, p 200.

<sup>3</sup>- David Lee Kuo Chuen, Digital currency: Bitcoin, Innovation, Financial instruments and Bid data, Springer Nature, Switzerland, 2018, p 368.

<sup>4</sup>- Olena Bondarenko et al., Op.cit, p 12.

<sup>5</sup>-Soonpeel Edgar Chang : Legal Status of Cryptocurrency in Indonesia and Legal Analysis of the Business Activities in Terms of Cryptocurrency, journal of kegal studies, Vol.06, No.01, 2019, p 77.

<sup>6</sup>-Sonny Zulhuda, Afifah binti Sayuti: hither policing cryptocurrency in malaysia?, The International Islamic University Malaysia Law Journal, Vol.25, No.02, 2017, p 192.

<sup>7</sup>- Sheila Aion Yussof, Abdullah Al-Harthy: Cryptocurrency as an Alternative Currency in Malaysia: issues and challenges, Islam and Civilisational Renewal, n.d, p 53.

<sup>8</sup>-Law No. 11-17 dated Rabi' Al-Thani 08, 1439 AH, corresponding to December 27, 2017 AD, which includes the Finance Law for the year 2018, Algerian Official Journal. No. 76 issued on December 28, 2017.

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payments and settlements, and the need for more efficient domestic and cross-border monetary interactions.

Central bank digital currency (CBDC) is a type of digital money issued by the central banks. It is a legal tender issued by the central bank, with the potential to be widely used by individuals and institutions as a store of value and a means of payments, just like physical currency in circulation<sup>1</sup>. CBDCs are digital versions of real cash, so they are considered safer and less volatile than crypto assets because they are issued and regulated by central banks<sup>2</sup>. CBDCs are structured on the same blockchain technology as bitcoin, Ethereum, or any other cryptocurrency, where they are stored in digital wallets and can be used for financial transactions; they can be transferred digitally to anyone in the world, who just has a cryptocurrency wallet and without any costs. However, there are key differences between it and other cryptocurrencies such as bitcoin and Ethereum. Firstly, a central bank digital currency (CBDC) is characterized by strict controls on access rights by the central bank, meaning it has the right to verify the owners' accounts and their information. Secondly, unlike other crypto-money, a central bank digital currency is not a financial asset in itself, but it is the digital representation of the national currency, and it derives its value from the physical/tender currency that is associated with it<sup>3</sup>. In fact, the ultimate goal of a central bank digital currency (CBDC) is to digitize the physical cash using blockchain.

The designed blockchain of central banks has a different architecture than most existing blockchain networks, such as the Bitcoin network. Since a central bank inherits a high level of trust, it does not need to use a fully decentralized blockchain system that operates entirely without mutual trust or through a distributed consensus. In contrast to regular cryptocurrencies, the central bank blockchain system uses "permissioned" blockchain that has known and trusted validators<sup>4</sup>. The process of using blockchain to transfer money is through the tokenization of fiat money deposited at banks, electronic money owners or other financial institutions to create "stablecoins"\*. Each of these stablecoin tokens must also be backed by financial units (or other assets) deposited in the customer's account, as the tokens must be fully backed by deposits, which helps to stabilize the value of these stablecoins against fiat currencies such as the Dollar/Euro. Stablecoin holders must trust token issuers, as all tokens are fully backed by deposits and they can be withdrawn even in the 100% liquidation case<sup>5</sup>. Therefore, blockchain could be used to tokenize central bank money and to digitally represent bank deposits using central bank digital currencies (CBDCs)<sup>6</sup>.

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<sup>1</sup>- Deloitte report, 2021, p 04.

<sup>2</sup>- Tommaso Mancini Griffoli et al.: Casting Light on Central Bank Digital Currency, International Monetary Fund, 2018, p 07.

<sup>3</sup>- Deloitte report, Op.cit, p 04

<sup>4</sup>- Jonas Grob et al.: The Digital Euro and the Role of DLT for Central Bank Digital Currencies, Frankfurt School Blockchain Center, 2020, p 08.

\* A stablecoin is a kind of cryptocurrency where the price is controlled by tying it to other asset classes, such gold or fiat money.

<sup>5</sup>- Ibid, p 10.

<sup>6</sup>- Raphael Auer et al.: Central bank digital currencies: motives, economic implications and the research frontier, Monetary and Economic Department, Bank for International Settlements, 2021, p 22.



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In fact, CBDCs could enable central banks to maintain control over money creation and be the only source of funds<sup>1</sup>. This process can also increase the speed of transactions through the rapid settlement in the interbank market. In addition, the use of permissioned blockchain can reduce the risks of anonymous money owners, which may solve money-laundering problems. Moreover, according to the International Monetary Fund, central bank digital currencies could reduce expenses, facilitate the smooth flow of funds, improve financial inclusion, cross-border payments, and provide more secure access to funds through digital applications<sup>2</sup>. On the other hand, many central banks are also aware of the growing influence of digital currencies and are concerned about the potential impacts on the financial system. Therefore, in recent years more than 60 central banks have launched CBDCs such as China, Sweden, Nigeria, Bahamas, Canada, Netherlands, Singapore, United Kingdom, Eastern Caribbean, Ecuador, Ukraine, Korea, and Uruguay<sup>3</sup>.

### 3.4. Cryptocurrency from Islamic Sharia View

As this study is related to the Islamic financial market, it is worth to note the different views of Sharia perspective on cryptocurrencies.

#### ❖ **First View: Cryptocurrency is prohibited**

According to this perspective, cryptocurrencies are forbidden (haram) for the following reasons<sup>4</sup>:

- Due to its ease of usage, people commonly employ cryptocurrencies for illegal and non-Sharia compliant enterprises in an effort to elude governments and other relevant authorities;
- It has no physical form and can only be utilized online;
- It permits fraud and money laundering;
- It has no central authority to oversee its system; instead, it undermines the ability of governments and central banks to oversee and regulate the monetary system, making it unstable and untrustworthy;
- Currently, it is not possible to combine religion and trading in cryptocurrency. This is due to its valuation being subject to speculative (high gharar);
- Cryptocurrency is a kind of gambling, as users invest a lot of money to create bitcoin without guaranteeing whether they will succeed or not, as cryptocurrency miners attempt to solve mathematical puzzles in order to earn money; but, if they fail, they receive nothing.

#### ❖ **Second View: Cryptocurrency is Permissible**

Another viewpoint asserts that using cryptocurrency is acceptable. This viewpoint can be examined using the presumption that anything with these characteristics can be regarded as money<sup>5</sup>:

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<sup>1</sup>-Ben S. C. Fung, Hanna Halaburda: Central Bank Digital Currencies: A Framework for Assessing Why and How, Currency Department, Bank of Canada, Canada, 2016, p 01.

<sup>2</sup>-Michael Kumhof, Clare Noone: Central Bank Digital Currencies: Design Principles and Balance Sheet Implications, Bank of England, 2018, p 04.

<sup>3</sup>- Deloitte report, Op.cit, p 07.

<sup>4</sup>- Mufti Muhammad Abu-Bakar, Sharia Analysis of Bitcoin, Cryptocurrency, and Blockchain, Blossom Report, 2017, p 15.

<sup>5</sup>- Mufti Muhammad Abu-Bakar, Op.cit, p16.

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- All cryptocurrency-based transactions are legal, unless we find a clear contradiction between them and Sharia principles;
- It is adopted by a large or universal group of people as a means of transaction;
- It serves as an accounting unit and a measure of value. Thus, any cryptocurrency that satisfies these requirements, such as bitcoin, is acceptable as a legal currency. However, users of cryptocurrencies must be aware of the risks involved.

### Section Two: Smart Contracts Technology Overview

Although cryptocurrency is the most famous blockchain applications, blockchain also can be applied into diverse applications far beyond cryptocurrencies. Smart contracts technology, which is one of the basic applications of blockchain, as it is a new technology that can automatically execute an agreement's terms in a blockchain environment, which simply takes the blockchain to a next stage enabling businesses to process their transactions automatically without intermediaries. Therefore, Smart contracts are one of the powerful blockchain technologies that are garnering more and more business attention, as they represent a self-executing program stored on blockchain to deal with different contract terms. Based on that, this section introduces the basic concept of smart contracts and their key features. In addition, it illustrates their working manner, as well as the benefits and the challenges that face smart contracts application.

#### 1. Smart Contracts Concept

The smart contracts were first introduced by the computer scientist and cryptographer Nick Szabo in 1994. He described it as a cryptographic contract in which contractual obligations are self-fulfilling and executed through computer codes<sup>1</sup>. Historically, smart contracts undergone through a long period of inactivity and lack of interest due to the miss of a special platform to work on. However, it got an attention when blockchain appeared, as it had taken it as a working platform since 2014<sup>2</sup>. In addition, nowadays, they have become one of the most important applications of blockchain, especially in the financial sector, as this technology is seen as an alternative to traditional legal contracts. Smart contracts are also known as executing contracts, or encrypted contracts, or digital contracts, as they digitally execute contracts based on pre-defined conditions without any manual intervention<sup>3</sup>.

##### 1.1. Definition of Smart contracts

Smart contracts can be defined from two aspects, a technical aspect and functional aspect. **Technically**, Smart contracts are seen as: “algorithms or lines of computer codes consisting of complex if-then clauses that are automatically applied on blockchain to conclude and execute contracts automatically and autonomously when a set of conditions are met and agreed upon between the parties involved in the contract without resorting to any intermediary.” However, **functionally**, “Smart contracts are an agreement that can be

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<sup>1</sup>-Rodrigo da Rosa Righi et al.: Blockchain Technology for Industry 4.0, Springer Nature, Singapore, 2020, p 73.

<sup>2</sup>-Koulu, Riikka: Blockchains and Online Dispute Resolution: Smart Contracts as an Alternative to Enforcement, Journal of Law, Technology & Society, Vol.13, No.01, 2016, p 08.

<sup>3</sup>- Bellaj Badr, Op.cit, p 33.

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automated and legally forced to execute. They are automated by computer, even some functions may need human input and supervision, and they are enforced by legal obligations and rights”<sup>1</sup>.

In simple word, the term smart contracts is used to describe a computer program code that is capable of facilitating, executing, and enforcing the negotiation or performance of an agreement (i.e. a contract) using blockchain technology. The entire process is automated and can act as a complement or substitute for legal contracts where the contract terms are recorded in a computer language as a set of instructions. In this regard, three key elements distinguish smart contracts from ordinary contracts<sup>2</sup>:

- 1. Autonomy:** A smart contract does not need to keep in touch with its initiating agent after it has been deployed and operated;
- 2. Self-sufficiency:** Any kind of resource can be independently regulated by smart contracts;
- 3. Decentralization:** Because smart contracts are kept on blockchain, they can be disseminated and self-execute throughout a huge computer network.

It is worth to be noted that, the literal interpretation of smart contracts have nothing to do with electronic contracts, as it is not a representation of paper driven contracts. In contrast, smart contracts are related to algorithms and not the law. They are just a computer program based on codes that summarize the conditions of the contractual obligation, translating into a computer language in the form of “if .... Then” clauses, as when the conditions established between the two parties are met, and ensured, the automatic implementation of these obligations is permitted<sup>3</sup>. Table (II-4) in turn summarizes the difference between conventional contracts and smart contracts.

**Table (II -4): The Difference between Traditional Contracts and Smart Contracts**

<b>Traditional contracts</b>	<b>Smart contracts</b>
<ul style="list-style-type: none"><li>▪ Drafted by lawyers</li><li>▪ Paper based and comprises of legal language and terms</li><li>▪ Lengthy in nature with legal clauses and contents</li></ul>	<ul style="list-style-type: none"><li>▪ Developed by software developers</li><li>▪ Digital and comprises of algorithms</li><li>▪ Straight forward with if-then clause to define the conditions and executions terms</li></ul>
<ul style="list-style-type: none"><li>▪ Third party is required for enforcement</li><li>▪ Judicial system is required for arbitration and legal disputes</li></ul>	<ul style="list-style-type: none"><li>▪ Auto execution based on the pre- defined terms and conditions</li><li>▪ Terms are auto executed upon meeting the pre-defined criteria</li></ul>

**Source:** Nafis Alam, Lokesh Gupta, Abdolhossein Zameni: Fintech and Islamic Finance: Digitalization, Development, and Disruption, Springer Nature, Switzerland, 2019, p 92.

### 1.2. Smart Contracts’ Features

<sup>1</sup>-Aries Wanlin Wang, Op.cit, p 31.

<sup>2</sup>-Erik Hofmann et al., Op.cit, p 44.

<sup>3</sup>- نريمان مسعود بور غدة: عقود البلوك تشين (العقود الذكية) من منظور قانون العقود، المجلة الجزائرية للعلوم القانونية، السياسية والاقتصادية، المجلد 56، العدد 02، 2019، ص 106.

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The key features of smart contracts are listed below:

- **Self-executable:** The most attractive feature of smart contracts is that they are pre-defined and can operate independently and autonomously. They use computer codes to automate tasks such as “if-then” to facilitate a complex scenario, as they can increase the execution speed of a wide range of business processes and contractual terms, which are currently handled manually;
- **Automated:** All agreement terms are fully automated or with restricted manual intervention. As it makes transactions less susceptible to manual error due to the automation based on blockchain technology<sup>1</sup>.
- **Tamper proof:** Smart contracts are automatically processed via a decentralized blockchain network rather than a central database. This gives an immutability kind in transactions data, as no person could change or tamper with transaction details without network consensus<sup>2</sup>.
- **Minimum reliance on intermediaries:** Smart contracts like many other financial technology innovations eliminate intermediaries. The terms of the smart contracts are executed without or with minimal reliance on external intermediaries such as judges and lawyers to execute the transactions. In fact, they rely on “trust” services similar to traditional escrow arrangements among counterparties, which are traditionally implemented using lawyers or juridical systems<sup>3</sup>.
- **Cost effective:** There is minimal reliance on intermediaries and automation, which results in lower costs. Cost savings can be seen in legal expenses, financial payment processing, minimal operating cost, as well as due to no more paper-driven processes<sup>4</sup>.
- **Simplified contracts:** Smart contracts can be greatly simplified with a simple line of computer codes following an “if-then-else” clause, which will require no legal expertise<sup>5</sup>.

### 2. Smart Contracts Operation Mechanism

Technically, smart contracts are a computer program that is called through pre-defined conditions. These conditions are set based on the conclusion of deals and transactions, as smart contracts conclude and execute contracts digitally. Unlike any other contract, smart contracts do not only specify instructions regarding the agreement and agreed terms, but also execute them<sup>6</sup>. Whereas in classical transactions involving a buy and sell agreement, the parties involved usually agree on the terms of the deal and conclude it by exchanging assets

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<sup>1</sup> Nafis Alam et al., Op.cit, p 121.

<sup>2</sup> Ibid, p 121.

<sup>3</sup> Mustafa Raza Rabbani: Fintech innovations, scope, challenges, and implications in Islamic Finance: A Systematic Analysis, International Journal of Computing and Digital Systems, 2020, p 10.

<sup>4</sup> Ibid, p 10.

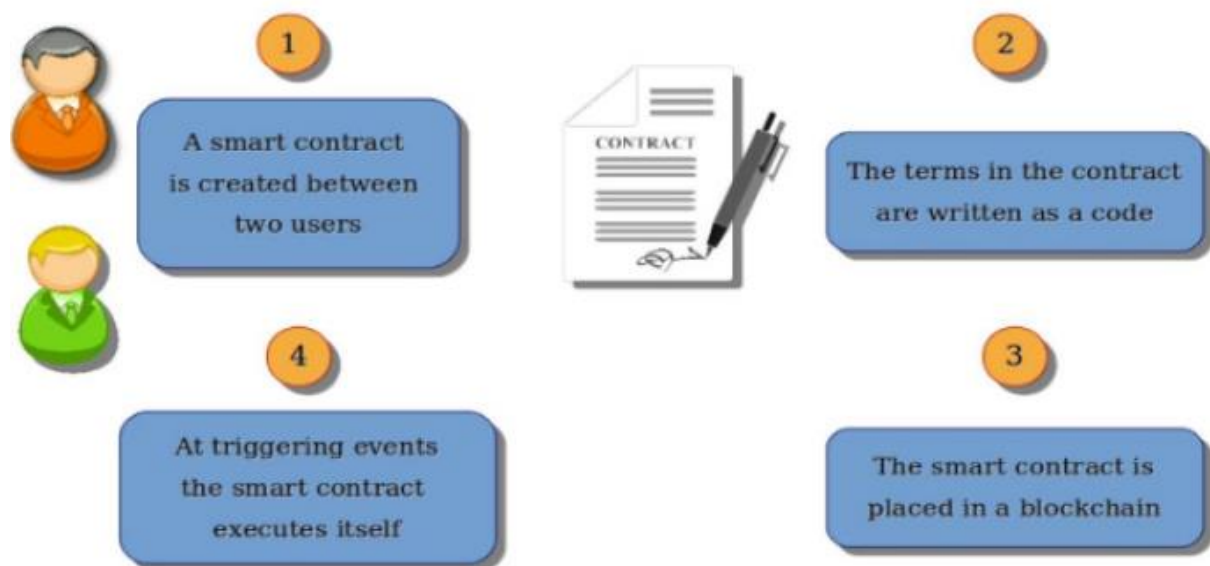
<sup>5</sup> Ibid, p 10.

<sup>6</sup> Nishith Pathak, Anurag Bhandari: IoT, AI, and Blockchain for NET, Springer, New York, 2018, p 206.

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and paying money. In fact, a digital transaction based on smart contracts is complex in nature, as the basic idea on which smart contracts are based is that all contractual terms such as laws, privileges, property rights, etc., can be specified and included in computer codes on blockchain<sup>1</sup>. In contrast to the paper version of regular transaction contracts, smart contracts are attached to a digital ledger system, which allows transactions to be executed in an automated manner after they have been verified and stored to be managed and settled within blockchain network. As, this process ensures the governance of contracts between the parties concerned without the need for an arbitrator<sup>2</sup>. Each contract contains details of the contracting parties such as the seller/buyer or sender/receiver, the value of the transaction, and the entered data related to the terms of the deal. Therefore, any blockchain user can see, operate, and execute the contract based on the entered terms, or what is called the input variable. The input variable represents the contract codes, which must be validated by all node members in the blockchain network before a successful block can be created and added<sup>3</sup>. Based on that, figure (II-3) below provides a simple steps of how smart contracts work.

**Figure (II-3): Smart Contracts Working Steps**



**Source:** Koulu, Riikka: Blockchains and Online Dispute Resolution: Smart Contracts as an Alternative to Enforcement, *Journal of Law, Technology & Society*, Volume 13, Number 1, 2016, p 09.

Smart contracts, also referred to as “Blockchain 2.0”, they are often written to ensure trust and fairness between two or more participants without the need of a trusted third party. Basically, the written terms in smart contracts cannot be changed even by the owner after

<sup>1</sup>- Nor Razinah Binti Mohd. Zainet al.: Smart Contract in Blockchain: An Exploration of Legal Framework in Malaysia, *Intellectual Discourse*, Vol.27, No.02, 2019, p 598.

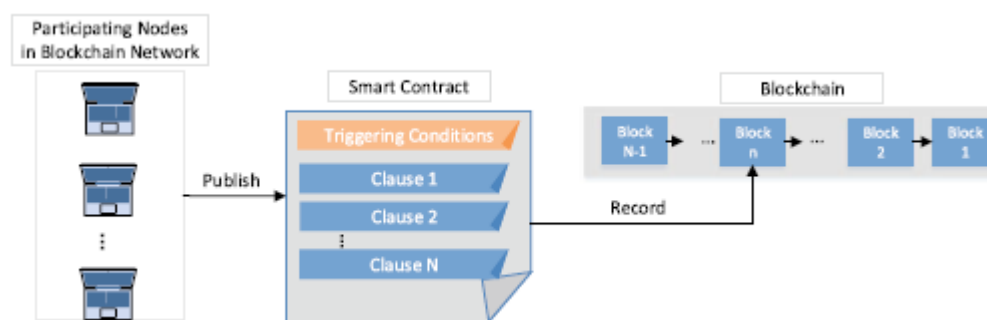
<sup>2</sup>- Antony Welfare: *Commercializing Blockchain: Strategic Application in the Real World*, Wiley, 2020, p 127.

<sup>3</sup>- Dhar Suparna, Bose Indranil: *Smarter banking: Blockchain technology in the Indian banking system*, *Asian Management Insights*, 2016, p 49.

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they are published on blockchain<sup>1</sup>, as instead of having written terms in a paper contract, smart contracts rely on the process of encoding the contractual terms using computer language instead of a legal language through “if-then” clauses<sup>2</sup>. The blockchain platform registers itself within a specific block and works side by side at the same time with the process of the offering and validation between network members, as the terms are automatically imposed through a protocol followed by the blockchain network. After the network members finish agreeing to the encrypted terms of the contract, they may place their encrypted signature or digital signature on smart contracts. Later, smart contracts are automatically registered in the form of blocks and automatically added to the blockchain after being validated<sup>3</sup>, as showing in figure (II-4). In general, the programming of these contracts are based on C++, Java Scripts, Python, and Solidity algorithms<sup>4</sup>, as these codes self-execute the contract without human intervention. These terms are specifically encoded on Ethereum<sup>5</sup>, which is a blockchain-based distributed computing platform that enables people to build smart contracts<sup>6</sup>. Essentially, Ethereum gives contracts the ability to secure and record all transactions from concluding the contract to its implementation and settlement<sup>7</sup>. The cryptocurrency associated with Ethereum is “Ether”, as it is not only a cryptocurrency, but it is also considered a unit of measurement in smart contract transactions<sup>8</sup>.

**Figure (II-4): The Generation and Recording of Smart Contracts**



**Source:** Ying Chang Liang: *Blockchain for Dynamic Spectrum Management*, Springer, Singapore, 2020, p 128.

Depending on the type of blockchain technology, public, private, or hybrid, both users and contracting parties can see the status of a given contract. All contracts processed through the blockchain are executed and accepted by a network of computers that use a consensus mechanism to add the contract to the blockchain. Contract details are stored in a decentralized manner to ensure transparency and ensure that the data are not tampered with. This mechanism also leads to the possibility of tracking the transfer of assets, as this

<sup>1</sup>- Dhar Suparna, Bose Indranil, Op.cit, p 49.

<sup>2</sup>- Michael G. Solomon: *Ethereum*, Wiley, New Jersey, 2019, p 43.

<sup>3</sup>- Debajani Mohanty: *Ethereum for Architects and Developers*, Springe, New York, 2018, p 52.

<sup>4</sup>- Merunas Grincalaitis: *Mastering Ethereum*, Packt Publishing, United Kingdom, 2019, p 27.

<sup>5</sup>- Nishith Pathak, Anurag Bhandari, Op.cit, p 207.

<sup>6</sup>- Richard Ozer: *Ethereum - The insider Guide to Blockchain Technology, Cryptocurrency and Mining* Ethereum, Springer, Switzerland, 2017, p 07.

<sup>7</sup>- Nor Razinah Binti Mohd et al., Op.cit, p 605.

<sup>8</sup>- Debajani Mohanty, Op.cit, p 52.

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technology is considered as a solution to eliminate many of the deficiencies in the traditional contract management process. According to the latest statistics published by Statista on its website, the size of the global smart contracts market reaches to US\$315.1 million, and it is expected to reach approximately US\$1460.3 million by the end of 2028<sup>1</sup>. The large size of smart contracts market is due to the widespread use of them in various industries because agreements and exchanges can now be run on smart contracts based on Ethereum, as they facilitate the exchange of any type of property or assets in a transparent manner<sup>2</sup>. It is a new way of concluding contracts and carrying out transactions based on trust, free of disputes and avoiding any kind of intermediary.

### 3. Benefits and Limitations of Smart Contracts

This part introduces the main benefits of smart contracts, as well as, the main limitations that face their applications.

#### 3.1. Smart Contracts Benefits

Since all of these decentralized applications will run on blockchain, they will have all the benefits associated to blockchain such as:

**a. Accuracy:** It is one of the most significant benefits that business organizations will experience from adopting smart contracts, since all terms and conditions must be expressed precisely and clearly in order to prevent errors when utilizing if-then clauses. They can also be synchronized with cryptocurrencies, which will improve the system's overall robustness, accuracy, and performance.<sup>3</sup>

**b. Clear Communication and Transparency:** In actuality, the blockchain makes the terms and conditions of the contract readily apparent to other network participants. As a result, once a contract is produced, it is difficult to make changes because every blockchain network node tracks, monitors, and controls every contract, improving transparency and removing fraud concerns.<sup>4</sup>

**c. Security:** When smart contracts are used with blockchain technology, a decentralized network of untrusted parties is used. Due to a lack of trust, network participants keep an eye on one another to make sure every transaction is completed successfully. Furthermore, data encryption is provided by cryptographic algorithms used in the implementation of blockchain technology. This significantly improves data security and deters any malevolent activity.<sup>5</sup>

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<sup>1</sup>- The official website of Statista, Op.cit, consulted on 24/08/2022.

<sup>2</sup>-Aries Wanlin Wang, Op.cit, p 31.

<sup>3</sup>- Richard Ozer: Ethereum - The insider Guide to Blockchain Technology, Cryptocurrency and Mining Ethereum, Springer, Switzerland, 2017, p 09.

<sup>4</sup>-Radu Stancu: The Notions of Blockchain and Smart Contract from the Point of view of the Intellectual Property Right, The 13th edition of the international conference European Integration Realities and Perspectives, 2018, p 104.

<sup>5</sup>-Ibid, p 104.

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**d. Cost Reduction:** The use of blockchain technology to implement smart contracts eliminates the need for middlemen like legal staff. As a result, profit margins are increased and overall operating costs are decreased.<sup>1</sup>

### 3.2. Smart Contracts Limitations

Despite the various benefits associated with smart contracts applications, it is also important to note that smart contracts are faced various limitations as they are listed below:

**a. Inflexible Contracts:** Smart contracts are algorithms that are programmed and cannot be changed during the execution of a transaction. Since smart contracts are written as a piece of codes, once set up, contacts cannot be easily modified, as the immutability of smart contracts could lead to a wide range of practical problems regarding modifying terms<sup>2</sup>.

**b. Contract Secrecy:** Concluding contracts and transactions on a public blockchain makes all transaction records visible to all participants, which make it none secure for transaction data. In fact, the essence of smart contracts is to maintain a public ledger that is visible to all parties in the network, and monitor the validity and accuracy of the transactions. Therefore, there is also a need to develop a protocol that can help in checking transactions without making the contents of the transaction visible<sup>3</sup>. Although the transaction participants may be anonymous, its contents are not, as every node can read and access the contents of the transaction. Thus, it is important to develop measures to reduce these privacy issues since security is not only about anonymity and encryption, but also it must ensures that the content of the transaction is protected<sup>4</sup>.

**c. Legal Adjudications and Enforceability:** When concluding smart contracts, to maintain consistency with the legal and judicial viewpoints of the contract, the programming logic translates the legal framework controlling the contracts. Therefore, it always entails taking into account the viewpoints of multiple parties, such as the blockchain developer and transacting parties, which ensure the validity of the contracts<sup>5</sup>. Thus, businesses using smart contracts must continually grapple with the issue of the contract's enforceability and validity while paying attention to all applicable legal and judicial requirements. Although the positive side of smart contracts is that smart contracts violations are rare. However, The contract's execution is predicated on predetermined parameters, which may operate independently of any node or user.<sup>6</sup>

## Section Three: The Potential Applications of Blockchain Technology in the Financial Sector

The financial industry, stimulated by digital innovations, is one of the industries that has the potential to benefit from blockchain technology due to their several advantages, as this technology provides the opportunities of saving costs and time, in addition to increasing the

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<sup>1</sup>-Silas Nzuva: Smart Contracts Implementation, Applications, Benefits, and Limitations, Journal of Information Engineering and Applications, Vol.09, No.05, 2019, p 71.

<sup>2</sup>- Amira El Sayed El Gendy: Impact of the use of smart contracts on the efficiency of Islamic banking, Journal of Financial, Accounting and Managerial Studies, Vol.06, No.02, 2019, p 13.

<sup>3</sup>- Silas Nzuva, Op.cit, p 72.

<sup>4</sup>- Amira El Sayed El Gendy, Op.cit, p 72.

<sup>5</sup>- Debajani Mohanty, Op.cit, p 31.

<sup>6</sup>-Ibid, p 31.



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security of online transactions of any kind, as well as reducing the settlement period and speeding up payment processes. Therefore, we find many financial companies rushing to adopt this technology to reduce their operational costs and speed up their payments. This advanced technology has gradually gained traction as it is now being explored beyond the scope of cryptocurrency projects. Therefore, this section presents the most important areas of blockchain application in the financial industry based on its two main applications: cryptocurrencies, smart contracts, or both of them.

### **1. Financial Applications based on Cryptocurrency**

This part introduces the main financial applications based on cryptocurrency, which represent in cryptocurrency exchange, which is applied in cross-border payments and financing projects based on crowdfunding.

#### **1.1. The Application of Blockchain Technology in Cross-Border Payments**

Cross-border payments can complete the transfer of money between any two parties in any two regions, as if a local consumer purchases a product abroad from foreign manufacturers, this process requires a settlement tool and payment system to complete cross-border settlement between the involved parties. The cross-border interbank payment system is the most common payment tool, which uses to settle transaction payments using foreign currencies. For example, any local consumer can easily purchase any commodity from abroad through banking payment channels, containing VISA card, MASTER card and so on. Typically, the main cross-border payments methods include: bank telegraphic transfer, remittance company transfer, credit card payment, and third-party payment\*. Firstly, the bank telegraphic transfer relies on the payment network of the Society for Worldwide Interbank Financial Telecommunication (SWIFT)<sup>1</sup>, where the buyer's bank sends a transfer message to the selling bank abroad, and then the seller's bank abroad pays the money to the beneficiary, i.e. the seller. However, this type of payment needs to pay a high fee and wait a long time. Secondly, cross-border payment can also be completed by a remittance company, which confirms the payment of the transaction by authorized agencies abroad, so the entire transaction process costs very little time. Thirdly, credit card payment depends on the bank payment and the clearing system. Although credit card payment is often used for online shopping or in a retail store; however, stores need a large cost of money to equip hardware and software facilities. Fourthly, in recent years the third-party payment is introduced as a new cross-border payment method<sup>2</sup>. If the government allows third-party payment institutions to provide their payment services to merchants at home and abroad, consumers can finish payment via a third-party payment instrument such as Alipay and PayPal\*.

The above-mentioned traditional methods of cross-border payments involve many trading parties and intermediaries, which lead to increase the operating costs. In such cases, blockchain technology could be used in cross-border payment business. In order to overcome the disadvantages of traditional methods of cross-border payments and reduce transaction

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\*A third-party payment processor lets you take online payments from your clients. One benefit of using a third-party payment processor is that you may still accept payments without having to open a bank account of your own.

<sup>1</sup>-Abdelouhed Mohamed: Challenges of Applying Blockchain Technology to the Algerian Financial Accounting System, Journal of El-Maqrizi Economic and Financial Studies, Vol.05, No.02, 2021, p 388.

<sup>2</sup>- Ibid, p 388.

\* Alipay and PayPal are online payment platforms. Alipay established in China. However, Paypal is a global financial technology corporation with American roots. In most countries that allow internet money transactions, they run an online payments system.

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risks, blockchain can create a private network for transaction settlements supported by trust and without the need for the presence of any external financial institution or external parties. Through this network, money is directly transferred between the debtor and the creditor. For example, Party (A) transfers funds to Party (B) via blockchain technology<sup>1</sup>; initially, the transaction is displayed on blockchain through a peer-to-peer platform, identifying the debit party (A) and the debtor party (B). Through this platform, which is responsible for the settlement process between the debtor and the creditor, i.e., between (A) and (B). On blockchain, the transaction is stored on several nodes in distributed networks, and after verifying the nature of the transaction, payments are easily exchanged between the two parties using cryptocurrencies. Generally, Ripple is one of the most popular cross-border payment networks, as it accepts not only all types of fiat tenders, but also any type of virtual currency<sup>2</sup>. Comparing to traditional cross-border payment method, the transaction cost based on the Ripple platform is nearly equaled to zero, and it only takes a few seconds. Moreover, on Ripple, it is possible for a trader to use any currency for its payments, either the legal tender or the virtual currency. For example, if party (A) holds bitcoin, he can exchange and finish his payment using US dollars or Euros<sup>3</sup>. It is worthy to note, that cryptocurrency payments are usually made in a pseudonym using the encryption key. Therefore, international exchange of cryptocurrencies can be done without real identification, and we may not know any actual person behind any account. However, international payments usually have regulatory requirements to identify participants, as part of anti-money laundering and counter-terrorism financing regulations. In addition, transacting parties can choose to deal using their own real identities, which is typically the method that has been imposed to regulate international payments based on blockchain technology<sup>4</sup>.

### 1.3. Blockchain-based Crowdfunding

Crowdfunding as shown in figure (II-5) is an alternative way of raising small amounts from a large number of investors using a digital platform. Typically, this alternative financing strategy is used by small firms and start-ups to fund new initiatives or raise growth capital to expand. The core of crowdfunding are depicted through two main aspects: first, raising small amounts of money from a large number of people (hence the term ‘crowd’); second, the fundraising process takes place via the internet.

**Figure (II-5): Diagrammatic Representation of Crowdfunding**



**Source:** Righi Rodrigo da Rosa, et al.: Blockchain Technology for Industry 4.0, Springer, Singapore, 2020, p 118.

<sup>1</sup>- Xiwei Xu et al., Op.cit, p 102.

<sup>2</sup>- Ibid, p 102.

<sup>3</sup>- Abdelouhed Mohamed, Op.cit, p 388.

<sup>4</sup>- Xiwei Xu et al., Op.cit, p 103.

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As shown above, crowdfunding is a process of raising funds for an idea or business by collecting together investors who have an interested project. As investors provide money until the objective is reached and the business is run. It has been done to support any group or entrepreneurial enterprise that aims to overcome conventional finance constraints and encourage social change over the past few years. However, today most of the existing platforms of crowdfunding are centralized, which could leads to several problem, representing in<sup>1</sup>:

- One of the major problems that exist in the traditional crowdfunding platform is the instances of fraud, as it has been stated that online crowdfunding leaves contributors vulnerable to fraud as traditional legal procedures and reputation protection measures may not work;
- On the existing crowdfunding platforms, there is no assurance provided to backers that the funds raised will be applied to the actual product development, which similar to the aforementioned issue;
- This raises a third problem, which is that the agreed upon project will not be delivered on time or the money may not even be recovered to their original owners, as more than 75% of crowdfunding projects submit their projects later than the expected time.

The aforementioned problems can be solved if crowdfunding platforms are structured on blockchain, making them decentralized platforms, as all participants can see the movements of funds and the implementation of projects through blockchain tracking feature. Therefore, the following points summarize the benefits of blockchain-based crowdfunding platform<sup>2</sup>:

- Establishing a voting mechanism based on blockchain that enables shareholders or even the general public to engage in corporate governance in a quick and affordable manner;
- Tracking any modifications to the contract reached between the general public and the project initiator using a blockchain-based smart contracts, which enables organizers to spot shady fundraising schemes;
- Create an identity management system that uses blockchain technology to give consumers total control, avoiding money laundering and identity theft;
- Use digital currency to cut out middlemen like banks and payment processors;
- Defining the terms under which the deal takes place, which helps regulators monitor and regulate investment stakes and qualify investors.

The current crowdfunding process, as shown in figure (II-6), consists of three parties: financiers, fundraisers, and the crowdfunding platform. The fourth party is the bank in which the funds are deposited. However, crowdfunding based-blockchain eliminates the need for these intermediaries, by allowing the formation of decentralized crowdfunding platforms, which operate independently on a peer-to-peer network. Generally, this process reduces the overall costs, as these platforms make a profit by charging a personal commission on the money paid for fundraising<sup>3</sup>. In addition, since the system is decentralized, fundraisers will offer the relevant project to the token holder that suits their needs and returns, where a

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<sup>1</sup>-Saadat Md Nazmus et al.: Blockchain based crowdfunding systems, International Journal of Electrical Engineering and Computer Science, 2019, p 410.

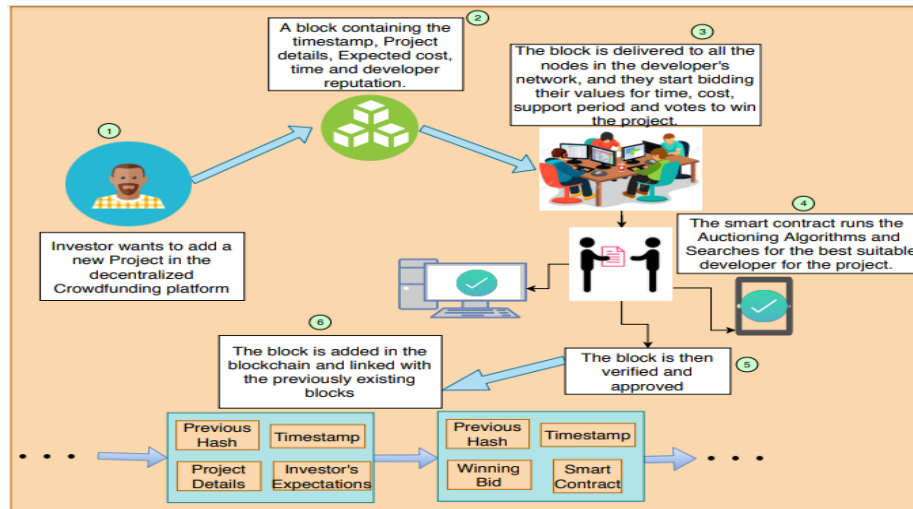
<sup>2</sup>- Righi Rodrigo da Rosa, et al.: Blockchain Technology for Industry 4.0, Springer Nature, Singapore, 2020, p 123.

<sup>3</sup>- Righi Rodrigo da Rosa, et al., Op.cit, , p 123.

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cryptocurrency wallet replaces the bank. Moreover, the blockchain system is transparent, so financiers will trust the platforms in all aspects such as project inception, tracking of returns, and contract terms, which make the financiers more confident concerning their money, as it will be spent in the right place with a record of every spend. Recently, there are plenty examples of blockchain-based crowdfunding platforms that use cryptocurrency (bitcoin) as a means of crowdfunding such as: “Funded by me”, “Start Engine” and “We Funder”<sup>1</sup>. However, “Swarm”, “koinify” and “Light house” allow companies to create their own coins (cryptocurrency) which can be exchanged to other virtual currencies<sup>2</sup>.

**Figure (II-6): Blockchain-based Crowdfunding Framework**



**Source:** Righi Rodrigo da Rosa, et al.: Blockchain Technology for Industry 4.0, Springer, Singapore, 2020, p 127.

## 2. Financial Applications based on Smart Contracts

Financial operations based on smart contracts such as insurance and international trade are thoroughly discussed in this part.

### 2.1. Blockchain Application in Insurance Industry

Building an insurance system on blockchain takes the insurance industry to a global level, as this technology has tremendous potential to improve many aspects of this industry. This new model of insurance is a decentralized system, through which all data are recorded while allowing any user at any time to start and end insurance coverage autonomously and automatically<sup>3</sup>. Thus, this decentralized system completely eliminates the need for intermediaries while ensuring stability, immutability, and not erasing the information. Which in turn ensures the effective use of insurance services. In addition, nowadays, insurance claims in insurance companies take several weeks and require a lot of papers and documents. Hence, the association of the insurance services with blockchain technology, specifically smart contracts<sup>4</sup>, allows the management of insurance contracts and the processing of insurance claims in an automated and rapid manner through the validation of

<sup>1</sup> Muneza Aishath, et al.: The Application of Blockchain Technology in Crowdfunding: Towards Financial Inclusion via Technology, International Journal of Management and Applied Research, 2018, Vol.05, No.02, 2018, p 88.

<sup>2</sup> Righi Rodrigo da Rosa, et al., Op.cit, p 123.

<sup>3</sup> Ronny Hans, et al. : Blockchain and Smart Contracts: Disruptive Technologies for the Insurance Market, Ebusiness and Ecommerce Digital Commerce (sigebiz), 2017, p 05.

<sup>4</sup> Deloitte Report: Blockchain Applications in Insurance, 2016, p 21.

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the network, which speeds up the processing and the settlement of the correct insurance claims without human intervention, saving the overall costs<sup>1</sup>.

### 2.2. Blockchain for International Trade

Every international trade transaction leads to hundreds of inter- and overlapping transactions. When these operations are carried out, they are recorded in the systems of each party, and throughout the logistics chain\*, these data are replicated in the systems of each party, resulting in multiple records, which often lead to errors, delayed, and inefficient information, and may even lead to fraud cases. According to the United Nations report of 2021, in Latin America and the Caribbean, it is estimated that 75% of exporters re-enter data into their systems and then submit paper documents to the relevant commercial authorities<sup>2</sup>. This problem can be addressed through blockchain technology using smart contracts, which contain a single shared and verified copy of data, providing the same information to all participants, eliminating the need for a central authority, and reducing the paper driven processes, as well as the time, costs and complexities of bilateral business communications<sup>3</sup>. Moreover, the storage system based on blockchain involves advanced encryption techniques associated with encrypted electronic communications between parties, which could provide more secure services, allowing traceability and analysis of data dynamics<sup>4</sup>. In this regard, the following table (II-5) shows the potential impact on international trade using blockchain technology.

**Table (II-5): Use Cases Relating to International Trade Based on Blockchain**

Use case	Potential impact of blockchain
Provenance and traceability of products	It would provide greater advantages and accuracy in managing product certifications and reducing the fraud risks.
Streamlining business processes	It would favor the secure exchange of information, promoting safe and paperless trade.
Smart contracts and Automation	Based on smart contracts, all the processes are automatically done when certain conditions are met in efficient and low administrative costs.
Trade finance	Particularly in terms of process efficiency and security, it would make trade finance simpler and more transparent.
Errors and fraud cases detection	It would encourage auditing of operations and thus encourage companies to be more transparent and ethical.

**Source:** Report of the United Nations: blockchain implementation in Latin America and the Caribbean, 2021, p 06.

### 3. Financial Applications based on Cryptocurrency and Smart Contracts

<sup>1</sup>- Report of the United Kingdom department of International trade: How Blockchain will reshape the financial services industry, United Kingdom, 2017, p 50.

\*The administration of goods movement between the point of origin and the site of consumption in order to satisfy the needs of consumers or businesses is known as logistics. Ensuring timely and cost-effective delivery of goods to customers is the aim of logistics.

<sup>2</sup>-Report of the United Nations: blockchain implementation in Latin America and the Caribbean, 2021, p 06.

<sup>3</sup>- Ibid, p 06.

<sup>4</sup>- Ibid, p 06.

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The financial applications based on both cryptocurrency and smart contracts are represented in different applications such as banking services, supplychain and settlements in financial market, as discussed below.

### 3.1. Blockchain Applications in Banking Industry

Banks are constantly seeking new ways to conduct faster and efficient banking transactions to improve customer services, while ensuring cost efficiency in their operations and transparency to customers and regulators. This is what blockchain technology provides, by automating parts of the bank's financial operations through smart contracts and cryptocurrency, which help in eliminating intermediaries. They enables banks to provide their services and products in a fast, secure and low-cost manner<sup>1</sup>. In fact, banks are wary of using blockchain technology associated with cryptocurrencies due to the lack of regulations and technical problems, so they are adopting private and permissioned blockchain technology, thanks to its many characteristics. As a permissioned/ private blockchain is a closed system that involved only pre-defined organizations and it requires lower costs and computing power to operate than public blockchains<sup>2</sup>, thus alleviating concerns about scalability and information security. This technology has the potential to solve most of the problems that currently affect traditional banking operations, such as efficiency, transaction delays, fraud, and operational risks, by reducing costs, enhancing process efficiency, and increasing security. Blockchain can also be applied to transform the ways financial services are delivered and will improve the competitive advantages of traditional financial institutions by enabling smart contracts, maintaining immutable records of transactions and facilitating real-time execution of transactions. For instance, the first trade finance transaction in 2018 between the two Indian banks, "the Hong Kong and Shanghai Banking Corporation" and "ING Vysya Bank", took a record time of 24 hours instead of the usual period of 5 to 10 days<sup>3</sup>. This can reduce manual labor costs and lead to enhanced customer services and satisfaction. The algorithms, in turn, become an online intermediary within the blockchain system, thus reducing infrastructure costs and transaction fees while increasing payment security, as it provides a decentralized network with more secure, transparent and reliable infrastructure<sup>4</sup>. Moreover, by accessing a range of information recorded in the ledger, banks can exploit this information to gain a better and more complete understanding of their customers' behaviors, needs and preferences. This in turn enables banks to create and offer new products and services that are not necessarily linked to traditional banking products, but they are designed to meet the customers' needs<sup>5</sup>. In addition, the ledger will provide a historical record of all shared documents and activities, which is useful in identifying entities trying to create fraudulent records, as banks can analyze the data to detect violations, directly targeting criminal activity<sup>6</sup>. Therefore, banks compete by investing heavily in technology in attempts to improve the efficiency of their financial innovation system. Thus, they launch a wide range of financial services based on blockchain such as<sup>7</sup>:

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<sup>1</sup>-Treleaven Philip, Gendal Brown Richard, Yang Danny: Blockchain Technology in Finance, Journal of Computer society, Vol.50, No. 09, 2017, p 14.

<sup>2</sup>- Sankaranarayanan G, Kumar Rajagopalan Kamal: Usage of blockchain technology in banking sector and its implication on Indian economy, Alochana Chakra Journal, 2020, p 7385.

<sup>3</sup>- Gupta Abhishek, Stuti Gupta: Blockchain technology application in Indian banking sector, Delhi Business Review, Vol.19, 2018, p 01.

<sup>4</sup>- Shah Tejal, Shailak Jani, Op.cit, P 09.

<sup>5</sup>- Martino Pierluigi, Op.cit, p57.

<sup>6</sup>- Deloitte Report: Blockchain applications in banking, 2016, p. 19.

<sup>7</sup>- Patki Aarti, Vinod Sople, Op.cit, p 69.

## **Chapter Two: The Main Blockchain Applications in the Financial Sector**

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- Automated Teller Machine (ATM), online Banking, Mobile Banking, Blockchain Banking, Cryptocurrency Wallet, etc.;
- Trade finance transactions involving the processing of bills of lading and letters of credit;
- Secured transaction processes with high efficiency in the capital markets;
- Real-time servicing of trades and securities using Know Your Customer\* data that has been stored, allowing for more transparency and a reduction in credit exposures for timely, risk-free settlement;
- Supplychain Financing services based on process with secured and efficient system;
- Cryptocurrency exchange in the trade settlement process, where third-party verification is eliminated, resulting in faster processing times, reduced operating costs and real-time transactions.

### **3.2. Supplychain Financing Using Blockchain**

Supplychain finance is a set of technology-based business and financing processes that connect different parties in a transaction (buyer, seller and financing institution) to reduce financing costs and improve business efficiency using cryptocurrency as a mean of payments and settlement. It provides short-term credit that improves working capital for both the buyer and the seller<sup>1</sup>. Simply put, it is a set of individuals, organizations, knowledge, activities, and resources involved in getting a product or service from supplier to consumer. They are made to keep important products in good condition during the process of shipping. In fact, it is a chain that is vulnerable to corruption, manipulation and fraud, and all risks associated with centralized supplychain management systems<sup>2</sup>. Therefore, blockchain technology as a decentralized and distributed information system can be a secure solution for supplychain management. As unlike the traditional method of supplychains, this technology provides a protection and traceability for goods, services, and total transactions, which lead to increase confidence between all the involved parties, as all terms of the agreement can be fulfilled automatically, without any human intervention or a huge amount of documents and administrative procedures thanks to smart contracts<sup>3</sup>. In addition, the settlement processes between the seller and the buyer directly take place based on cryptocurrencies, instead of relying on bank like the traditional model<sup>4</sup>, which improve operational efficiency.

### **3.3. Blockchain in Capital market**

Blockchain technology has the ability to change the working mechanism of financial markets by automating the process of management and settlement of various securities in a digital manner from the issuance phase until the trading and settlement phase, through

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<sup>1</sup>- Choi Tsan-Ming: Supply chain financing using blockchain: impacts on supply chains selling fashionable products, *Annals of Operations Research*, 2020, p 02.

<sup>2</sup>-Mustafa Raza Rabbani: Fintech innovations, scope, challenges, and implications in Islamic Finance: A systematic analysis, *International Journal of Computing and Digital Systems*, 2020, p 07.

<sup>3</sup>- Dikilitaş Yılmaz, Onur Toka Kazım, Sayar Ahmet: Current Research Areas in Blockchain, *European Journal of Science and Technology*, 2021, p 05.

<sup>4</sup>- Choi Tsan-Ming, Op.cit, p 03.

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various functions representing in storing, management, tracking and settlement. As, the system of the financial markets, which is composed of several intermediaries and centralized organizations that handle securities settlement procedures, suggests the possibility of using blockchain technology<sup>1</sup>. Thus, it can be used as a platform to record and track any financial asset through smart contracts, and the total number of various transactions could be settled based on cryptocurrencies. An example of how blockchain technology can aid in the facilitation of securities transactions is to look at what occurs during a transaction in the conventional stock market. A market maker or specialist receives an order from an investor over the phone in traditional financial exchanges, and the market maker matches the buy and sell orders to execute the transaction. Following this, the shares are exchanged through a broker along with the purchase price attached to them<sup>2</sup>. This procedure could call for several brokers and result in expenses and delays. On the other hand, technically, securities structured on blockchain rely on smart contracts, as these algorithms allow investor information and trading rules to be placed on Ethereum platform to construct smart contracts, as these contracts include trading rules and the implementation mechanisms, such as price requests, and if the condition are met, the trading is automatically executed; and if the conditions are not met, these transactions do not take place. For example, the Ethereum blockchain allows individuals to invest directly in companies in exchange for “tokens” in crowdfunding-like funding campaigns called initial coin offerings\*. Another advantage of blockchain-based securities is that they enable investors to communicate with each other directly on the stock markets, without going through an intermediary. Blockchain technology used in securities offerings fosters previously unheard-of levels of legal confidence and openness between contract parties. In addition to providing much-needed transparency, the establishment of a global consensus registry of data and transactions makes direct stock market funding available to a wider range of people worldwide.<sup>3</sup> One of the other processes that can benefit from this technology is the financial settlement of securities. Instead of resorting to clearing house through the intervention of banks, this process is executed through different cryptocurrencies based on the currency in which the securities are priced or valued. In short, an environment with multiple intermediaries can benefit from blockchain technology through efficient transaction settlement, reduced risk, increased transparency, and other benefits<sup>4</sup>. A lot of businesses have made the decision to work together to implement blockchain technology in order to manage the securities life cycle in different

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<sup>1</sup>-Janis Bauvars: Applicability of Blockchain Technology in Securities Settlement, *Complex Systems Informatics and Modeling Quarterly*, 2020, p 34.

<sup>2</sup>- Zachary A. Smitha, et al.: Blockchain and the Future of Securities Exchanges, *Artificial Intelligence and Blockchain for Future Cybersecurity Applications*, 2021, p 02.

\* An initial coin offering (ICO) is a process by which a business offers a new cryptocurrency in order to raise capital or take part in investment opportunities.

<sup>3</sup>- Mahdi H. Miraz, David C. Donald: Application of Blockchain in Booking and Registration Systems of Securities Exchanges, the *IEEE International Conference on Computing, Electronics & Communications Engineering*, University of Essex, United Kingdom, 2018, p 04.

<sup>4</sup>- Ibid, p 586.



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financial markets, including Islamic financial market, by structuring one of its main instrument, sukuk, on blockchain, which is known as Smart Sukuk or Blockchain Sukuk<sup>1</sup>.

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<sup>1</sup>- Reade Rya, Mayme Donohue: Securities on Blockchain, the Business Lawyer, Vol. 73, 2018, p 92.

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### **Summary**

Blockchain technology is one of the innovations that has drastically changed the financial sector in recent years based on its main mechanisms, which are cryptocurrency and smart contracts. In recent years, cryptocurrency, which is one of the latest types of currency generation, has become one of the greatest innovations in the financial field due to its physical cashless nature, as the most important aspect of cryptocurrency is the decentralized nature of the currency, as it is not issued by any central authorities. For this reason, it is out of the central banks control, unlike traditional currency. This currency has great traction due to its advantages of saving cost and settlement time, avoiding double spending, and third party involvement. However, cryptocurrency faces various challenges regarding to its regulatory framework and its nature as a legal tender, which has led to the creation of central bank digital currencies (CBDCs) by central banks in different countries as a radical solution to settle a digital legal transactions around the world.

Smart contracts, on the other hand, is one of the main application of blockchain, they are computer codes that contain instructions for dealing a transaction or exchanging something of value when certain conditions are met. These contracts operate in a precise manner that is not subject to change or tampering. They are executed automatically without the need for a third party, without the risk of hacking or downtime. Contracts are written through (if-then) statements that exactly define the terms of contracts and transactions, ensuring their flawless execution on blockchain platform. Blockchain technology and smart contracts have the potential to change how business contracts are executed and how those contractual terms and rules are enforced in a decentralized system. Their main benefits representing in: accuracy, clear communication, transparency, security and cost reduction. However, their limitations are inflexible contracts, contract secrecy, and legal provisions and enforceability.

Blockchain technology based on its main application cryptocurrency and smart contracts provides many opportunities for the financial industry. The use of this cutting-edge technology is expanding outside of the cryptocurrency projects, as it has steadily gained popularity. Reduced settlement period, faster payment processing, cost savings and security are some of the biggest attractions of this technology. As, cross-border payments and crowdfunding-based financing projects could be the main financial areas that are rely on cryptocurrency. However, insurance and international trade are financial operations that rely on smart contracts. Likewise, banking services, supplychain and financial market settlements are based on both of them, i.e., cryptocurrency and smart contracts.

# Chapter Three

## **Chapter Three: Smart Sukuk as a Financing Alternative in the Islamic Financial Market**

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### **Preface**

Islamic financial market in turn needs to keep up with the quickening pace of technical advancements in the global financial markets by creating new technologies and refining its financing strategies. Sukuk are one of the main Islamic financing instrument that affected by the new technologies, giving birth to smart sukuk or blockchain sukuk that are issued and traded on blockchain platforms. Smart Sukuk are the new generation of conventional sukuk that automated the framework of sukuk industry, which may contribute to the spread of sukuk more widely, leading to the creation of more Islamic financing sources. As this technology came to address several issues associated with sukuk industry such as standardization, transparency and the limited access in sukuk market, as well as the costs of issuance and processing sukuk from the issuance phase to the maturity phase. Hence, this chapter firstly gives an overview about sukuk; secondly, it presents the financial market ecosystem, as well as its main challenges that face sukuk industry growth. Finally, it demonstrates blockchain technology's adoption in the sukuk sector, giving birth to smart sukuk, which used for easier sukuk issuance, trading, and settlement. It also addresses its applicability in financing economic development. Therefore, it is divided as follows:

### **Section One: Conventional Sukuk Overview**

### **Section Two: Islamic Financial Market and Sukuk Industry Challenges**

### **Section Three: Smart Sukuk Overview**

# Chapter Three: Smart Sukuk as a Financing Alternative in the Islamic Financial Market

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## Section One: Conventional Sukuk Overview

Sukuk are among the most prominent innovations of Islamic financial engineering as an alternative to traditional financing tools, which contributed to the efficiency of the financing products of the Islamic finance industry. Thus, the financial intermediation domains and the methods of investment and financing have multiplied, and new financial designs and tools have been formed, boosting the Islamic financial industry all over the world. Hence, this section provides an introduction to sukuk and their issuing mechanism as well as their main types.

### 1. Introduction to Sukuk

The term sukuk is applied to financial instruments offered by banks, Islamic financial institutions as a substitute for interest bonds. It is a modern term in the dictionary of Islamic financial industry, due to the industry's need for Islamic financial instruments that perform the same purposes as traditional bonds. Therefore, they are the Islamic alternative to bonds in the conventional financial system and are issued backed to assets, but in a legitimate way that meets dealers and investors needs, who are looking for a financing option that does not include interest. This part addresses the origin and development of sukuk, the concept of sukuk, as well as denotes the differences between sukuk and other traditional financial instruments, in addition to sukuk's main objectives.

#### 1.1. The Concept of Sukuk and its Origins

This part addresses three points, the origin of sukuk, sukuk definition as well as their characteristics.

##### 1.1.1. The Emergence of Sukuk

The reason behind the emergence of sukuk is due to the need of the Islamic community for derived financing sources obtained Islamic Sharia as a substitute for traditional bonds associated with the interest rate; and from this standpoint, the idea of sukuk was emerged and formed through different stages. Jordan was the first country, which attempted to create and introduce a Sharia-compliant bond-like security in 1978, when the Jordan Islamic Bank was allowed by the government to issue Islamic bonds known as Muqaradah bonds, which contributed in the creation of Muqaradah Bond Act in 1981<sup>1</sup>. Pakistan in its turn made similar efforts in the creation of Islamic bonds, where a special law called the Mudarabah Companies and Mudarabah Flotation and Control Ordinance in 1980 was introduced. However, due to inadequate infrastructure and a lack of market openness, neither of these efforts produced anything of significance. In contrast, the Malaysian government issued Government Investment Issues, formerly known as "Government Investment Certificates" in 1983, marking the first successful introduction of Islamic bonds. However, because of the excessively slow rate of innovation, financial institutions were unable to create a vibrant market for these assets. Meanwhile, the asset securitization's success in conventional markets has produced a

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<sup>1</sup>- Ahcene Lahsasna, et al.: Forward Lease Sukuk in Islamic Capital Markets, Springer Nature, Switzerland, 2018, p 184.

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framework that may be applied to Islamic assets as well. As, in the latter part of the 1990s, Malaysia and Bahrain established the well-known sukuk structure for asset-backed securities<sup>1</sup>.

### 1.1.2. Sukuk Definition

- ❖ The term Sukuk, which is the plural form of the Arabic word Sakk, which means certificate, defining by the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI)\* as “certificates of equal value representing undivided shares in ownership of tangible assets, usufruct and services or in the ownership of the assets of particular projects or special investment. However, this is true after receipt of the value of sukuk, the closing of subscription and the employment of funds received for the closing of subscription and the employment of funds received for the purpose for which the sukuk were issued”<sup>2</sup>;
- ❖ Whereas, they are defined by the Islamic Financial Services Council\* as “certificates that represent an ownership right for a common percentage of in-kind assets, or a mixed group of in-kind assets and others. The assets may be in a specific project or investment activity in accordance with the provisions of Sharia”<sup>3</sup>.

So it can be said that sukuk represent certificates or securities of equal value, which represent common shares in certain and legally permissible assets, which are issued in accordance with Islamic financing formulas on the basis of sharing profits and losses. Many features characterize sukuk, namely:

- Sukuk are equivalent certificates that are issued in the bearer's or owner's name to prove the bearer's ownership claim over the financial rights and responsibilities they represent;
- Sukuk denotes a collective ownership stake in the assets that are made accessible for investment, be they intangible rights, debts, non-monetary assets, usufructs, services, or a combination of all of these.<sup>4</sup>
- Sukuk are issued in compliance with Sharia regulations, which control their circulation and selling;

<sup>1</sup>- Ahcene Lahsasna, et al, Op.cit, p 184.

\*The Accounting and Auditing Organization for Islamic Financial Institutions was founded in line with the incorporation agreement that many Islamic financial institutions signed on 01 Safar 1410 AH corresponding to 26 February 1990. The Authority was officially registered as an international organization in the State of Bahrain on 11 Ramadan AH corresponding to 27 March 1991. It has an independent, non-profit legal personality; it includes in its membership many different financial institutions, central banks and government regulatory bodies, with 200 members representing more than 45 countries.

<sup>2</sup>-Accounting and Auditing Organization for Islamic Financial Institutions in its Sharia Standard No.17, Investment Sukuk, Bahrain, 2007, p 469.

\*Islamic Financial Services Council (IFSB) official opening took place on November 3, 2002, and it started operations on March 10, 2003, with its headquarters located in Kuala Lumpur. In order to protect the safety and stability of the industry, it serves as an international standard-setting body for regulatory and supervisory agencies; its services generally include banking sectors and capital markets.

<sup>3</sup>-Islamic Financial Services Council: Capital adequacy requirements for sukuk, sukuk and real estate investments, Standard No.07, 2009, p 03.

<sup>4</sup>- زنتاتي فارس محمد، الصكوك الإسلامية: الإطار النظري والشرعي وكيفية التطبيق، دار المطبوعات الجامعية، الإسكندرية، 2014 م، ص

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- Not all sukuk are legally negotiable, as sukuk that generate indebtedness, such as Salam, Istisna, and Murabaha sukuk are not permissible to be traded as a matter of prohibiting the sale of debt;
- The owner of sukuk is entitled to participate in the output of the project financed by the funds of sukuk, so he gets his share of the return and bears his share of the loss within the limits of what the sukuk represents;
- The idea of sukuk is based on participating in the financing process of a project, or a medium, or long-term investment operation according to the Sharia rule of “el ghanam bel gharam” i.e. participation in the profit and loss<sup>1</sup>.

### 1.2. Comparison between Sukuk and Traditional Securities

Sukuk agree with other traditional securities such as shares and bonds In certain organizational and issuing administrative processes, and they distinguish from them in terms that are financial securities that adhere to the provisions of Islamic principles, which gives them a high degree of safety from price fluctuations that are exposed to other conventional securities.

- **Sukuk Versus Bonds:** The following details highlight how sukuk and bonds differ from one another:
  - Both of them are traded securities, whose primary purpose is financing;
  - It is comparable to traditional bonds, as they are securities instrument that offer a consistent return rate. However, in the case of liquidation of the project, the owner of the bonds shall have priority in obtaining the value of the bond and its agreed benefits as for sukuk, the holder does not have priority, in contrast a percentage is paid to him from what remains of the project's assets after debts are paid, meaning that the assets of the project belong to the sukuk owners and return to them;
  - Sukuk represent a common ownership interest in assets and real assets, while bonds represent an interest in a long-term loan. In other word, sukuk, on the other hand, indicate a share of ownership of a project or asset that is already established or well defined, whereas bonds represent the issuer's pure debt<sup>2</sup>.
  - In contrast to bonds, where the relationship between the certificate holders and the issuer is one of creditor and debtor, certificates' holders, who are investors, stand as the owners of the underlying asset. Bonds are contractually obligated to the issuer to pay principal and interest to bondholders on certain dates. Even when the proprietor of a sukuk asserts complete beneficial ownership over the underlying assets;
  - Bonds always have a return determined by the fixed coupon agreed upon by the bond's issuer. However, sukuk have returns that are either fixed or floating depending on the structure chosen by the issuer<sup>3</sup>.
- ❖ **Sukuk versus Shares:** there is a close relationship between sukuk and shares. A brief comparison between them is highlighted as follows:
  - Sukuk and share represent a common share of ownership in the net assets of the company, including a real estate with its benefits, and what devolves to them in terms of money, debts, or a combination. However, the shareholder has direct rights over the management of the company. He has the right of appointing of board of directors'

<sup>1</sup> محمد سعد عامر: الأصول الشرعية في الاقتصاد الإسلامي، مؤسسة شباب الجامعة، الإسكندرية، مصر، 2018، ص 236.

<sup>2</sup> -عادل عبد الفضيل عيد: الصكوك الاستثمارية: دراسة مقارنة، دار التعليم العالي، الإسكندرية، 2003، ص 43.

<sup>3</sup> - زياد جلال الدماغ: الصكوك الإسلامية ودورها في التنمية الاقتصادية، دار الثقافة، عمان، الاردن، الطبعة الاولى، 2012، ص 78.

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members or dismissing them. Additionally, he is entitled to approve the final accounts and distribute earnings; while sukuk holder does not have the right to appoint or dismiss the members of the sukuk board of directors, although he has the right to sell his sukuk to a third party, just as the holder of a share has the right to sell it to a third party<sup>1</sup>.

- The share or sukuk owner shall be entitled to a share in the net profit of the company or project, commensurate with the value of the shares that he owns in the company, or the value of sukuk that he owns in the project<sup>2</sup>.
- The share is a part of the company's capital, which often does not have a date of liquidation, so the shareholder is considered a permanent participant in the company's capital, as the purpose of its establishment is to invest and expand it for an indefinite period, as it is not subject to refund or extinguishment. However, sukuk must be issued for definite period and it must be refund<sup>3</sup>.

### 1.2.Sukuk Objectives

The following are the primary goals of the sukuk issuance process<sup>4</sup>:

- Establishing investment projects through the mobilization of resources from investors and the issuance of sukuk in accordance with different Islamic financing formulas in the financial markets, where the capital of the project is derived from the subscription profits;
- The process by which government and corporate financial assets are transformed into units represented in sukuk and then issued in the market to attract savings to finance long-term investment projects is known as "it seeks to obtain the necessary liquidity to expand and develop the project base;
- Enhancing the creditworthiness and funding framework of sukuk issuing organizations, given their dependence on a strong credit standing.

## 2. Sukuk Issuance Mechanism

The structure of sukuk is quite akin to the securitization process used in traditional markets, which involves a wide variety of asset kinds. The word "securitization" in traditional financial thought is based primarily on the debt component by converting those debts into transferable securities for trading in the financial markets. Therefore, before discussing the stages of sukuk issuance, it is necessary to familiarize our self with the term **securitization** or what some called Islamic securitization.

### 2.1. Islamic Securitization

#### 2.1.1. Islamic Securitization Definition

According to the approach followed by (AAOIFI) in Sharia standard No.17, "securitization is the process of dividing what the sukuk represent in terms of assets, benefits, rights and

<sup>1</sup> - عادل عبد الفضيل عيد، مرجع سابق، ص 49.

<sup>2</sup> - عمر عيو: دور الصكوك الإسلامية في تنشيط سوق الأوراق المالية الإسلامية، الأكاديمية للدراسات الاجتماعية والإنسانية، العدد 18، الجزائر، 2017، ص 51.

<sup>3</sup> - أحمد شعبان محمد علي: الصكوك الإسلامية ودورها في تحقيق التنمية الاقتصادية، دار التعليم العالي، الإسكندرية، 2014، ص 37.

<sup>4</sup> - بن قادة الشيخ: دور الصكوك الإسلامية في تطوير التمويل الإسلامي وتحقيق التنمية الاقتصادية-دراسة التجربة الماليزية(2008-2017)، أطروحة مقدمة ضمن متطلبات نيل شهادة دكتوراه علوم، تخصص علوم اقتصادية، جامعة غرداية، الجزائر، 2017، ص 64.



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activities into equal shares, then issuing sukuk based on its value, as this division and fragmentation do not contradict Sharia principles<sup>1</sup>, and its **features** can be clarified as follows<sup>2</sup>:

- Islamic securitization can be framed within a specific time frame;
- A separate financial estate theoretically means the existence of a Special Purpose Vehicle (SPV);
- The assets subject to securitization must be legally acceptable to the Sharia, and the majority of them must be tangible asset;
- The ability to trade in the financial market when the legal conditions required for trading are met.

### 2.1.2. The Motives for Islamic Securitization

The most important motives behind sukuk securitization are<sup>3</sup>:

**a. Increasing Liquidity:** It provides liquidity to asset owners, especially those for which there is no active market to sell or because their maturities are long;

**b. Diversifying Financing Sources:** that is, expanding the investor base, with the aim of accumulating the necessary capital for financing expansion of the activity in order to obtain new assets, and working to harmonize the assets terms and commitments to reduce risks;

**c. Reducing Credit Risks:** It is well known that the company that wants to issue some of its assets to be certified is not responsible for fulfilling the sukuk holders, because the sukuk are a real sale of assets to the company assigned to it, and thus the credit risks were transferred to others;

**d. Integration between Credit and Capital Markets:** The process of securitization leads to revitalization of the capital market and the credit market, through the trading of sukuk issued by the assets to be liquidated in financial markets;

**e. It is an Extra-Budgetary Source of Financing:** During the process of securitizing (structuring) assets, the institution hides the balance of assets from the balance sheet, because the assets were sold to the Special Purpose Vehicle (SPV), and then their place in its budget is the price paid to them by the (SPV). On the other hand, any company that has debts to others deducts a certain percentage from its revenues to form what is called the allowance for doubtful debts, and this in turn reduces the company's net profits. However, when the auditing process is used, the balance of the allowance for doubtful debts will be canceled and returned to the company's profits and then increase its profits.

### 2.2. Parties of the Islamic Securitization Process

Securitization is the process of converting legally accepted assets into financial instruments that are separated from the financial liabilities of the entity that originated them, and are

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<sup>1</sup> - سليمان ناصر، ربيعة بن زايد: الصكوك الإسلامية كأداة لتمويل التنمية الاقتصادية، ومدى إمكانية الاستفادة منها في الجزائر، بحث مقدم إلى المؤتمر الدولي حول منتجات وتطبيقات ابتكار والهندسة المالية بين الصناعة المالية التقليدية والصناعة المالية الإسلامية، يومي 05 و06 ماي 2014م، كلية العلوم الاقتصادية والتجارية وعلوم التسيير، جامعة فرحات عباس، سطيف1، الجزائر، ص 03.

<sup>2</sup> - Ibid, p 03.

<sup>3</sup> - بن قادة الشيخ، مرجع سبق ذكره، ص 64.

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negotiable in the financial market, providing that the majority of them are notable, with fixed terms, with an unspecified or specified return, but not devoid of risks. These operations take off through various parties as follows:

**a. The Original Issuer (Originator):** It is the entity, or company that establishes the securitization portfolio. It is the issuing party or the originating party (the originator of the asset), the initiator, or the asset owner, and if the terms are different, but the meaning is the same. It refers to the entity in need of liquidity that wishes to issue its assets to obtain liquidity, inventory and collect its various assets into one investment pool known as sukuk portfolio, transfer (sell) it to the Special Purposes Company (SPV), and obtain cash in exchange for it. It is called subscription revenue in order to use it legally. The issuer may come from the public, private, or nonprofit sectors and may be a business, an individual, a government agency, a central or commercial bank, a finance firm, a real estate company, an airline, etc.<sup>1</sup>

**b. The Issuing Authority:** Sukuk is often offered to investors by a specialized financial institution known as a special purpose Vehicle (SPV)\*. This organization also coordinates and oversees the issuing process. An agency agreement for compensation is the basis of the partnership between the issuing agent and the originator;

**c. Investors (Sukuk Holders):** They are the owners of several kinds of sukuk documents, which stand in for assets, which could be benefits, services, tangible assets, or a combination of some or all of these.<sup>2</sup>

**d. The Trustee of Investment:** its function represents in protecting sukuk holders' interests and overseeing sukuk manager are the responsibilities of the intermediate financial institution. Furthermore, under an agency agreement, it keeps records and guarantees for a fee that is specified in the prospectus;

**e. International Rating Agencies:** These are specialized organizations that carry out an assessment to evaluate the proportion of the involved risk, the assurances enjoyed by the financial issuances that will be issued in the capital market, and their credit and financial acceptability. They are specialized agencies that conduct an evaluation to indicate the credit and financial worthiness of the financial issuances that will be offered in the capital market, the guarantees they enjoy and determine the percentage of the risks involved. Among these agencies, Standard and Poor's, Fitch, and Moody's are the most significant. Furthermore, Islamic rating agencies like the Islamic International Rating Agency (IIRA) currently provide the Sharia quality rating service, that it is based in Bahrain, as well as the Malaysian Rating Agency (RAM). They are agencies specialized in rating and evaluating Islamic financial institutions and their products according to international standards<sup>3</sup>.

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<sup>1</sup> - باهي نوال، أيمن فريد: الصكوك المالية الإسلامية كبديل متاح لتمويل عجز الموازنة العامة في الجزائر في ظل الأوضاع الراهنة، مجلة شعاع للدراسات الاقتصادية، العدد الرابع، الجزائر، 2018، ص 139.

\* SPV is a private company, mostly established in tax-free areas such as the Cayman Islands in the Caribbean and Labuan Island in Malaysia; It has limited liability, and it is established for a specific purpose, which explains the reason for its name, and this company aims to collect funds in exchange for the sale of sukuk in order to achieve profit according to the controls stipulated in the prospectus. In the traditional concept, this company works to enable the lender to transfer his debts to other lenders by converting these debts into securities.

<sup>2</sup> - معطي الله حير الدين، شرياق رفيق: الصكوك الإسلامية كأداة لتمويل مشاريع التنمية الاقتصادية، ورقة بحثية مقدمة في إطار الملتقى الدولي حول مقومات تحقيق التنمية المستدامة في الاقتصاد الإسلامي جامعة قلمة يومي 03 و04 ديسمبر 2012، ص 19.

<sup>3</sup> - باهي نوال، أيمن فريد، مرجع سبق ذكره، ص 19.

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### 2.3. Stages of Islamic Securitization

Sukuk are securitized based on two ways offering sukuk or securitization of existing sukuk. The former is made by issuing sukuk for subscription in order to fulfill a future requirement for funding an investment project, by marketing them to investors (the holders of sukuk) and using the proceeds to establish the project and benefit from it for a certain period of time, then sell it and extinguish the sukuk. However, Securitization of existing asset is the process where existing assets are already issued and vended to investors, and taking advantage of the issue's profits for personal gain, given that investors rent the sukuk asset for a while before selling it and redeeming the sukuk<sup>1</sup>. Generally, the process of issuing sukuk (securitization) takes place by collecting and classifying assets and converting them into sukuk for selling them to investors, and this process takes place through three stages, namely: stage of issuance of sukuk, the stage of managing the sukuk portfolio and stage redeeming of sukuk

**a. Sukuk Issuance Stage:** this stage takes place through the following steps<sup>2</sup>:

- The first step: The originating company will specify the assets to be certified by listing and gathering all of its assets into a single investment vehicle, or sukuk portfolio, and transferring them to (SPV). It is a separate organization that was founded by the original business following a decision made by the Capital Market Authority in compliance with unique guidelines and processes. At this particular stage, it is necessary to take into account and know the type of sukuk in terms of their connection to real assets or not. This asset must be a physical one, like a land, office building, roadway, or airport. However, a pool might be created from a collection of heterogeneous assets that include both tangible and intangible assets, such as financial assets;
- The second step: This is done by issuing assets and then selling them, through reclassifying assets and splitting them into units or sections that satisfy investor demands and wishes is handled by a special purpose vehicle (SPV), which also converts the assets into sukuk and sells them to investors. After the asset is moved to this special company, it is no longer included on the issuer's balance sheet and is therefore safe from potential financial difficulties. The presence of an SPV, then, gives investors (holders of sukuk) assurance regarding the predictability of cash flows on the certificates, hence improving the credit quality of the certificates.

**b. Stage of Managing Sukuk Portfolio:** When investors purchase sukuk, the SPV manages the portfolio for them for the duration of the issuance period. It does this by gathering returns and periodic income from the sukuk assets and giving them to investors. It also provides all the services required for the portfolio<sup>3</sup>.

**c. Stage of Redeeming Sukuk:** It is also called extinguishing or recovery process, it is the act of repurchasing sukuk by buying them back. Where, the issuer purchases the investment share represented by sukuk from the investors according to a prior commitment between them in the issuance prospectus, after completing the issuance process and before its expiration date. At the maturity date, The SPV begins its winding up process by paying the investors or certificate holders back after selling the assets back to the original seller or owner at a preset price. The

<sup>1</sup> - أحمد شعبان محمد علي، مرجع سبق ذكره، ص 03.

<sup>2</sup> - Zamir Iqbal, Abbas Mirakhor: An Introduction to Islamic Finance-Theory and Practice, Wiley, Singapore, 2011, p 186.

<sup>3</sup>-Ibid, p 186.

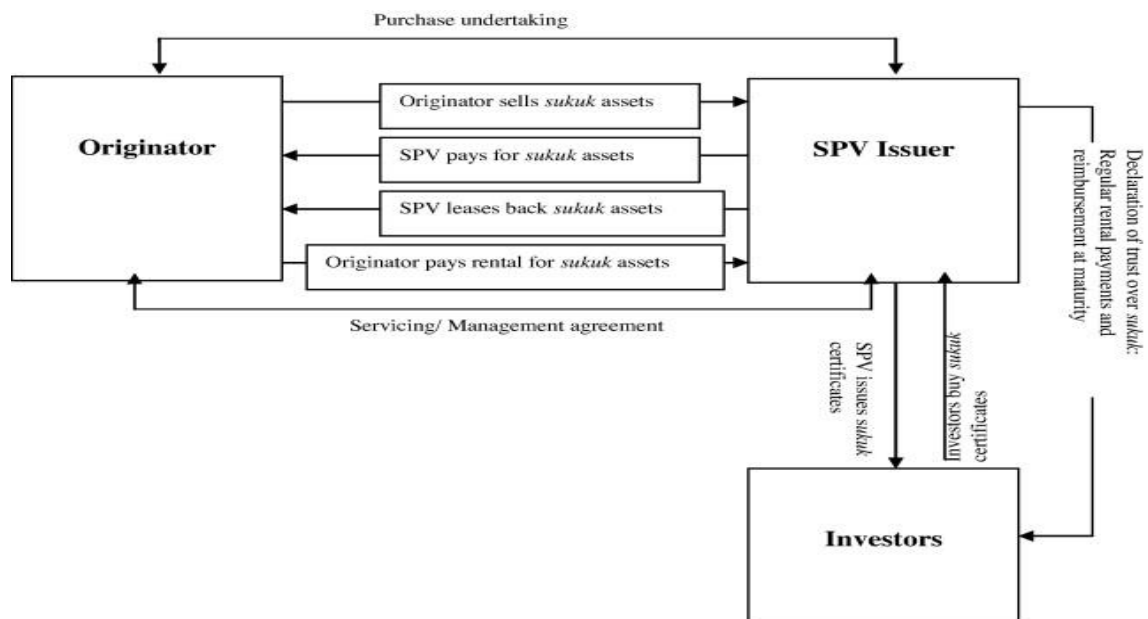
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issuer, at sukuk issuance time, undertakes to repurchase them at an agreed upon later date. The undertaking may be obtained through other financial institutions. In both cases, the recovery requires a commitment to repurchase and provide liquidity upon demand<sup>1</sup>. This undertaking is binding on the one who issued it during the sukuk term. This process takes place after the completion of the issuance process and before the expiry of its term. Generally, there are two approaches to the extinguishing procedure<sup>2</sup>:

- The liquidation method of extinguishment: wherein, in accordance with the terms agreed upon and the maturity date, the owner makes a specific provision to sukuk holders for the actual worth of the sukuk and their earnings;
- The periodic assessment extinguishing technique: When a periodic payment is made, the amounts paid are regarded as account payments, the amortized value of the sukuk is subtracted from its initial nominal value, and the return is split into two halves; one part is distributed to the sukuk holders as profits, and the second part returns to them in return for the partial extinguishment of sukuk value at the end of the issuing period. Sukuk holders shall have recovered the initial value of the sukuk along with its profits.

In short, the figure (III-1) summarizes the manner in which sukuk is structured and the connections between the various stakeholders involved. This is a general procedure, and variations will occur based on the kind of underlying instrument that was utilized to purchase the assets.

**Figure (III-1): General Sukuk Structure**



**Source:** Christophe J. Godlewski et al.: Sukuk Vs. Conventional Bonds: a stock market perspective, Journal of Comparative Economics, Vol.41, 2013, p 755.

### 3. Types of Sukuk

<sup>1</sup>- Zamir Iqbal, Abbas Mirakhor, Op.cit, p 186.

<sup>2</sup>- Benzekkoura Laounia: Sukuk and economic development (Prospects and Challenges) Refer to the experience of Malaysia, Journal of Economics and Human Development, Vol.10, No.2, 2019, p 183.

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There are three in which sukuk could be classified; the first classification is based on the maturity dates, the second classification is based on the issuing entity, whereas the third classification is based on the areas of use<sup>1</sup>.

- ❖ **Sukuk based on Maturity Dates:** Sukuk are divided into three categories: short-term sukuk, which have terms of three months to a year; medium-term sukuk, which have terms of more than a year to three years; and long-term sukuk, which have terms of more than three years. Sukuk must be issued for a particular time, and if they expire, they must be recovered. This recovery can be accomplished in one of two ways: either by gradually distributing the project's net assets to sukuk holders, or by liquidating and compiling the project (i.e. selling it and converting it into cash and liquidity). Each partner asserts his or her rights, whether by project ownership or exiting the project in a situation known as an expired sukuk with the promise of ownership<sup>2</sup>.
- ❖ **Sukuk based on the Issuance Entity:** According to the issuing authority, sukuk can be divided into<sup>3</sup>:
  - a. Governmental/Sovereign sukuk: These sukuk are issued by governments, and the proceeds are used to fund public services and goods, as well as the exploitation of natural resources. In accordance with the development agenda, the state also uses it to encourage investment in certain sectors and to mobilize savings. These sectors include Lease sukuk, Istisna, Salam, Musharaka, and Qard hasan sukuk;
  - b. Corporate sukuk: These are sukuk issued by private corporations, and they range widely in terms of their aim, which is to offer financial resources to meet the demands of fixed and working capital. There are profit-sharing instruments, absolute and restricted speculation instruments, and so-called investment sukuk;
  - c. Banks' sukuk: they are sukuk issued by Islamic banks. They include mudarabah (speculation), musharaka, ijara, istisna, salam, murabaha, and sukuk for trading in commodities and securities. Banks issue these sukuk to finance their investment operations, and banks could manage the process of sukuk issuance for the benefit of third parties such as government lease sukuk, bearing in mind that banks can subscribe to part of their resources in these sukuk. These sukuk are distinguished by their ability to mobilize savings from various categories, due to the variety of their terms, value, purposes, and method of obtaining the returns.
- ❖ **Sukuk based on the Areas of Use:** The types of sukuk are multiplied by the multiplicity of the financing needs and purposes. There are fourteen (14) different kinds of Sukuk, according to the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI). A select selection of them, representing the most well-liked and active varieties of sukuk available, will be highlighted in this study. AAOIFI divided them into two main groups; sukuk issued for financing, and sukuk issued for the purpose of investment<sup>4</sup>. Each group includes several types of sukuk as illustrated in figure (III-2) below.

<sup>1</sup> - بن قاده الشيخ، مرجع سبق ذكره، ص 31.

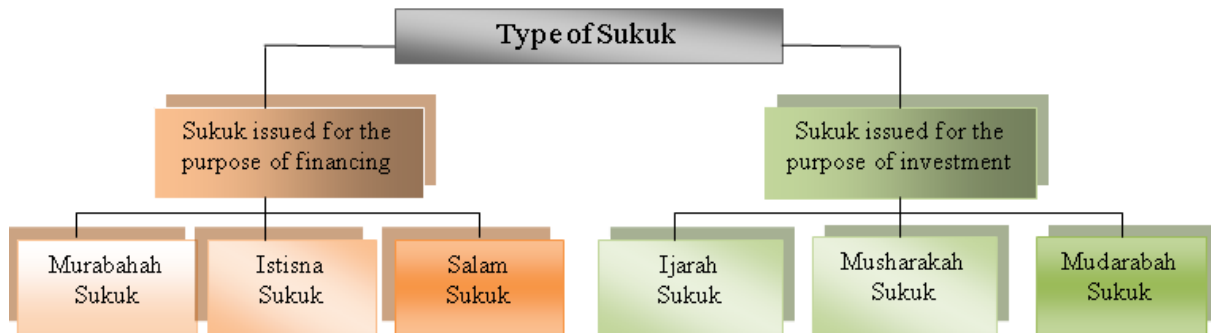
<sup>2</sup> - طوالبية نهاد، بملول لطيفة: الصكوك الإسلامية كبديل تمويلي لتحقيق التنمية الاقتصادية وسد العجز الموازي-ماليزيا أمودجا-، مجلة البشائر الاقتصادية، المجلد 5، العدد 2، 2019، ص 949.

<sup>3</sup> - Ibid, p 950.

<sup>4</sup> - طوالبية نهاد، بملول لطيفة، مرجع سبق ذكره، ص 950.

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Figure (III-2): Types of Sukuk



**Source:** by the author based on: Tawalbiya Nihad, Bahloul Latifa: Islamic Sukuk as a Financing Alternative to Achieving Economic Development and Bridging the Budget Deficit-Malaysia as a Model, Al-Bashaer Economic Journal, Vol.05, Issue 2, 2019, p 950.

### 3.1. Mudarabah Sukuk

Mudarabah sukuk are among the oldest and most famous sukuk, they known as Islamic muqarabah bonds in the modern era, and their idea goes back to Sami Hammoud when he drafted the Jordan Islamic Bank Law in 1978. It was intended at that time to find an alternative to loan bonds, which issued by interest based banks<sup>1</sup>. In this context, the concept, characteristics, and structure of mudarabah sukuk are introduced below.

#### 3.1.1. Definition of Mudarabah Sukuk

Mudarabah is partnership contracts, as it is a profit-sharing agreement, which means an agreement between two parties that one of them, called the owner (rab al-mal) of the money, who will pay known cash to the other party, who called the mudarib, in order to work on a project where they make an agreement about profit value<sup>2</sup>. Based on this respect, mudarabah sukuk are equal-value certificates that are divided according to the mudarabah capital. They signify projects or activities that are managed by designating a partner or another individual as the Mudarib, or person in charge of running the business, and sukuk are registered in the names of their owners<sup>3</sup>.

#### 3.1.2. The Features of Mudarabah Sukuk

The following are some of the key characteristics of mudarabah sukuk<sup>4</sup>:

- Mudarabah sukuk are investment certificates that signify ownership of equivalent-valued mudarabah equity units, and these sukuk are repaid based on the share's ownership percentage;
- They denote a common ownership and grants holders the opportunity to participate in specific projects, making it possible for a sizable group of investors to take part in investment projects;

<sup>1</sup>- M. Kabir Hassan, Mervyn K. Lewis: Hand Book of Islamic Bnaking, Edward Elgar Publishing Limited, 2007, p 221.

<sup>2</sup> - بن قادة الشيخ، مرجع سبق ذكره، ص 32.

<sup>3</sup>- Accounting and Auditing Organization for Islamic Financial Institutions in its Shari'ah Standard No. (17), Op.cit, p 470.

<sup>4</sup>- Ahcene Lahsasna et al., Op.cit, p 68.

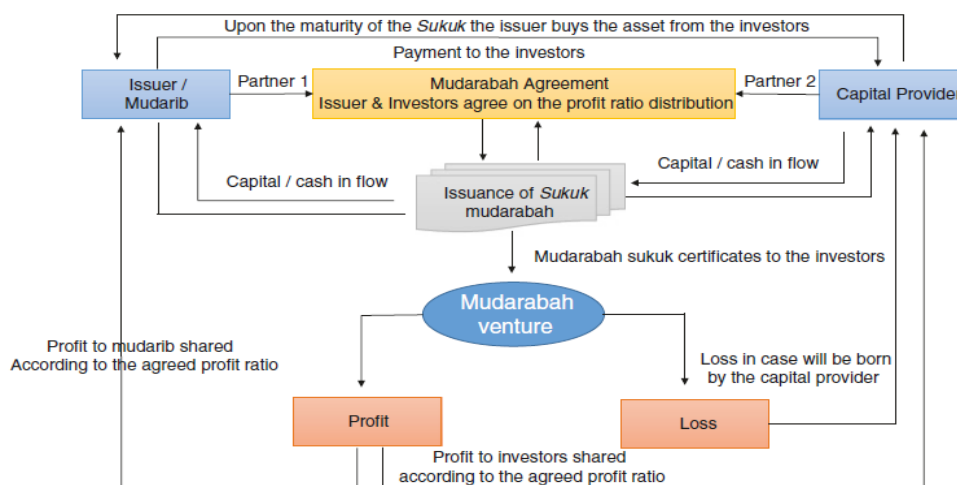
## Chapter Three: Smart Sukuk as a Financing Alternative in the Islamic Financial Market

- For Sukuk investors, the profit ratio should be expressed as a percentage, where sukuk holders, who contributed the money, are accountable for any losses;
- For the advantage of sukuk holders, it is acceptable to set up reserves for unforeseen circumstances. However, the fund manager (Mudharib) is not permitted to warrant the capital under terms of the guarantee, but a third party may do so by providing a guarantee;
- On the maturity date or upon the expiration of the subscription period, holders of certificates may redeem, sell, or trade them in the stock market at their choice.

### 3.1.3. The Structure of Mudarabah Sukuk

Mudarabah is a profit partnership in which one party provides capital (Rab al-Mal) and the other (Mudharib) provides labor. As well as in mudarabah sukuk issuance, the project owner and Mudharib engage into a contract for a project construction. In short, based on this structure, a SPV is established to issue sukuk in order to raise money for the project with an agreement of regular profits received by Mudharib and given to sukuk holders (investors). After that, Following completion, Mudharib delivers the project to the owners, who are the holders of sukuk (investors). The figure (III-3) below gives a well illustration about the structure and the framework of mudarabah sukuk.

**Figure (III-3): Mudarabah Sukuk Structure**



**Source:** Ahcene Lahsasna et al.: Forward Lease Sukuk in Islamic Capital Markets, Springer Nature, Switzerland, 2018, p 70.

### 3.2. Musharakah Sukuk

Under musharakah, an Islamic bank and its clients form a partnership in which each party contributes capital in equal or varying amounts to start a new project or share in an already-existing one. As a result, each party becomes a permanent or declining owner of the capital and is entitled to his or her fair share of profits<sup>1</sup>. Based on these principles and concepts, musharakah sukuk are issued, as this part introduces musharakah sukuk's definition, features and structure.

#### 3.2.1. Definition of Musharakah Sukuk

<sup>1</sup>- Faizal Karbani: Mastering Islamic Finance, Pearson Education, Great Britain, 2015, p 202.

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The AAOIFI defines musharakah sukuk as: “Certificates of equal value issued by the owner of an existing project who wishes to develop it with the proceeds of these sukuk, or who wishes to invest this proceeds in establishing a new project on the basis of a legal partnership contract, or issued by an intermediary financial institution on his behalf. Those wishing to participate in this project should subscribe through these instruments as participants. The proceeds of the sukuk in addition to the owners' assets of the existing project are the project capital; the prospectus shall determine the participation capital, the type of activity, the nature of the project, the method of managing the project, its expected profits, and the method of distributing these profits. As for the loss in participation, it is according to the shares of the partners”<sup>1</sup>.

Based on the previous definition, it concludes that musharakah sukuk are equal-value certificates. It is issued with the intention of using the proceeds to finance an activity on the basis of a partnership contract, expand an existing project, or establish a new investment project. The project or activity assets belong to the sukuk holders to the extent of their shares.

### 3.2.2. The Features of Musharakah Sukuk

Musharakah sukuk hardly differ from mudarabah sukuk except in terms of organization of the relationship between the issuer and sukuk holders; as in mudarabah sukuk, there is a relationship of Mudarib- owners, while in musharakah sukuk the issuing authority is one of the participants (the sukuk holders). In which, he handles the affairs of the project and refers to it in making investment decisions. Accordingly, these sukuk are governed by the following<sup>2</sup>:

- Musharakah sukuk are equal-value certificates that are issued to fund an activity through a partnership contract, expand an existing project, or establish new investments. The project or activity assets belong to the sukuk holders to the extent of their shares;
- Sukuk holders in the musharakah project have a partnership-based relationship and are involved in the investment decision-making process;
- Sukuk holders possess a segment of the project based on their percentage contribution or investment, as per Sharia partnership requirements that has to be followed when arranging sukuk;
- In the secondary market, musharakah sukuk are negotiable and marketable instruments.

### 3.2.3. The Structure of Musharakah Sukuk

Musharaka sukuk are issued on the basis of a Musharakah contract, and the proceeds of their issuance are used to finance the establishment of a project, develop an existing project, or finance an activity on the basis of Musharaka. The Sukuk represent a common share in the ownership of Musharaka assets, and the owners of the sukuk are entitled to a share of the musharaka profits according to the number of sukuk each of them owns. Based on t agreement, special purpose vehicle (SPV/Partner 2) signs a contract with another one (Partner1) in which they agree upon profits share percentage and specified maturity time. As (partner 2/SVP) could provide money and the contribution of (partner1) could be a real estate or other tangible assets. Based on this capital, they will obtained sukuk certificates, which display their ownership of the project in accordance with their partnership ratio. As in order to build the project, (partner1)

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<sup>1</sup>- Accounting and Auditing Organization for Islamic Financial Institutions in its Shari'ah Standard No. (17), Op.cit, p 239.

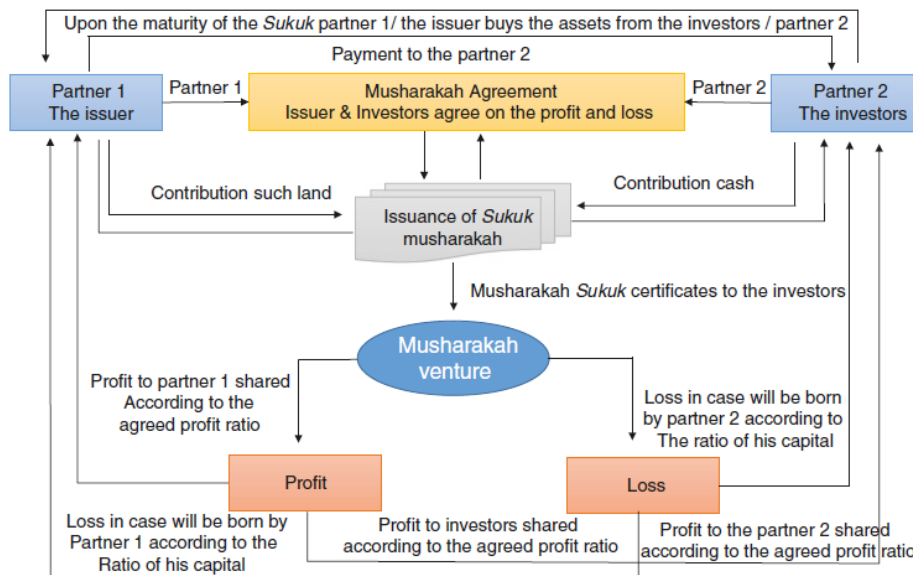
<sup>2</sup>- Brian Kettell: Introduction to Islamic Banking and Finance, Wiley, Great Britain, 2011, P 84.



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is appointed as a manager to follow up on the project, and after the project's completion, he leases or sells the project, and the proceeds of the project are shared among the sukuk partners. In short, figure (III-4) below provides a good illustration of musharakah sukuk structure.

**Figure (III-4): Musharakah Sukuk Structure**



Source: Ahcene Lahsasna et al.: Forward Lease Sukuk in Islamic Capital Markets, Springer Nature, Switzerland, 2018, p 72.

### 3.3. Ijarah Sukuk

The idea of Ijarah sukuk is based on converting leasing financing into the form of financing sukuk, that is, they are sukuk emerging from a process based on the lease contract. Therefore, through this part, the definition of Ijarah sukuk, their characteristics, and their working structure will be clarified.

#### 3.3.1. Definition of Ijarah Sukuk

Ijarah sukuk represent the ownership of equal shares in a rented property or the right to usufruct the property. These sukuk give their owners the right to own the property, receive rent, and dispose of their sukuk in a way that does not affect the lessee's right, also all repair and maintenance expenses over real estate are covered by sukuk holders<sup>1</sup>.

#### 3.3.2. The Features of Ijarah Sukuk

Ijarah sukuk are considered a very dynamic asset class because of the important advantage that have, which makes them more powerful and superior compared to other types of sukuk, which are:

- Compared to other contracts under Islamic commercial law, the Ijarah contract is always considered the most dynamic contract with flexible Islamic Sharia provisions. In fact, it is forbidden by Sharia to contract on something that does not yet exist, and in order for the contract to be legally enforceable, its subject matter must exist. However, ijarah contracts, which can be concluded regardless of their subject matter, are exempt from

<sup>1</sup>- Accounting and Auditing Organization for Islamic Financial Institutions in its Shari'ah Standard No. (17), Op.cit, p 470.

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this legal requirement. This characteristic makes ijarah/leasing, along with Salam and istisna, considered an exception to the general rules and principles of Sharia;

- Ijarah sukuk is a fixed income type of sukuk making them one of sukuk holders' preference. They similarly function as bonds in terms of fixed income, which in turn helps in sukuk portfolio diversification that make sukuk market more dynamic and competitive, as they can be fully exchanged in secondary markets.<sup>1</sup>
- The rental value of the building or asset that has been rented must be known to both parties at the time of the rental contract in order to be valid. It is also possible to agree on renting the asset even if it has not been built, if the rental amount is clearly stated in the contract and the lessor can purchase the asset by the delivery date. If the lessor sells the asset, the lessee will still be able to use the leased and the right to receive the rentals will belong to the new owner;
- According to Islamic law, the lessee is responsible for the maintenance costs associated with the operation of the asset while the owner is responsible for expenses related to the basic characteristics of the asset;
- This type of sukuk could be issued by government, or by any public, or private investors; the holders of the leased assets could directly issue them or using SPV<sup>2</sup>.

### 3.3.3. The Types of Ijarah Sukuk

Ijarah sukuk can be divided into four major categories, which are as follows<sup>3</sup>:

- Sukuk of ownership of leased properties: They are documents of equal value issued by the owner of a leased property through a financial intermediary, for the purpose of selling it and collecting its price from the subscription proceeds, and the asset becomes owned by the sukuk holders;
- Sukuk of ownership over usufructs: They are equivalent-value documentation that the lessee's property owner has issued, or a property described in the trust by himself, or through a financial intermediary; with the aim of selling it and collecting its price from the subscription proceeds, and the property becomes owned by sukuk holders;
- Sukuk of ownership over services: Certificates of equal value issued for the purpose of providing a service from a specific party, then the fee will be collected from the proceeds of subscription, and sukuk holders acquire ownership of these services;
- Investment Fund Sukuk: An investment fund is a mechanism for collecting funds by subscribing in sukuk, with the aim of investing them in a specific investment field in the subscription prospectus, and there are many fields of use, as they include all economic activities.

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<sup>1</sup>- Ahcene Lahsasna et al, Op.cit, P 102.

<sup>2</sup>- Brian Kettell: Introduction to Islamic Banking and Finance, Wiley, Great Britain, P 90.

<sup>3</sup>- بن قاده الشيخ، مرجع سبق ذكره، ص 39.

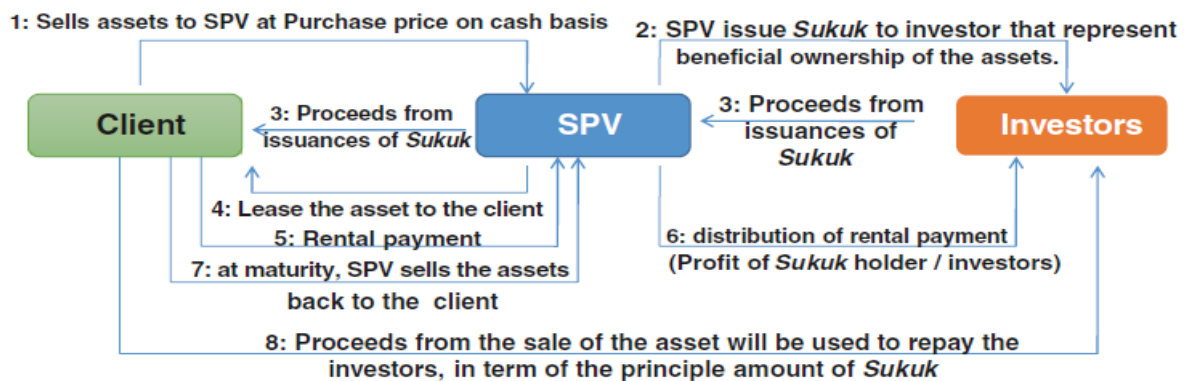
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### 3.3.4. The Structure of Ijarah Sukuk

As shown in figure (III-5), the following procedures should be taken into account when structuring ijarah sukuk<sup>1</sup>:

- An SPV is made in order to issue the sukuk (the originator) obtains advice and direction from the investment bank;
- The obligor or originator sells a particular asset to the SPV at a predetermined purchase price that has been mutually agreed upon such as an office tower. At the value of the purchase price, the SPV issues Sukuk certificates that can be traded in the secondary market in order to raise financing taking in consideration the sum and time frame based on the signed agreement with the originator;
- After that, a third party is leased the asset for their usage;
- The SPV distributes the periodic rental payments it gets from the lessee to the owners of Sukuk;
- The SPV sells the assets back to the seller upon maturity or upon a dissolution event.

Figure (III-5): Ijarah Sukuk Structure



Source: Ahcene Lahsasna et al.: Forward Lease Sukuk in Islamic Capital Markets, Springer Nature, Switzerland, 2018, P 104.

### 3.4. Salam Sukuk

Through this part, salam sukuk's definition, features, and their structure are illustrated.

#### 3.4.1. Definition of Salam Sukuk

“Salam Sukuk are certificates of equal value issued for the purpose of financing the production of a commodity, so that the goods that will be delivered on the basis of Salam become owned by the holders of these certificates”<sup>2</sup>.

#### 3.4.2. The Features of Salam Sukuk

The following are the main features of salam sukuk<sup>3</sup>:

- Salam sukuk are sukuk that indicate the sale of a good at a fixed price with a postponed delivery. The good in this case considers as a type of debt, because it is subjected to the

<sup>1</sup> Ahcene Lahsasna et al., Op.cit, P 103.

<sup>2</sup> - أدهم إبراهيم جلال الدين: الصكوك والأسواق المالية الإسلامية ودورها في تمويل التنمية الاقتصادية، دار الجوهرة للنشر والتوزيع، القاهرة، 2014، ص 74.

<sup>3</sup> - Ahcene Lahsasna et al., Op.cit, p 73.

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seller. Therefore, these instruments are considered untradeable if they are issued by the seller or buyer, but rather they are kept until the maturity date;

- The issuer of the certificates is the seller of the Salam commodity, the subscribers are the buyers of the commodity, and the funds reached from the subscription are the purchase price (salam capital) of the commodity;
- One of the sharia requirements for salam sukuk is that because the commodities are provided in the future, the certificates cannot be exchanged on the secondary market\*. Therefore, it is prohibited to sell the product before having physical or legal ownership of it;
- Additionally, SPV may designate an agent to promote the committed quantity at the time of delivery, maybe at a premium cost. The profit to the SPV and, consequently, to the holders of sukuk is the difference between the purchase price and the sale price.

### 3.4.3. The Structuring Steps of Salam Sukuk

Salam sukuk, as shown in figure (III-6), are structured based on the following steps below<sup>1</sup>:

1. In order to source both buyers and goods, SPV makes an agreement with an obligator. The obligator enters into a contract to purchase the good on behalf of the end-sukuk holders and subsequently sell it for the benefit of those investors.
2. a. Investors obtain Salam certificates, while SPV receives the revenues from the sale of sukuk.  
b. The obligator, who sells commodities in advance, receives the Salam sukuk revenues.
3. The commodities are delivered to SPV by the obligator.
4. a. Obligator makes a profit by selling the goods on behalf of the sukuk holders.  
b. Holders of sukuk receive the money from the sale of commodities.

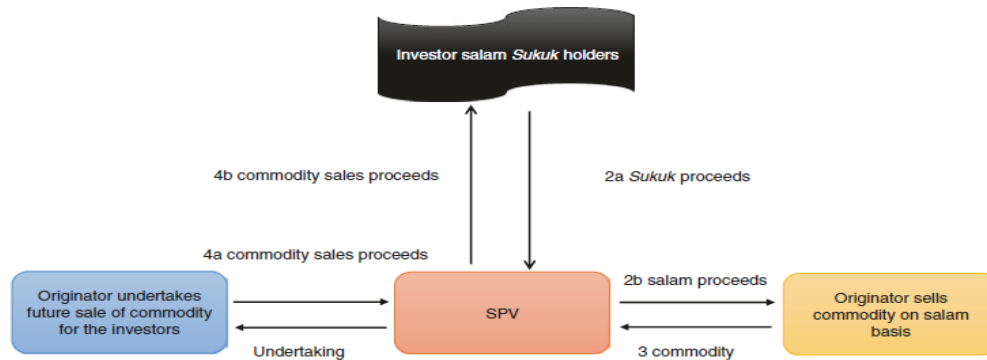
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\*According to sharia, sukuk based on salam and murabahah contracts cannot be exchanged in the secondary market because these contracts generate debt as a result of sales based on salam and murabahah. The purpose of this limitation is to keep traders of debt instruments in the secondary markets from having to deal with riba.

<sup>1</sup>- Ibid, p 74.

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Figure (III-6): Salam Sukuk Structuring Steps



Source: Ahcene Lahsasna et al.: Forward Lease Sukuk in Islamic Capital Markets, Springer Nature, Switzerland, 2018, p 74.

### 3.5. Istisna Sukuk

Istisna Sukuk are one of the most circulated forms in sukuk market, as they are used in the construction of buildings, building ships, aircraft, bridges, roads, electric power and water generation stations, and others. This part tackles the istisna sukuk's definition and structure.

#### 3.5.1. Definition of Istisna Sukuk

Istisna sukuk are equal-valued certificates that are issued to use the proceeds of subscription in the manufacture of a commodity, and the manufactured item becomes owned by the holders of the certificates. Where the manufacturer, the contractor or the agent of any of them holds the value of the sukuk. Then, he proceeds to manufacture the product according to the specifications, and delivers it within the agreed period, and the contractor can agree with the manufacturer on a different financing formula such as paying installments, and the sukuk holders become the owners of the manufactured product”<sup>1</sup>.

#### 3.5.2. The Features of Istisna Sukuk

The following are the main features of istisna sukuk<sup>2</sup>:

- The producer issues these certificates, and the subscribers will be the ultimate buyers and sellers of the sukuk's content;
- Istisna sukuk-based project is often under construction, including the construction of homes, flats, schools, colleges, and other essential infrastructure;
- The funding of projects is significantly aided by Istisna sukuk, which receives funds from subscriptions that cover the project costs. Due to the subscription, the holders of

<sup>1</sup> – يوسف حسن يوسف: الصكوك المالية وأنواعها، دار التعليم العالي، الإسكندرية، مصر، 2014، ص 09.

<sup>2</sup>- Ahcene Lahsasna et al., Op.cit, P 76.

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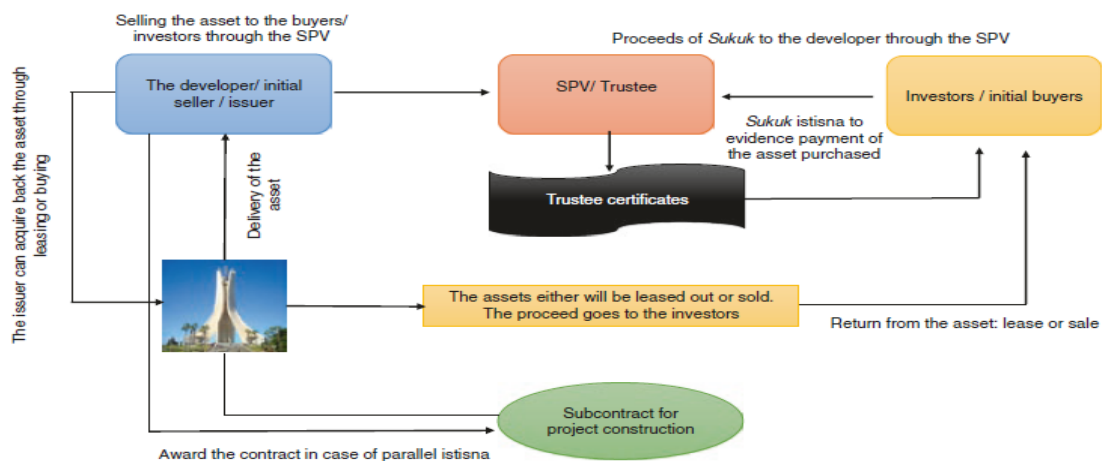
- the certificates acquire ownership of the project and are eligible to receive either the project's sale price or the sale price of the certificates issued in accordance with a parallel Istisna\*;
- It is crucial to keep in mind that selling these debt certificates to a third party for more than their face value is prohibited by AAOIFI Shariah regulations. These certificates cannot therefore be traded on the secondary market.

### 3.5.3. The Structure of Istisna Sukuk

The following list of steps associated with the figure (III-7) summarize the structuring istisna sukuk<sup>1</sup>:

- An SPV is founded by a developer as a trustee vehicle, with the goal of raising capital from investors;
- In order to gather funds for the building of the meticulously planned project, the investors are given istisna sukuk certificates by the SPV;
- The funds received will be used to pay the contractor so that they may fulfill their construction and delivery commitments under the terms of the negotiated contract for the project;
- The SPV, which represents the holders of sukuk, receives ownership to the acquired assets;
- The ultimate consumer either purchases or rents the project, and the SPV is paid on a regular basis by the end user;
- Finally, sukuk holders (investors) receive periodic payment returns.

**Figure (III-7): Istisna Sukuk Structure**



**Source:** Ahcene Lahsasna, M. Kabir Hassan, Rubi Ahmad: Forward Lease Sukuk in Islamic Capital Markets, Springer Nature, Switzerland, 2018, P 78.

\*Parallel Istisna is an istisna contract concluded between the bank in its capacity as a manufacturer and the contractor in its capacity as the actual manufacturer. In addition, the customer and another independent contractual relationship between the bank and the actual contractor or manufacturer.

<sup>1</sup>- Ahcene Lahsasna et al., Op.cit, P 78

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### 3.6. Murabahah Sukuk

This part introduce murabaha sukuk's definition, features, and structure.

#### 3.6.1. Definition of Murabahah Sukuk

Murabaha sukuk are certificates of equal value issued for financing the purchase of goods through murabaha contract, so that the certificate holders become owners of the murabaha commodity<sup>1</sup>.

#### 3.6.2. The Features of Murabahah Sukuk

Among the most important features of Murabaha sukuk are the following<sup>2</sup>:

- The purpose of issuing murabaha sukuk is to finance a murabaha sale contract\* for goods, such as equipment and devices, and the financial institution signs it with the buyer as a murabaha, in its capacity as the issuance manager, on behalf of sukuk holders. The proceeds of the sukuk are used to own Murabaha goods and receive them before selling them through murabaha. These sukuk are usually issued to finance major projects such as purchasing ships or aircraft, building dams, power plants, etc;
- The issuer of murabaha sukuk is the seller of the murabaha commodity, and the subscribers are the buyers of that murabaha commodity, and the proceeds of the subscription are the cost of purchasing the commodity. The sukuk holders own the murabaha commodity and are entitled to the price of its sale;
- The issuance of murabaha sukuk is possible only in the case of the primary market, especially in the case of a huge project. For instance, an airplane or a large development project, while trading them in the secondary market is considered contrary to Sharia because the sale of murabaha may be deferred; therefore it is considered a debt, and the sale of debt is not permitted by the jurists. However, there are some jurisprudential opinions that permit the trading of murabaha instruments, but within a container that is mostly made up of other assets, such as lease contracts, partnership contracts, or mudarabah contracts, for example.

#### 3.6.3. The Structure of Murabahah Sukuk

The following steps and the figure (III-8) summarize the steps involved in the structure of murabahah sukuk<sup>3</sup>:

1. The underling contract is signed by the SPV and the borrower.
2. a & b. The revenues from the sale of sukuk are received by SPV.
3. a & b. SPV purchases commodities from the commodity supplier on a spot basis.

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<sup>1</sup>- Accounting and Auditing Organization for Islamic Financial Institutions in its Sharia Standard No. (17), Op.cit, p 471.

<sup>2</sup>- بن قاعة الشيخ، مرجع سبق ذكره، ص 40.

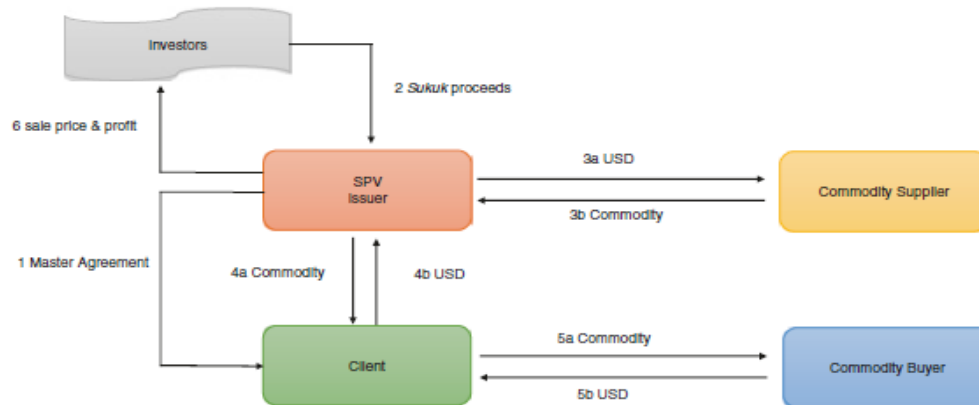
\* Murabaha formula is one of the types of trust sales, in which the seller commits to selling the commodity with capital and increasing a known profit.

<sup>3</sup>- Ahcene Lahsasna et al., Op.cit, p 82.

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- a & b. The commodity is sold by SPV to the borrower for the spot price plus a profit margin, which is paid in instalments over a predetermined period.
- a & b. The commodity is sold by the borrower on a spot basis to the commodity buyer.
- Finally, the sale's profits are paid to the investors.

**Figure (III-8): Murabahah Sukuk Structure**



**Source:** Ahcene Lahsasna, M. Kabir Hassan, Rubi Ahmad: Forward Lease Sukuk in Islamic Capital Markets, Springer Nature, Switzerland, 2018, P 82.

### 3.7. Hybrid Sukuk

This type of sukuk is structured by combining multiples sukuk structures like ijara, mudaraba and Istisna, which comprised a pool of assets, as this diversified pool of asset that comprised on different structures of sukuk provided more attractiveness to the investors in the Islamic financial market<sup>1</sup>.

## Section Two: Islamic Financial Market and Sukuk Industry Challenges

Islamic finance fundamentally differs in some important respects from the traditional financial model, as it is based on the principles of Islamic law. Financial markets in turn at the present time are witnessing an increasing trend towards attracting Islamic financial instruments of various types, especially sukuk, because of the advantages and opportunities they provide, which were not available before, thanks to the mobilization of financial savings that contribute to financing economic development and activating the Islamic financial market, where sukuk play an important role in revitalizing and developing the Islamic financial market. This is done through issuing multiple and diverse financial instruments compatible with Sharia, which allow strengthening the role of the financial market by expanding the diversity of Islamic financing instruments and attracting a wide network of institutions participating in the financial market. Therefore, this section provides an introduction to Islamic financial market, as well as the main challenges that face sukuk industry, which are the main financing instruments in Islamic financial market.

### 1. Introduction to Islamic Financial Market

<sup>1</sup>-Junaid Haider, Muhammad Azhar: Islamic Capital Market- Sukuk and its Risk Management in the Current Scenario-, School of Business publication, Sweden, 2010, p 30.



## Chapter Three: Smart Sukuk as a Financing Alternative in the Islamic Financial Market

The concept of the Islamic financial market does not differ from the traditional financial market in terms of its essence and working nature. As, generally, the Islamic financial market derives its concept from the concept of the traditional financial market. However, it is distinguished from it by its compliance with the provisions of Sharia, as it is free from all legal prohibitions, and this can be clarified through the following elements.

### 1.1. Islamic Financial Market Concept

The term financial market is applied in its narrow sense to the stock market or stock exchange, as it is applied in its broad sense to the sum of financial flows in society, whether for short, medium, or long terms between its individuals, institutions, and sectors. In light of this broad meaning, the financial market is not confined to a specific place but rather to specific transactions; hence, the term Islamic financial market can include financial transactions disciplined by Sharia controls. Therefore, the Islamic financial market can be defined as “the legal and organized framework that regulate the market in which funds are transferred from entities or persons who have financial surpluses to parties that have a shortage or need of funds. However, the condition is that these transactions are in accordance with Islamic Sharia., which must be completely free from usury”<sup>1</sup>.

According to the aforementioned statement of the concept, the Islamic financial market maintain that<sup>2</sup>:

- Financial markets perform their function by issuing specific financial instruments that are issued by the economic units with financing deficit according to their need and inability, and purchased by the economic units with financing surplus according to their ability and willingness to invest;
- All operations and transactions that take place in the Islamic financial market must be free from all legal prohibitions, such as fraud, ignorance, deceit, monopoly, gambling, etc;
- The financial instruments that are dealt with in the Islamic financial market must be compatible with the provisions of the Islamic Sharia in terms of issuance and trading, such as ordinary shares, for example, while it is not permissible to deal in bonds because they contain usurious interest;
- It should be noted that there are no Islamic securities unless there are Islamic financial institutions that issue them, and an Islamic central bank or an Islamic central institution grants a license to issue them;
- Thus, it can be said that the financial market includes the central bank, commercial banks, insurance companies, financial investment companies, financial institutions, stock exchanges, and all institutions that deal with financial flows. In order for the financial market to be Islamic, these institutions and banks should be subject to Sharia controls;
- The aim of the financial market is to attract savings, and invest them in the market through the sale and purchase of assets, and various Islamic securities to increase economic growth rates.

<sup>1</sup>- كمال توفيق خطاب: نحو سوق مالية إسلامية، المؤتمر العالمي الثالث للاقتصاد الإسلامي، جامعة أم القرى، مكة المكرمة، المملكة العربية السعودية، 2005 م، ص 06.

<sup>2</sup>- شافية كتاف: دور الأدوات المالية الإسلامية في تنشيط وتطوير السوق المالية الإسلامية -دراسة تطبيقية لتجارب بعض الأسواق المالية العربية-، أطروحة مقدمة كجزء من متطلبات نيل شهادة دكتوراه علوم في العلوم الاقتصادية، جامعة سطيف1، الجزائر، 2013-2014، ص 10.

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### 1.2. The Objectives of the Islamic Financial Market

Islamic financial market seeks to achieve the following objectives:

- Establishing an international financial market based on the provisions and principles of Islamic Sharia, which regulates and develops its framework;
- Improving the cooperative framework between Islamic financial institutions universally<sup>1</sup>.
- Seek to create an environment that will encourage both Islamic and non-Islamic financial institutions to participate in the market's effectiveness;
- Addressing the problem of liquidity in Islamic banks, and finding new investment alternatives, as well as finding new investment opportunities<sup>2</sup>.

### 1.3. Islamic Financial Market Classification

Before presenting the classification of Islamic financial market, the structure of the conventional financial market must be known, which does not differ from the Islamic market except through the instruments traded in it.

#### 1.3.1. Financial Market Structure

Classical financial markets are essentially divided to three main structures in terms of securities types, their manner of issuance, and their maturity date as follows<sup>3</sup>:

**a. Based on the Securities Type:** Based on their instruments, financial market can be classified as either debt markets or equity markets.

- Debt markets: The most popular way for businesses or governments to raise money is through debt instruments that are traded on debt markets, such as bonds, sukuk (salam), and mortgages. It is a contractual obligation on the part of the borrower to make periodical payments of a defined sum of money to the owner of the instruments, which may include principal, interest, or a profit margin, up until a deadline for the final payment. The maturity date is the date that is designated for the last payment. If a debt instrument's duration is one year or less, it is referred to as short-term; if it is ten years or more, it is referred to as long-term instruments. The intermediate-term instruments are located in between.
- Equity markets: In contrast to bonds, sukuk, or other debt instruments, equities are regarded as long-term securities since they lack maturity dates. Investors or companies holding ordinary shares, as an example of equity instruments, receive their shares from the net income and assets of the company. Therefore, shareholders are sometimes called residual claimants, which means that they can only get their shares after the issuing has paid all of its debts and taxes. Therefore, a corporation raises equity funds when it offers shares to the public, who are more interested in the firm's progress and growth than they are in earning interest on debt. In contrast, a company is said to acquire debt funds when it obtains loans or sells bonds.

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<sup>1</sup>-Fayaz Ahmed Lone, Siraj Ahmed: Islamic finance: More expectations and less disappointment, Investment Management and Financial Innovations, vol.14, No.01, 2017, p 135.

<sup>2</sup>- Simon Archer, Rifaat Ahmed Abdel Karim: Islamic Capital Markets and Products- Managing Capital and Liquidity Requirements Under Basel III-, Wiley, Chichester, United Kingdom, 2018, p 08.

<sup>3</sup>- كمال توفيق خطاب، مرجع سبق ذكره، ص 06.

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**b. Based on the Issuing Manner:** In financial markets, people or companies can sell new securities and resell old ones issued by them or by others. **The primary** market is the market in which new issues of securities such as bonds and stocks are issued by the primary issuer, such as governments and companies. However, **the secondary** market is a market in which securities are traded after they are initially offered in the primary market. The function of the secondary market depends heavily on brokers and dealers. Brokers act as the investors' agents in bringing together buyers and sellers of securities, whereas dealers connect buyers and sellers by purchasing and reselling securities at a predetermined price.

**c. Based on the Maturity Date:** Based on maturity, financial market can be classified as either money markets or capital markets.

- **Money market:** Is a section of the financial market, where financial instruments with high liquidity and relatively short maturities are exchanged. Participants utilize the money market as a means of borrowing and lending money for short periods, ranging from a few days to just under a year. Money-market securities include commercial papers, municipal notes, repurchase agreements (repos), short-term sukuk, bank acceptances, Treasury bills, or Islamic accepted bills. Due to the extremely liquid nature of the assets and their short maturities, the money market is often regarded as a secure area to invest money. However, there are market dangers that every investor needs to be aware of, including the possibility of default on instruments like commercial paper.
- **Capital market:** It serves as the market where longer-term debt (with a maturity of one year or more), and equity securities are traded.

### 1.3.2. Islamic Financial Market Types

Islamic financial market, as an integral part of the Islamic financial system, plays an important role in complementing the investment role of the Islamic banking sector. Although their functions are similar to the traditional financial markets, the way they are structured may differ from the traditional ones. In the modern financial world and in terms of the types of instruments traded therein and their investment periods, the Islamic financial market alike to conventional financial market can be divided into two well-known categories, which are the Islamic money market and Islamic capital market.

#### 1.3.2.1. Islamic Money Market

Islamic money market plays a crucial role in the financial market; it is the market, where short term project financing takes place. Thus, this part introduces the Islamic money market and its main financial instruments.

##### a. Islamic Money Market's Concept

Technically speaking, the Islamic money market does not differ from the traditional market except in terms of its used instruments, which are totally free of usury<sup>1</sup>. According to the traditional concept, the money market, also called liquidity market, short-term transaction market, is defined as “The mechanism by which short-term capital is issued and traded, which allows the intervention of banking system institutions represented by the Central Bank and commercial banks, in addition to some non-bank financial institutions”<sup>2</sup>. Accordingly, Islamic money market is distinguished from other markets by the following:

<sup>1</sup>- Andri Soemita et al: Islamic Perspective On Money Market and The Operation of Sharia Money Market, Jurnal Ilmiah Ekonomi Islam, Vol.7, No. 03, 2021, p 1664.

<sup>2</sup> - محفوظ جبار: البورصة وموقعها من أسواق العمليات المالية، الجزء الأول، دار هومة، الجزائر، 2002، ص 65.

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- Islamic money market specializes in short-term instruments that have a high level of liquidity so that they can be liquidated at any time as soon as they are offered for sale, with least amount of losses. For this reason, investing in these instruments may be safer than investing in capital market instruments in particular, and it was called the money market as well, because of the speed and ease of converting investment instruments into liquidity
- Money market does not have a special and specific place in which deals are concluded, as it is done through specialized brokers or commercial banks, either by meeting directly or by various means of communication such as telephone, telex, fax, internet, etc<sup>1</sup>.
- It provides financial institutions a high degree of security, by investing their money in financial assets with high liquidity. As we know that, the most important institutions of money market are commercial banks and central banks. Therefore, through this market, commercial banks can invest some of their funds in a liquid and safe manner. As well as for the central bank, it can influence the quantity and price of liquid funds in a manner that is suitable to the implemented monetary<sup>2</sup>.
- It is considered one of the most important components of the Islamic financial market because of the important functions it performs, especially with its main feature, which is represented in not dealing with usury, giving and receiving<sup>3</sup>.

### b. Islamic Money Market Instruments

Money market is a segment of financial market in which financial instruments with high liquidity and very short maturities are traded. They are usually traded for a period of three (3) months or less and have a maturity of less than one year. Therefore, Islamic money market securities are usually more widely traded than longer-term one thanks to their liquidity. As, among its most important instruments we provide the following

- **Islamic Treasury Bills:** They are short-term securities issued by a government and sometimes they are issued based on established Sharia principles by central bank on behalf of the government to raise short-term funds to finance the Government spending. They are traded based on a discounted basis<sup>4</sup>. They are attractive investment instruments for a number of reasons, as they have no default risk; they are highly liquid and they can be easily bought and sell in the secondary market. Treasury bills are also used to absorb excess cash from the banking sector and help the government to borrow from banks to meet its budgetary shortfall<sup>5</sup>.
- **Islamic Accepted Bills:** Also called bills of exchange. They are one of the Islamic financial instruments that are traded in Islamic inter-bank money market, promising future payment that traded based on Murabahah principle for import/purchase<sup>6</sup>, and representing an order to a bank by its customer obliging it to pay a certain amount of

<sup>1</sup> - محمد صبري هارون: أحكام السواق المالية الأسهم والسندات عمان - الأردن، دار النفائس الطبعة الثانية 2009، ص 75.

<sup>2</sup> - أنطوان الناشف، خليل الهندي: العمليات المصرفية والسوق المالية، المؤسسة الحديثة للكتاب، لبنان، 2000، ص 31.

<sup>3</sup> - أسامة محمد الفولي، زينب عوض الله: "اقتصاديات النقود والتمويل"، دار الجامعة الجديدة، مصر، 2005، ص 135.

<sup>4</sup> - Ola Al-Sayed: Money Market Instruments in Conventional and Islamic Banks, European International Journal of Science and Humanities, Vol.1, No.3, 2015, p 05.

<sup>5</sup> - Mohammed Jashim Uddin and Md. Nezum Uddin: Scenario of Islamic money market instruments in some selected Muslim countries: A lesson for Bangladesh, IIUC Business Review, Vol.05, 2016, p 79.

<sup>6</sup> - Mohd Ma'Sum Billah: Islamic Products: Principle, Instruments and Structure, Palgrave Macmillan, United Kingdom, 2019, p 217.

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money to the holder of the acceptance bill in which a bank, rather than the importers/customer, guarantees the payment of goods and commodities, i.e. to finance the client's purchases<sup>1</sup>.

- **Islamic Certificates of Deposit:** They are mudarabah-based deposits financial instruments issued by Islamic banks for different denominations and for different maturities to mobilize savings from 3 months to 1 year. The Islamic banks act as Mudarib to collect these funds and have the right to invest them on any project as they see fit. The profit and loss sharing percentages are set at the time of issuance<sup>2</sup>.
- **Non- Tradable Sukuk:** Represented by Murabahah, Salam and Istisna sukuk. These securities are based on tangible asset and represent non-tradable instruments which means they do not trade in the secondary market. They have a short-term maturity, which make them good instruments to manage liquidity in money market<sup>3</sup>. Murabaha, salam and istisna certificates are asset-backed sukuk, i.e., they are debt securities arising from standard Murabaha or Salam or Istisna contracts offering to finance goods purchasing. These kind of securities have limited attraction due to trading restrictions of these certificates in the secondary market<sup>4</sup>.

The main participants in money markets are banks, nonbank financial institutions such as takaful and insurance companies, business corporations, the government treasury, and the Central bank<sup>5</sup>. Banks use the money market for liquidity purposes, especially to adjust the mismatch of assets and liability in their balance sheet. They also use it to obtain liquidity or to place their surplus funds for a limited period. In addition, business corporations along with government agencies use the money market for short-term investments. As, The central bank, who take the role of regulating money market and promoting monetary stability, uses this market to apply its monetary policy, such as the use of open-market operations as a means of influencing the liquidity level. Moreover, the government in turn uses this market as a source of short-term funding using treasury bills.

### 1.3.2.2. Islamic Capital Market

Capital market is a vital requirement to support economic growth; it is the market that project owners resort to provide a capital to finance their various projects. However, the existing financial framework, which is marred by many prohibited violations that prevent many Muslims from exploiting this market to finance their investments. Therefore, it was necessary to create an Islamic capital market, which fulfill Muslims medium and long-term financing needs.

#### a. Islamic Capital Market's Concept

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<sup>1</sup>-Chaibou Issoufou: Islamic Money Market and Application of Third party guarantee for Economic Development, Humanities & Social Sciences Reviews, Vol.07, No 2, 2019, p 03.

<sup>2</sup>-Hanudin Amin et al.: Islamic Financial Institutions and Markets, London, United Kingdom, 2013, p 84.

<sup>3</sup>- Mohammed Jashim Uddin, Md. Nezum Uddin, Op.cit, p 83.

<sup>4</sup>- Ola Al-Sayed, Op.cit, p 06.

<sup>5</sup>- Mohd Azmi Omar et al.: Fundamentals of Islamic Money and Capital Markets, Wiley, Singapore, 2017, p 52.

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Islamic capital market is a subsector of the Capital Market that promotes medium to long-term sharia-compliant securities/instruments as alternatives to conventional ones, providing investment opportunities for a wide range of investors. As the main difference between the two markets is the quality of these instruments, which must be free from activities prohibited by Sharia, such as dealing with usury, gambling, ambiguity<sup>1</sup>. However, the narrow and limited definition of the capital market, which is the most common in use. It is limited on the regulated market for stocks and bonds, which is known as the Stock Exchange, where buying and selling of securities take place, so it is the main channel through which money flows from individuals and institutions, in a way that develop savings and encourage investment for economic benefits<sup>2</sup>. Accordingly, the main features of the Islamic capital market are the following:

- Islamic capital market is considered an integral part of the Islamic financial system and complements the investment role of the Islamic banking sector;
- The major difference between money market and capital market is securities' maturity. Capital market securities are debt and equity instruments with a maturity of more one year<sup>3</sup>.
- Islamic capital market has activities and transactions mechanism, which are in line with Sharia, as the market is free from activities prohibited by Islam, such as usury (riba), ambiguity (gharar) in contractual agreements, gambling (maisir)<sup>4</sup>.
- It plays a crucial role in offering different financing modes and investment options to individuals and corporations, and works parallel to the conventional market in several countries such as Malaysia, as well as investing in Sharia-compliant securities is not only limited to Muslims<sup>5</sup>.

### b. Islamic Capital Market Instruments

Islamic capital market is a highly specialized and organized financial market. Indeed, it is an essential agent of economic growth thanks to its ability to facilitate and mobilize savings and investments using long-term securities. These markets are favored for governments and companies that look for long-term investments with no maturity condition, which mainly include tradable sukuk (mudarabah, ijarah sukuk and musharaka sukuk), Islamic ordinary stocks, Islamic preferred stocks and Islamic mutual funds.

- **Tradable Sukuk:** Sukuk can be categorized based on how easily they can be exchanged on the secondary market. There are tradable sukuk and others are non-tradable. Sukuk based on debt, such as Murabaha, Istisna and Salam sukuk, are non-tradable securities due to the prohibition of trading in debt securities<sup>6</sup>. However, tradable sukuk such as mudaraba sukuk, Musharaka sukuk, and Ijarah sukuk are negotiable securities. These

<sup>1</sup>- Imam Wahyudi, Gandhi Anwar Sani: Interdependence between Islamic capital market and money market: Evidence from Indonesia, *Borsa Istanbul Review*, Vol.32, No.47, 2014, p 32.

<sup>2</sup> - شعبان محمد إسلام البرواري: بورصة الأوراق المالية من منظور إسلامي: دراسة تحليلية نقدية، دار الفكر، سوريا، 2002، ص 31.

<sup>3</sup>- Mohd Azmi Omar et al., *Op.cit*, p 12.

<sup>4</sup>- Novita Sari: The Impact of Islamic Capital Market Development on Economic Growth: the case of Indonesia, *Journal of Smart Economic Growth*, Vol.03, No.02, 2018, p22.

<sup>5</sup>- Gani Ibrahim Musa et al.: The Impact of Islamic Capital Market on Malaysian Real Economy, *Jurnal Ekonomi Malaysia*, Vol.54, No.02, 2020, p 92.

<sup>6</sup>- Ola Al-Sayed, *Op.cit*, p 07.

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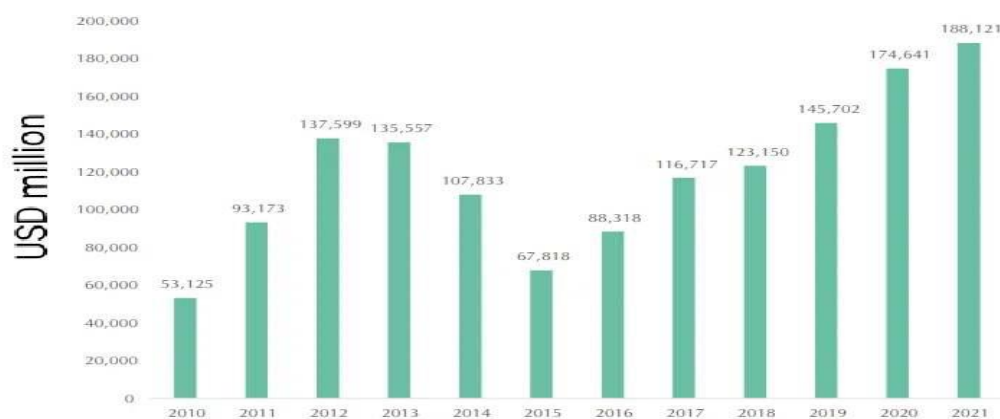
securities entitle the holder to a temporary ownership of a project or company, and they are based on the terms of sharing profits and mobilizing funds to create a new project or expand an existing project for a long-term period<sup>1</sup>.

- **Islamic Ordinary Stocks:** They refer to securities that signify an ownership in a corporation and represent a claim on a part of the corporation's assets and earnings. A holder of ordinary stock is normally entitled to one vote per share. The shares are distributed according to the percentage of shareholder ownership in the company. Shares cannot be classified as Sharia-compliant unless their commercial activities are consistent with the provisions of Islamic Sharia<sup>2</sup>.
- **Islamic Preferred Stocks:** They are securities that represent ownership in a company, and have a priority claim over ordinary shares on the company's assets and profits<sup>3</sup>.
- **Islamic Mutual Funds:** They are a collective investment system that provides investors with the opportunity to invest in a diversified portfolio of Islamic Sharia-compliant securities, including stocks, sukuk, and fixed-income securities. They have become increasingly important due to high demand from many investors, including those outside the Islamic investment community<sup>4</sup>.

### 2. Challenges of Sukuk Market Development

Sukuk market has been expanding quickly as a result of the high demand and growing investor base. The main factors for this growth path are the continued economic stimulus measures implemented by several governments. As the total global sukuk issuances reached US\$188.121 billion in 2021 as shown in figure (III-9) below, which is the highest value of annual sukuk issuances to date<sup>5</sup>.

**Figure (III-9): Total Global Sukuk Issuances for the Period (2010-2021)**



**Source:** International Islamic Financial Market: Sukuk Report, 2022, p 29.

<sup>1</sup>-Ahmet Ulusoy, Mehmet Ela: Secondary Market of Sukuk: An Overview, International Journal of Islamic Economics and Finance Studies, Vol.04, NO.02, 2018, p 20.

<sup>2</sup>- The International Organization of Securities Commissions: Islamic Capital Market Fact Finding Report, 2004, p 29.

<sup>3</sup>- Ibid, p 29.

<sup>4</sup>- Francisco Climent et al.: The Investment Performance of U.S. Islamic Mutual Funds, Sustainability, 2020, p 03.

<sup>5</sup>- International Islamic Financial Market Sukuk Report, 2022, p 29.

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From the figure (III-9) above, the issuance of global sukuk showed an increase of 7.72% in 2021, as it was US\$174.641 billion in 2020. On a cumulative basis for the period between 2010 and 2021, Malaysia continued to maintain its first position with total issuances reached to US\$ 877 billion, followed by Saudi Arabia with US\$ 216.755 billion, Indonesia with US\$ 148.295 billion, and the United Arab Emirates with US\$ 102.195 billion, and Turkey with US\$ 84.692 billion. Malaysia, due to the strength of its capital market, continues to maintain its leadership over its counterparts in Asia and the Gulf Cooperation Council countries<sup>1</sup>. However, recently the increase in issuances in Bahrain, Saudi Arabia, Indonesia, the United Arab Emirates, Turkey and others has led to a decrease in Malaysia's portion in sukuk global market. Even though, the expanding of sukuk market is appeared to be high in recent years, there are number of obstacles delaying its full growth, including lack of standardization, limited accessibility, lack of transparency, and different operating costs. Which, in turn delay the full exploitation of primary and secondary markets.

### 2.1. Lack of standardization

In sukuk industry, standardization has two main problems related to sukuk processing. The first is the lack of standardization in term of documentation, and the second is the lack of standardization in term of Sharia interpretations. These two types of standardization issues have harmed the sukuk industry making it difficult for investors to assess and compare different offering sukuk.

- The lack of standardization in Documentation and Structures: Since there are many types of sukuk structures, standardization in documenting sukuk and their structures have not yet been achieved. Hence, there may be a difference between the rights of issuers and investors in term of the sukuk structure. Although it is clear that the lack of standardization is hindering the growth of the sukuk market, in recent years, no many efforts have been made to standardize their documentation, and these efforts are consider failed attempts<sup>2</sup>. On the other hand, according to Islamic principles, sukuk must be based on Sharia rules, but in practice, documents are subjected to the law of certain governments and not Islamic law, which may lead to a different authentication of sukuk structures. Therefore, there have been conflicts between Sharia-compliant and uniform documents and legislation in countries, which have led to the lack of uniform documents. Thus, the lack of standardization may negatively affect the growth of the sukuk market, due to the ambiguity in documentation, and the rights of different sukuk parties. In addition to that, the international variation in Sharia products, where one entity's Sharia-compliant product may not necessarily be accepted as another party's Sharia-compliant product. For instance, while AAOIFI specified more than 10 sukuk types such as murabahah, istisna, salam, ijarah, mudarabah, musharakah, wakalah, muzarah, musaqa, muqarasah, ijarah mowsufa bithimn, manfaah ijarah, Malaysia issued bai' al-inah and bai'al-dayn sukuk structures. However, bai' al-inah and bai'al-dayn have been criticized by most of Islam scholars<sup>3</sup>. Thus, it can be said that there is no standardized sukuk structure in the sukuk market yet.
- The lack of standardization in Sharia interpretations: There are varieties of views held by experts of Sharia about the subject of Sharia law. Sharia law is subject to interpretation, and scholars of the religion frequently express varying views on relevant

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<sup>1</sup>- International Islamic Financial Market sukuk Report, Op.cit p 23.

<sup>2</sup>- Hatem A. El-Karanshawy et al.: Ethics, Governance and Regulation in Islamic Finance, Developing Inclusive and Sustainable Economic and Financial Systems, Vol.04, 2015, p 143.

<sup>3</sup>- Ahmet Ulusoy, Mehmet Ela, Op.cit, p 149.



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topics. As other Sharia experts may disagree with a position taken by some of the scholars. In fact, Sharia scholars can choose different schools of thought to make decisions about the compliance of any financial transaction with Islamic law. Hence, the main problems facing the Islamic finance industry are the lack of unification of Sharia rules and structure of financial transactions<sup>1</sup>. As without the guidelines (standards), every nation and organization might apply their own set of rules to Islamic financial transactions that comply with Sharia law. As a result, there may be a wide variety of perspectives on Sharia and transactional models. To be precise, Islamic financial laws and regulatory methods differ between nations, thus, the lack of compatible viewpoints make it difficult to standardize the sukuk structure. That is to say, many financing sukuk could be tradable for some investors, while they are invalid for the others<sup>2</sup>.

### 2.2. Limited Accessibility

A diversified investor base is essential for the development of any financial market. As the diversified investor base comprising investor segments such as banks, mutual funds, insurance companies, pension funds, retail, small investors, and foreign investors could provide the basis for sustained demand of any securities market. However, sovereign entities, such as central banks and the Ministry of Finance, in addition to semi-sovereign entities such as public banks, insurance companies, and various financial institutions, currently dominate the total sukuk market, in an effort to finance their budgets. As, in 2021, the share of sovereign issuance reached 64% of the total issuance of energy, aviation, financial, infrastructure development sectors<sup>3</sup>. Generally, sovereign and semi-sovereign entities issue a high valued sukuk, which prevent small investors from entering this market and invest in sukuk market due to their high values. This position makes it challenging to sell and resell sukuk to other small parties due to their limited access<sup>4</sup>. Therefore, limited market access hindered the expanding growth of sukuk market. Hence, it is necessary to build a diversified investors base by providing sukuk that are diverse in structure and value to expand the scope of sukuk industry.

### 2.3. Lack of Transparency

One key issue impeding the sukuk market's expansion and development is the lack of transparency, as sukuk lack transparency in terms of structure, trading, and settlement process, which makes it challenging for investors to track their properties and confirm their underlying assets.

- In terms of sukuk issuing structure: One of the main reasons for the lack of transparency in sukuk market is the complexity of sukuk-issuing structures. Sukuk are often issued as assets-based securities, where the assets are used as collateral for sukuk holders. However, sometimes it can be difficult to value the underlying assets, leading to an ambiguity in the market<sup>5</sup>. In addition, sukuk can vary greatly in their structures and

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<sup>1</sup>- Ketut Ariadi Kusuma, Anderson Caputo Silva: Sukuk Markets A Proposed Approach for Development, Policy Research Working Paper, 2014, p 6.

<sup>2</sup>- Ibid, p 08.

<sup>3</sup>- International Islamic Financial Market Sukuk Report, Op.cit, p 49.

<sup>4</sup>- Abdul aziz Abdullah et al.: Risk in Funding Infrastructure Projects through Sukuk or Islamic Bonds, International Review of Management and Business Research, Vol.03, No.02, 2014, p 922.

<sup>5</sup>- Sarah Iftikhar, Irum Saba: Blockchain Based Smart Sukuk as Shariah Compliant Investment Avenues for Islamic Financial Institutions in Pakistan, Journal of Finance & Economics Research, Vol. 5, 2020, p 35.

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characteristics. This lack of uniformity makes it difficult for investors to compare different sukuk offerings and evaluate their risks and returns in order to get complete and trustworthy information about their sukuk and the financial position of sukuk issuers and investors, which could absolutely lead to inactive sukuk trading<sup>1</sup>.

- In term of sukuk trading: unlike bonds, which are traded on established exchange with active secondary markets, sukuk often have limited trading activities that result from illiquid secondary market. In fact, sukuk are non-tradable at secondary market, as most sukuk are active only in the primary one, due to the limited number of issuances and the lack of alternative financing instruments in the asset-based class. As well as, due to the limited access, as most of the sukuk holders are higher institutions or private investors<sup>2</sup>. Furthermore, the lack of a central and unified reporting framework of sukuk increases transparency issues. In contrast to traditional bonds, which are traded on established exchanges with clear reporting requirements, sukuk are frequently exchanged over-the-counter, making it challenged to analyze and monitor sukuk's performance. Therefore, the lack of information can break market confidence and delay the development of a liquid secondary market, as it is possible that investors will not have an access to reliable information needed to make the right selections, which lead to sukuk mispricing<sup>3</sup>.
- In term of sukuk settlement Process: Clearing and settlement are one of the most basic requirements for sukuk market development. Weak clearing and settlement procedures may hinder market development in several ways. They may increase the risk of settlement failures, as well as increase transaction costs, and reduce the possibility of market liquidity and investor diversity<sup>4</sup>. Sukuk are often exposed to liquidity risk, as most investors hold sukuk until maturity time due to different trading issue resulting from the lack of finding buyers and sellers. This issue could delay the process of distributing payments and dividends. Therefore, the lack of liquidity can make it challenging to investors to trade their sukuk and ameliorate their positions or diversify their portfolios, leading to higher costs and potential mispricing in order to liquid their financial securities<sup>5</sup>.

### 2.4. Operating Costs

Sukuk issuing costs are typically high, as this process involves several procedures and fees such as legal and advisory, underwriting and listing, and other intermediary fees, which makes the process of issuing sukuk more expensive than other securities.

- Legal and advisory Fees: These are the fees associated with the sukuk structuring process, representing by Sharia consultation fees, which basically guarantee that this process does not conflict with Sharia rules. As for legal advisory, it mainly concerns the totality of documents related to the documentation process and everything that

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<sup>1</sup>- Ketut Ariadi Kusuma, Anderson Caputo Silva, Op.cit, p 08.

<sup>2</sup>- Abdul aziz Abdullah et al., Op.cit, p 922.

<sup>3</sup>- Essia Ries Ahmed et al.: Islamic Sukuk: Pricing Mechanism and Rating, Journal of Asian Scientific Research, Vol.04, 2014, p 644.

<sup>4</sup>- Ketut Ariadi Kusuma, Anderson Caputo Silva, Op.cit, p 15.

<sup>5</sup>- Essia Ries Ahmed et al, Op.cit, p 644.

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preserves the privacy of the participating parties, as well as all the required printed-paper (sukuk certificates and other papers) associated with the issuing process<sup>1</sup>.

- **Underwriting and Listing Fees:** If sukuk are issued based on a SPV agency, the subscription fees are represented by a percentage of the total value of sukuk taken by the special purposes company. However, if sukuk are integrated on stock exchange or require regulatory approvals, the issuer will be responsible for paying listing and regulatory fees to the appropriate authorities<sup>2</sup>.
- **Other Intermediary Fees:** Sukuk issuers may require bank intervention to settle their payments. They may also need to engage auditors and bookkeepers to ensure compliance with accounting standards and to provide guarantees on the financial statements relating to sukuk issuance. Moreover, if the issuing operations need to be rated to rating agency in exchange for their evaluation and rating, this process need extra fees<sup>3</sup>. Therefore, the overall services associated with the issuing process require paying different fees to the concerned authorities in order to complete the issuing process.

Generally, sukuk issuance considers as an expensive, complex and time-consuming process, as it handles many challenges, which could not boost the development of sukuk industry and the Islamic financial market. Thus, sukuk market cannot realize its potential unless these challenges are overcome. Therefore, the new blockchain technology is adopted in sukuk industry as a solution, introducing new sukuk generation called “blockchain sukuk” or “smart sukuk” as an alternative to conventional sukuk structuring on blockchain platform. Blockchain offers a full automated structuring and trading process to sukuk industry, which in turn provide several advantages such as accessibility, immutability, transparency, and efficiency. Therefore, smart sukuk attend to provide more standard, transparent, secure, and efficient alternative to conventional sukuk, which reduces several costs and in turn promotes Islamic financial market's growth.

### Section Three: Smart Sukuk Overview

Financial instruments are being rapidly transformed by technological innovation, and linking sukuk with blockchain is one of the area that is being adopted in financial market. Blockchain Sukuk or what so called Smart Sukuk is the new generation of sukuk structure based on blockchain technology. The world's first innovation in smart sukuk introduced in 2018 by Blossom Finance company in Indonesia, aiming to change the traditional ways of the issuing process of sukuk. Blockchain-based sukuk seek to use technology to enhance efficiency and transparency, reduce costs, and enable small and medium-sized businesses to issue their own sukuk based on technology, which in turn guarantee their financial returns by reducing different costs. In this regard, this section provides an introduction to smart sukuk as well as their basic issuance process and describes the importance of smart sukuk in financing economic development.

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<sup>1</sup>- Sarah Iftikhar, Irum Saba, Op.cit, p 36.

<sup>2</sup>- Ida Syafrida et al.: Securities Issuance Considerations as an External Funding Source for Sharia Commercial Banks, *Economica: Jurnal Ekonomi Islam*, Vol.01, No.02, 2020, p 225.

<sup>3</sup>- Sarah Iftikhar, Irum Saba, Op.cit, p 35.

# Chapter Three: Smart Sukuk as a Financing Alternative in the Islamic Financial Market

## 1. Introduction to Smart Sukuk

This part introduces smart sukuk definition and characteristics as well as presents the difference between smart sukuk and conventional sukuk, it also addresses the Sharia perspective of smart sukuk.

### 1.1. Smart Sukuk Definition

Today, Smart sukuk or blockchain sukuk is a novel concept in the financial industry. Different scholars based on the working mechanism of sukuk, or the way they are organized define this concept as follow:

- ❖ “Smart sukuk are financial securities where the blockchain technology is used via smart contracts to execute functions in a transparent and reliable manner. There would be no difference in the underlying Sharia contracts used to set up blockchain-based sukuk and classical sukuk. The difference lies in the use of technology in structuring and executing contracts where the business rules are directly encrypted into basic payment coins using smart contracts on designed algorithms that enforces contract rules vis-à-vis payments and ownership transfer”<sup>1</sup>.
- ❖ “Blockchain sukuk are encrypted securities/ financial instruments of equal value that represent common shares in the ownership of objects, benefits, services, or in the assets of a specific project or a private investment activity by collecting money from investors in exchange for encrypted sukuk or as they are called sukuk Tokens. Which in turn represent a part of the sukuk investment ownership, and the money is automatically distributed to the holders of sukuk tokens through the blockchain platform according to the rules of smart contracts without the need for intermediaries”<sup>2</sup>.

From the aforementioned definitions, smart sukuk or blockchain sukuk or blockchain –based sukuk could be defined as follows: they are encrypted Islamic securities/ financial instruments of equal value that represent a part of the investment ownership issued based on blockchain platform in accordance with smart contracts’ rules. This technology provides transparency, costs reduction and mediation costs, in addition to the fact that financial returns and dividends are automatically paid through blockchain platform.

### 1.2. Smart Sukuk Features

Smart sukuk have different features that determine their structure, the following points are considered as the main ones:

- There is no difference in the underlying Sharia contracts used to structure smart sukuk and conventional sukuk. However, technically speaking the main difference

<sup>1</sup>- Sherin Kunhibava et al.: *Shukūk on blockchain: a legal, regulatory and Sharī’ah review*, International Journal of Islamic Finance, Vol.11, No.1, 2021, p 07.

<sup>2</sup>- أمل خيرى أمين محمد: منصات إصدار الصكوك الذكية بواسطة تقنية سلاسل الكتل لتمويل المنشآت الصغيرة والمتوسطة في المملكة العربية السعودية: الفرص والتحديات، بحث مشارك في برنامج دعم الأبحاث في المالية الإسلامية – ساما البنك المركزي السعودي، 2022، ص 15.

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appears in the issuing process, which is mainly based on blockchain particularly smart contracts, which are responsible of structuring and executing the contracts<sup>1</sup>;

- In blockchain sukuk, the issuing process of sukuk is digitized. Operationally, the blockchain automates and applies rules of contract with regard to payment and ownership transfer, enabled by a smart contracts algorithm, which encrypts business rules and parties' agreement where investments are made through digital tokens or cryptocurrency<sup>2</sup>;
- Smart sukuk go through an automated process that smart contracts undertake in order to boost efficiency, transparency, reducing costs, gaining time and tracking assets, which enhance investor trust<sup>3</sup>;
- When sukuk are issued using blockchain, the returns provided to sukuk holders or investors are distributed as tokens (cryptos) that represent a portion of ownership in the underlying asset<sup>4</sup>;
- The main importance of smart sukuk is to standardize and automate the accounting and legal payments and overheads for traditional sukuk offers<sup>5</sup>;
- There is no difference between smart sukuk and conventional sukuk in terms of their types, or their Sharia issuing principles, as they only differ in the way they are structured<sup>6</sup>.

### 1.3. The Difference between Smart and Conventional Sukuk

Smart sukuk do not differ from regular sukuk in terms of their legality and the principles of their issuance, as both of them are structured based on Sharia provisions. However, the difference lies in their issuing mechanisms. Therefore, the following table (III-1) explains the technical procedural differences between conventional and smart sukuk.

**Table (III-1): The Difference between Conventional Sukuk and Smart Sukuk**

Comparison Items	Conventional Sukuk	Smart Sukuk
The Entire Lifecycle	Conventional sukuk issuing process are papers-driven	Smart sukuk are based on online blockchain platform
Sukuk Issuer and Manager	A special purpose company (SPV) or a financial company that performs a number of roles,	Blockchain platform acts as an issuer and agent for sukuk holders, and smart contracts, in turn, assume

<sup>1</sup>-Osama Hamza: Smart Sukuk Structure from Sharia Perspective and Financing Benefits: Proposed Application of Smart Sukuk through Blockchain Technology in Islamic Banks within Turkey, *European Journal of Islamic Finance*, Second Special Issue, 2020, p 04.

<sup>2</sup>-Dhiaeddine Rejeb: Smart Contract's Contributions to Mudaraba, *Tazkia Islamic Finance and Business Review*, Vol.15, No.1, 2021, p 11.

<sup>3</sup>-Aldi khusmufa Nur Iman, Sirajul Arifin: The Advantages and Challenges of Implementing Sukuk through Blockchain Technology, *An-Nisbah, Jurnal Ekonomi Syariah*, Vol.08, No.02, 2021, p 05.

<sup>4</sup>- Ibid, p 17.

<sup>5</sup>- Babas Mounira, *Op.cit*, p 319.

<sup>6</sup>- Sherin Kunhibava et al., *Op.cit*, p 123.

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	<p>according to what are specified in sukuk documents, including:</p> <ol style="list-style-type: none"> <li>1. Owning and registering sukuk assets.</li> <li>2. Receive the subscription proceeds from investors.</li> <li>3. Entering into sukuk documents on behalf of the investors.</li> <li>4. Manage the payments due to sukuk holders</li> </ol>	the role of managing the payments of sukuk holders
Sukuk Documents	Sukuk contracts regulate the process of the issuance and the use of proceeds according to Sharia structure based on the signed agreement between the issuer, the originator and other sukuk parties.	Sukuk parties can enter into the documents regulating the issuance through smart contracts and signing them electronically through the platform
Investors	Investment funds, banks, companies or qualified individuals that authorized to invest in sukuk.	Institutions or persons dealing in cryptocurrencies through platforms based on blockchain technology.
Investment Currency	Based on fiat currencies	Based on cryptocurrencies that are issued and traded through digital platforms based on blockchain technology, however, some issuance use fiat currencies, and in this case they are forced to deal with banks that work to manage the proceeds of the issuance.
Listing of Sukuk	Sukuk are listed in financial markets, after obtaining the necessary licenses and approvals	Sukuk are listed and made available for trading among investors through the platform, and the trading price is according to the supply and demand mechanisms between investors.
Extinguish/ Redemption of Sukuk	Sukuk will be redeemed on the redemption date according to the terms and conditions of the documents of issuance. Redemption may be at the nominal value as in the case of Murabaha sukuk, or at the market value of sukuk assets on the redemption date.	Sukuk will be redeemed on the redemption date according to the terms and conditions of smart contracts that were concluded through the platform when sukuk were issued.
Sharia Committee for Sukuk	Sharia committee is appointed to prepare and review the structure and documents of sukuk, and issue its decision regarding their Sharia compatibility. The formation of Sharia Committee may be subject to governance standards.	Blockchain platform can obtain Sharia advice and appoint a Sharia committee that prepares and reviews the structure of sukuk and smart contracts related to the issuing process.

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Risks	Sukuk face range of risks, the most important of which are credit risks, market risks, operational risks, liquidity risks, risks of Sharia violations, and legal risks associated with the offering process, in addition to the risk of failure to fulfill.	In addition to the risks involved in traditional sukuk, there are risks specific to smart sukuk, such as technical risks related to electronic penetration and technical failures, which are rare in blockchain technologies. In the case of a decentralized issuance, there are risks of non-submission to the regulatory and supervisory authorities, and the possibility of its use by illegal entities, money laundering, or tax evasion by unlicensed issuers.
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**Source:** أمل خيري، أمين محمد: منصات إصدار الصكوك الذكية بواسطة تقنية سلاسل الكتل لتمويل المنشآت الصغيرة والمتوسطة في المملكة العربية السعودية: الفرص والتحديات، بحث مشارك في برنامج دعم الأبحاث في المالية الإسلامية – ساما البنك المركزي السعودي، 2022، ص 15

### 1.4. Sharia Perspective of Smart Sukuk

Although there are some drawbacks inherent to blockchain technology such as software errors and the lack of regulations, as it is considered as a new technology that may face technical defaults. However, it still be seen as a revolutionary technology that could change the global financial system. Generally speaking, smart contracts based on blockchain technology could effectively operate smart sukuk. These human-programmed protocols have numerous advantages such as transparency, unalterable, incorruptible, low transaction cost with effective audit and reconciliation system that minimize operational processes (documentation, signature, etc.), which offers more access to markets with fast processing capability, and mainly provide 24/7 open transactions, which could help sukuk market's progress<sup>1</sup>. Thus, the adoption and implementation of this new technology would help to simplify the issuing and trading processes of sukuk, and improve regulatory oversights in Islamic financial market in general and sukuk industry in particular. This is possible because Ethereum smart contracts can help in standardizing and automating the legal, accounting and payment overhead of sukuk structure and prevent fraud, which is one of the pillars of sharia's aims, which is individual property protection<sup>2</sup>. In this regard and from Sharia perspective, there is no difference in terms of the requirements of the underlying Sharia contract used to issue traditional and blockchain sukuk<sup>3</sup>. The AAOIFI in its turn ensures in its report of 2017 that the general principles of Sharia should serve as a guide for smart contracts when designing blockchain-based sukuk by ensuring that transactions do not contain any prohibited elements. This means that sukuk may be traded in any known way that does not conflict with Sharia provisions, such as registration or any electronic means<sup>4</sup>. Therefore, blockchain technology does not conflict with Islamic teachings, because technology is always considered permissible in Sharia. As the using matter of the technology is what makes it permissible or forbidden operations (halal or haram)<sup>5</sup>. As making a closer look on blockchain technology indicates that its structure, content, and implications

<sup>1</sup>- Osama Hamza, Op.cit, p 06.

<sup>2</sup>-Ibid, p 06.

<sup>3</sup>- Nurul Izzati Septiana, Hilda Sanjayawati: Sukuk on Blockchain: Application, Advantages, and Challenges, JIHBIZ, Vol.05, No.02, 2021, p 125.

<sup>4</sup>-Accounting and Auditing Organization for Islamic Financial Institutions in its Shari'ah Standard No.10, Salam, Bahrain, 2017, p 279.

<sup>5</sup>- Aldi Khusmufa Nur Iman, Sirajul Arifin, Op.cit, p 254.

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are all in line with Islamic principles, because it promotes irrevocability and transparency in financial affairs. In addition, financial and commercial transactions in Islam are characterized by transparency, fairness and accountability; which make the concept of smart contracts as one of the close concepts of the contract's concept in Islamic doctrine. Therefore, it is compatible with the goals of Sharia in ensuring transparency in commercial and financial transactions. Thus, the Islamic finance industry can greatly benefit from blockchain technology, which could provide services in accordance with Sharia provisions<sup>1</sup>.

### 2. Smart Sukuk Working Mechanism

Smart sukuk process involves the use of blockchain technology to issue and manage sukuk, which provides a more efficient and transparent way to issue and manage sukuk that are compatible with the principles of Sharia. This involves working with Sharia advisors to ensure that are compliant with Islamic finance principles, which in turn help in attracting more investors to the Islamic financial market. Therefore, this part introduces the main parties involved in smart sukuk issuing process, as well as the main stages of their processing and the role played by blockchain technology in sukuk industry.

#### 2.1. Smart Sukuk Issuing parties

A standard sukuk issuing process passes through different parties, consisting at least of five (5) parties such as: the originator, a special purpose company (SPV), investors (sukuk holders), investment trustee, and international rating agencies. Also, the number of these parties can be increased depending on sukuk types. For instance, musharaka and mudarabah sukuk require a manager to manage the project. Ijarah sukuk also require the presence of a lessor, lessee and service agent. Which means, there is a possibility of increasing the number of individuals interacting in the issuing process to more than five (5) elements/individuals. This in turn may require more costs, so blockchain-based sukuk eliminate these additional parties and additional costs. In contrast, smart sukuk consist of three main parties in a maximum as illustrated in the table (III-2) below.

**Table (III-2): The Main Parties in Structuring Smart Sukuk**

Parties	Roles and Responsibilities
User/Issuer	<p>A legal entity which offers and issues sukuk; it can either be an obligor or an SPV.</p> <ul style="list-style-type: none"><li>➤ Obligor: an entity, which needs funding. It raises smart sukuk and offers them to investors, and it is responsible for paying sukuk holders the dividends and the principle amount at the redemption date.</li><li>➤ Special purpose vehicle (SPV): is a separate legal entity aims to protect originator's and investors' underlying assets in case of deficits. Its main role is to facilitate the issuance of sukuk and their structures for various purposes, including tax efficiency and asset protection, as well as input data (transactions) into the</li></ul>

<sup>1</sup>- Aishah Muneeza, et al.: The Application of Blockchain Technology in Crowdfunding towards Financial Inclusion via Technology, International Journal of Management and Applied Research, Vol.05, No.2, 2018, p 91.



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	system (platform). These data should be ensured by Sharia and legal advisers who legally organize the structure of smart sukuk.
Smart sukuk developers	They are (software experts), and services providers, who develop blockchain platforms for smart sukuk transactions and contractual agreements, i.e., who create and deploy the network for smart sukuk and transactions between sukuk investors and obligors/users
Sukuk holders (Peers)	Peers are users and owners of the investments in the platform (investors). They agree on the number of sukuk and pay the principal amount to the SPV in return for sukuk certificates. They propose blocks to add to the sukuk chain while another peer (sukuk holder) validates the proposed blocks, and the last peer (sukuk holder) strives to reach consensus.

**Source:** Saheed Abdullahi Busari, Sikiru Olanrewaju Aminu: Application of blockchain information technology in Sukuk trade, Journal of Islamic Accounting and Business Research, 2019, p 06.

In addition to the three main aforementioned parties, such issuing process may require an intervention of an investment bank, where it can be individually or as part of group, acting as lead manager underwriting, or rating advisor, or book manager, or offering arranger<sup>1</sup>.

### 2.2. Smart Sukuk Securitization Stages

Smart sukuk process passes through three (3) main phases, from the issuing phase until the extinguishing phase, as described below:

#### 2.2.1. The Issuance of Smart Sukuk

Any smart sukuk issuing structure goes through numerous steps as follow<sup>2</sup>:

**a. The issuing process announcement:** It is the first step in smart sukuk issuing process, where the special purpose vehicle (SPV)/Obligor announces the issuance of blockchain sukuk for sale to all investors through smart contracts platform. The issuer creates smart contracts that outline the terms and conditions that determine this issuance under Sharia principles. Smart contracts in turn are programmed to be automatically executed when certain conditions are met. The issuer, here, choose the blockchain platform, which is suitable for issuing and managing smart sukuk, because the platform should have the necessary features to ensure transparency, security and efficiency that attract investors' interests. Figure (III-10) below illustrates the role of smart contract in the issuing phase;

<sup>1</sup>- Nurul Izzati Septiana, Hilda Sanjayawati, Op.cit, p 124.

<sup>2</sup>- Based on the following :

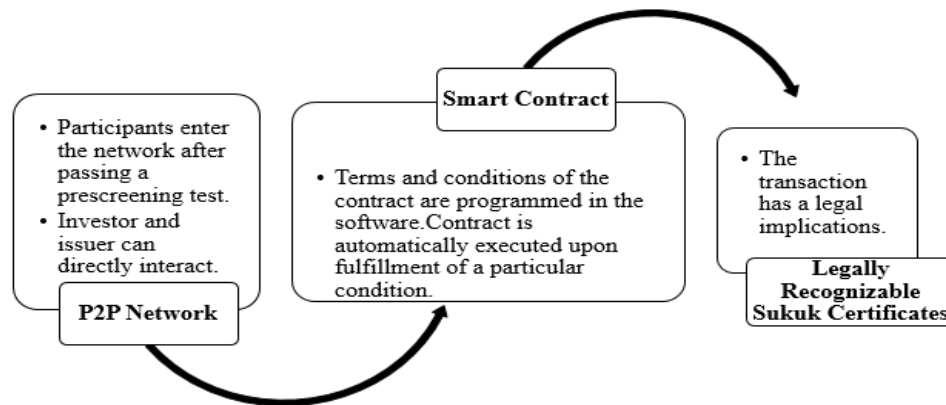
- Babas Mounira: Blockchain Sukuk Industry... A Revolution In The World Of Model A As Experience Platform Wethaq - Sukuk Investment, Journal of Financial, Accounting and Managerial Studies, Vol.09, No.02, 2022, pp. 11-12.

- Benalkama Malika: Sukuk Tokenization: Successful Experiences, Journal of Studies in Economics and Management, Vol.04 No.01, 2021, p 914.

- Osama Hamza, Op.cit, p 04.

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Figure (III-10): Using Smart Contract in the issuing process



**Source:** Sarah Iftikhar, Irum Saba, Blockchain Based Smart Sukuk as Shariah Compliant Investment : Avenues for Islamic Financial Institutions in Pakistan, Journal of Finance & Economics Research, Vol. 5, No.01, 2020, p 42.

**b. The transmission process:** The second step may pass through the intervention of the bank, using banking services or any authorized investment institution using mobile application or the bank's web site. As, investors pass their requests to purchase smart sukuk from the bank branches using mobile application or online banking services. After that, these requests pass through smart contracts on blockchain platform, which are linked to the banks' web sites and mobile applications;

**c. The distribution list:** After completing the collection of requests, the SVP company and the investor's bank start to distribute and classify the list of smart sukuk over their holders as a third step in this process;

**d. Tokenization:** It also called "digital securitization", in this step, sukuk are tokenized, which means that they are converted into digital Tokens, and here sukuk can be traded on blockchain platform as encrypted sukuk. Tokens resemble the digital representation of sukuk ownership. This process is automatically done through smart contracts based on Sharia principles from two sides. Firstly, the bank determines the value of smart sukuk in the Token account in its platform. Secondly, SPV equivalent the encrypted sukuk to fiat currencies at the clearing day;

**e. The approval and registration procedures:** At this stage, the central registry institution (securities clearing and settlement institution) will automatically approve smart contracts in order to complete the clearing transaction on the settlement day, and the transactions will then be recorded in the nodes of the bank and the central registry institution;

**f. Transferring the encrypted sukuk to the clients' wallets:** Following the central registry institution's automatic approval procedure, the necessary sukuk tokens will be transferred to the clients' wallets.

### 2.2.2. Smart Sukuk Trading Process

In blockchain sukuk version, the certificates are issued to primary subscribers and investors, and they are distributed to them as tokens (cryptos), which represent their ownership of the underlying asset and dividend payments. Here in this phase, after the sukuk tokenization phase, the tokens are listed on digital exchange where investors can buy and sell them<sup>1</sup>. The exchange

<sup>1</sup>- Sherin Kunhibava, Zakariya Mustapha, Op.cit, p 123.

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provides liquidity to sukuk market, and enables investors to easily trade their tokens. Also, investors could trade their tokens on the secondary market, as the trading process of smart sukuk could be done through the interventions of the buyer, purchasing bank and the settlement bank, as depicted in the figure(III-11) below.

**Figure (III-11): Smart Sukuk Trading Process**



**Source:** Osama Hamza: Smart Sukuk Structure from Sharia Perspective and Financing Benefits: Proposed Application of Smart Sukuk through Blockchain Technology in Islamic Banks within Turkey, *European Journal of Islamic Finance*, Second Special Issue, 2020, p 05.

As shown in the figure above, the trading process of smart sukuk passes through the following acts<sup>1</sup>:

1. The bank (sukuk sales bank) notifies the network and blockchain system of the desire to sell sukuk at a specific quantity and price;
2. The bank, that desires to purchase sukuk, transmits the demand from the system and provides access to the Tokens in its account;
3. Transactions between the two banks are done based on tokens using smart contract platform, i.e., from sukuk tokens as a representation of sukuk to Tokens as a representation of fiat coins in the account of investors;
4. Based on smart contracts, the clearing of transaction will be approved by the clearing institution, and it will perform automatically via the settlement bank at the settlement date.

### 2.2.3. The Settlement Process of Smart Sukuk

The settlement process is done via the intervention of the securities clearing and settlement institution that is used to facilitate the transfer of funds between the issuer's bank account and investors' bank accounts when they sell their tokens. As it said before the transaction between the selling and purchasing bank is done based on tokens, here the role of the settlement bank is to exchange funds between the two banks. Which involves converting the virtual value as tokens into a real cash value. This process is done through two phase<sup>2</sup>:

- The first phase at the settlement day takes place between the clearing and settlement institution and the issuer bank, where Tokens (cryptocurrency) are sent to the issuer

<sup>1</sup>- Osama Hamza, Op.cit, p 05.

<sup>2</sup>- Babas Mounira, Op.cit, p 13.

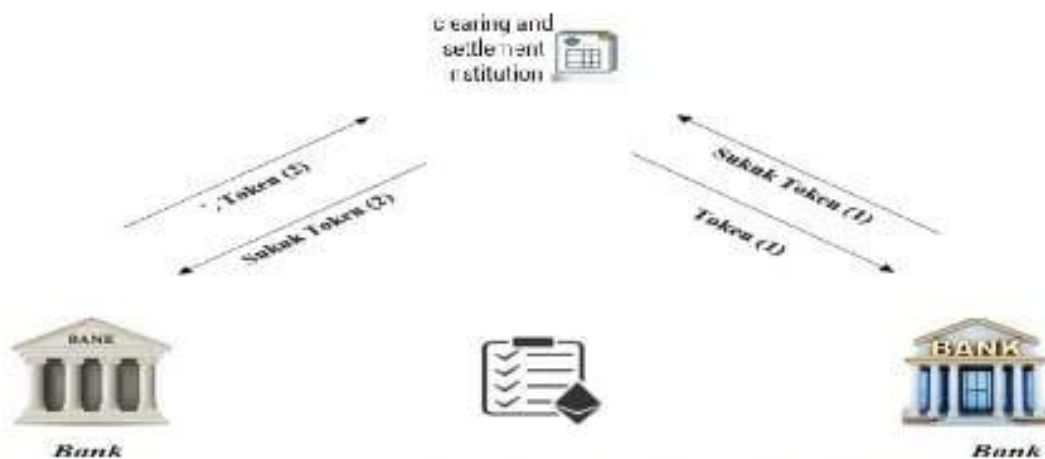
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bank by the settlement bank of the securities clearing and settlement institution through smart contracts and the encrypted sukuk, i.e., sukuk token are automatically transferred to the securities clearing and settlement institution as a first step in this process;

- The second phase takes place between the clearing and settlement institution and the purchasing bank, i.e., the investors' bank, where the bank provides the Tokens in their investors' account to purchase sukuk from clearing institution, whereas the clearing institution provides sukuk tokens, as an exchanging operation.

Thus, the transaction is stored in the nodes of the banks and the securities clearing and settlement institution, which are connected to blockchain platform as shown in figure (III-12). Smart contracts in turn ensure that the returns are paid automatically and transparently.

**Figure (III-12): Transaction settlement of smart sukuk**



**Source:** Osama Hamza: Smart Sukuk Structure from Sharia Perspective and Financing Benefits: Proposed Application of Smart Sukuk through Blockchain Technology in Islamic Banks within Turkey, *European Journal of Islamic Finance*, Second Special Issue, 2020, p 05.

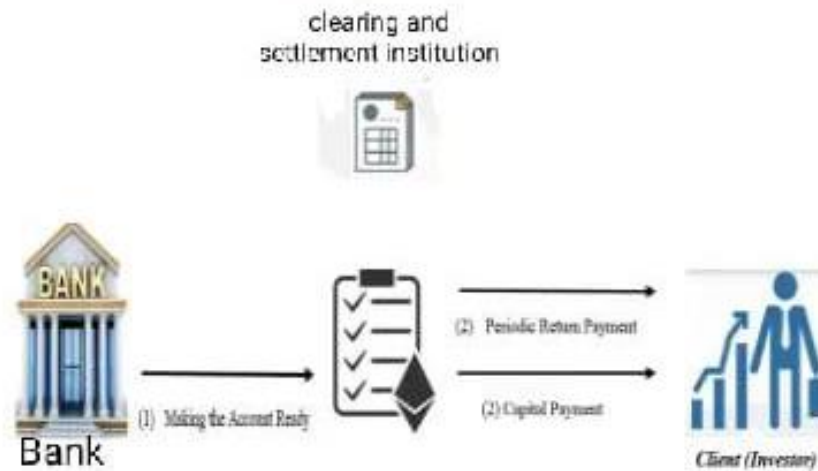
### 2.2.4. The Extinguishing of Smart Sukuk

Smart sukuk are extinguished in the same manner as conventional sukuk, either by paying the total cash value of sukuk, or by making periodic payments. The only difference here is that this process is done through smart contracts, where the payment of returns are paid automatically and transparently based on the terms and conditions of sukuk as shown in figure (III-13). The obligor pays the installments as agreed to the SPV, and the SPV transfers the required profit from the proceeds of the payment to the various investors<sup>1</sup>.

<sup>1</sup>- Nida Khan, et al.: Tokenization of Sukuk: Ethereum Case Study, Preprint submitted to *Global Finance Journal*, 2020, p 17.

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Figure (III-13): Smart Sukuk Extinguishing



**Source:** Osama Hamza: Smart Sukuk Structure from Sharia Perspective and Financing Benefits: Proposed Application of Smart Sukuk through Blockchain Technology in Islamic Banks within Turkey, *European Journal of Islamic Finance*, Second Special Issue, 2020, p 05.

From the figure above, the extinguishing process is done as follow<sup>1</sup>:

- At the time of extinguishing, the issuer bank makes the Tokens account ready to cover the extinguishing amount as a periodic payment for the investors; Investors are accessed through their Ethereum smart contracts addresses, and the profits are distributed to the investors depends on the number of sukuk; and
- The system as a reacting act automatically based on smart contracts makes the payment to the clients' accounts, and in the same time sukuk tokens are erased from the system.

### 2.3. The Role of Blockchain in Sukuk Industry

Blockchain could improve sukuk industry and enhance the rapid access to sukuk market making investors in touch with the real time records and movements of sukuk. Thus, the role of blockchain technology in sukuk industry could be summarized in the following items:

**a. Reducing Costs:** The advantage of executing sukuk on blockchain is represented through the comparison of issuing costs. As, it is evident that tokenizing sukuk on smart contracts' blockchain saves money as compared to the issuing process of conventional sukuk. Blockchain technology can reduce transaction costs by reducing or eliminating the role of intermediaries and exchange fees. Thus, financial services firms may take an advantage of this by making not only faster transactions but also cheaper one. Moreover, blockchain technology has the potential to greatly improve the efficiency of information processing greater than the paper based process<sup>2</sup>.

**b. Transparency:** Technically speaking, sukuk transactions on blockchain are connected to one another in chronological sequence like a chain of substances. The sukuk chain order is publicly available to all chain members, and provides a hash of the preceding sukuk block

<sup>1</sup>- Osama Hamza, Op.cit, p 05.

<sup>2</sup>- Aldi khusmufa Nur Iman, Sirajul Arifin, Op.cit, p 017.

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published on a database of records. As, before agreements are finalized and become legally binding, the majority of participants will confirm sukuk chain transactions. As a result, once transactions are recorded in the database, the data cannot be removed. In addition to broadcasting to each node in the sukuk chain network in a public ledger, the receiving entity of sukuk is the owner of the digital signature that authenticates sukuk transaction on the public platform. In its turn, the system prevents the double spending, because it broadcasts the transactions among the computers of the participating investors/nodes, which confirms the transparency over all the network<sup>1</sup>.

**c. Regulation:** The implementation of blockchain technology streamlines the format of sukuk issuing and trading operations, and enhances regulatory monitoring; as smart contracts help in standardizing and automating the legal costs, accounting expenses and payments related to sukuk. Furthermore, the transactions are visible, traceable, and auditable. This enables a single record presentation to have a seamless influence on the audit process, allowing regulators to more easily watch and interfere only when it is necessary<sup>2</sup>.

**d. The settlement process:** blockchain makes clearing and settlement procedures more efficient by ensuring automatic delivery and payment methods without the need for a central authority. This considerably reduces the risk of the settlement process. Furthermore, blockchain can significantly reduce expenses, especially when it comes to settlements, which may be reduced by more than 99% . As well as, counterparty risk is further reduced because the settlement takes place in a real time.<sup>3</sup>

### 3. The importance of Smart Sukuk in Financing Economic Development

Sukuk are generally considered financial instruments associated with real investment, and this is what drives them to be one of the best instruments for achieving economic development. Smart sukuk, in turn, could be among the most important financial investment options in our world today, especially after technology has invaded the financial world. Therefore, smart sukuk could be adopted in the process of achieving economic growth. In this sense, the relationship between smart sukuk and the various fields of economic development can be clarified as follows:

#### 3.1. The Role of Smart Sukuk in Collecting and Mobilizing Financial Resources

Smart sukuk as conventional sukuk are characterized by its ability to collect, and mobilize savings of various categories due to the diversity of their terms between short, medium and long term, and the diversity of their categories in terms of their value and their purposes, Also in terms of the diversity of the method of obtaining returns, as well as the liquidity derived from the trading possibility in the secondary market. In addition to these advantages, sukuk do not being exposed to interest rate risk, especially in the fact that their returns are not linked to the interest rate because they do not deal with it in the first place. Moreover, smart sukuk as conventional ones, which are not exposed to inflation risks, but they are positively affected by inflation because these sukuk represent real assets in the form of properties and services, whose

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<sup>1</sup>- Saheed Abdullahi Busari, Sikiru Olanrewaju Aminu, Op.cit, p 05.

<sup>2</sup>- Babas Mounira, Op.cit, p 10.

<sup>3</sup>- Aldi khusmufa Nur Iman, Sirajul Arifin, Op.cit, p 17.

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prices rise with the rise in the general level of prices, which leads to an increase in sukuk returns<sup>1</sup>.

### 3.2. The Role of Smart Sukuk in Financing Investment Projects

Focusing on the internal sources, especially for the developing countries to provide financial resources is the best option for financing investment projects, because they can be linked to real investments. The significant of Islamic financial industry does not rely only in the ability of financial innovations to mobilize financial resources, but rather in the way of using these resources to bring those resources closer to the desired development goal. Therefore, the efficiency of collecting financial resources through sukuk issuance is equivalent to its ability to mobilize these resources. As smart sukuk vary in a way that makes them suitable for different economic sectors and projects. For instance, smart murabaha sukuk are suitable to commercial business, smart salam sukuk in turn are most suitable for financing agricultural projects, extractive industries and craftsmen, while smart istisna sukuk are used in financing the construction and real estate sector. However, despite the importance of these formulas in financing investment projects, smart musharaka sukuk are considered as the most suitable for financing all long, medium and short-term investments types, including commercial, industrial, agricultural and service, due to their provisions flexibility<sup>2</sup>.

### 3.3. The Role of Smart Sukuk in Financing Infrastructure Projects

Sukuk meet the needs of countries in financing infrastructure projects that require a large capital to be built, instead of relying on treasury bonds and public debt. For instance, governments could issue smart ijarah sukuk to finance public projects, such as financing the construction of bridges, airports, roads, dams, and others. Where the government here is the lessee and sukuk holders are the owners of these properties leased to the state, then the government- as a lessee - makes these projects available for use to citizens. Smart ijarah sukuk could also be used to finance housing and real estate development programs, as Build–Operate–Transfer projects (BOTs) are one of the most known example that are based on sukuk structure, which allow developing economies to meet their liquidity needs without using interest-based financing methods<sup>3</sup>.

### 3.4. The Role of Smart Sukuk in Reducing the Budget Deficit and Indebtedness

Sukuk open the door for public participation by individuals to meet the financing needs necessary to support the public budget, which expresses the financial program expected to be implemented by the government to achieve its economic and non-economic goals. Therefore, it needs huge funds to implement its economic programs and bridge the existing budget deficit. As the government could issue smart musharaka sukuk to fill the deficit in its budget, and invest its returns in generating income projects such as power plants, ports, and others<sup>4</sup>. In addition, it could use smart mudarabah sukuk in generating profit projects, in a way that does not required the participation of the owners (sukuk holders). Governments could also face the budget deficit and indebtedness problem using smart ijarah sukuk to provide social services such as education, health and transportation services. Government's loans could be also exchanged in the form of

<sup>1</sup> -راضية لسود، سامية بولعسل: تجارب عالمية ناجحة في إصدار الصكوك الإسلامية لتمويل التنمية المستدامة وآفاقها في الجزائر، مجلة نماء للاقتصاد والتجارة، المجلد 01، 2018، ص 7.

<sup>2</sup> - معطى الله خير الدين، شرياق رفيق، مرجع سبق ذكره، ص 19.

<sup>3</sup> -طوالبية نماد، بلول لطيفة، مرجع سبق ذكره، ص 06.

<sup>4</sup> - باهي نوال، أمين فريد، مرجع سبق ذكره، ص 139.

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smart istisna sukuk to produce the commodities they need. Moreover, financing government spending through real asset-based sukuk keeps public spending under control because the availability of financing without tangible assets is limited<sup>1</sup>.

### 3.5. The Role of Smart Sukuk in Revitalizing the Financial Market

Smart sukuk could play a major role in consolidating and developing the financial market in general and the Islamic financial market in particular. The great and effective role of listing sukuk in the stock exchanges through creating financial investments and trading them in the stock market helps to create investment opportunities and direct savings for various investment channels, which is a vital matter that drives economic growth and enhances the vitality of the stock market. The investment diversity that characterizes smart sukuk, both traditional and smart, makes it a vital and appropriate instrument for financing all investments types<sup>2</sup>. Therefore, smart sukuk can be used to finance projects in various sectors: agricultural, industrial, and real estate. Moreover, it is expected to improve the stability of financial markets and institutions, as they are based on tangible assets. Which, in turn, strengthens the relationship between the real sector and the financial sector.

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<sup>1</sup>- Velid Efendic, et al.: Critical Issues and Challenges in Islamic Economics and Finance Development, Springer Nature, Switzerland, 2017, p 01.

<sup>2</sup> - العرابي مصطفى وآخرون: دور الصكوك الإسلامية في تمويل الاقتصاد-ماليزيا نموذجاً-، مجلة البشائر الاقتصادية، المجلد الثالث، العدد 01، 2017، ص 72.



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### Summary

The term sukuk is applied to financial instruments offered by banks, Islamic financial institutions, and other individuals as a substitute for interest bonds. There are different sukuk structures, including sukuk issued for financing purposes and others issued for investment purposes. They can also combine the two purposes through hybrid sukuk. Generally, sukuk are structured according to specific needs and requirements to meet market demand. As, they are one of the most prominent Islamic financing instruments, as they represent one of the means of attraction savings to finance several projects and economic activities that serve national economies. This financial instrument provides unique financing opportunities for public and private projects, providing individuals with the opportunity to participate in supporting the needs and requirements of the economic development.

Islamic financial market, as an integral part of the Islamic financial system, plays an important role in financing investments, although its functions are similar with conventional financial market, the way it is structured may differ from the conventional one. As it provides a sustainable way that could match different investors' needs based on its two markets, money and capital markets; using its several financial instruments especially sukuk, which are one of the most knowing Islamic financial instrument. Sukuk market in turn has a continuous development leading by sovereign and semi sovereign entities. However, recently it faces many challenges such as the lack of standardization, limited accessibility, and lack of transparency, and different operating costs, which could delay its potential growth. Therefore, blockchain technology was adopted as a solution to address and confront the challenges that contributed to the emergence of smart sukuk.

Smart Sukuk are the digital generation of conventional sukuk, which are based on blockchain technology. Their unique structure seeks to use technology to provide a secure, efficient and transparent way to issue and manage sukuk in a manner compatible with Islamic Sharia principles, enabling SMEs to issue their own sukuk based on technology. The tokenization process is the digital representation of sukuk securitization, which passes through four stages: issuance, trading, settlement and extinguishing, all of them are based on smart contracts, which ensure the full-automated sukuk processing. Sukuk are generally considered financial instruments associated with real investment, and this is what drives them to be one of the best instruments for achieving economic development, hence smart sukuk, in turn, could be among the financing alternatives for reach the development in our today world, which could play an important role in collecting and mobilizing financial resources, financing investment projects, financing infrastructure projects, reducing the budget deficit and indebtedness, as well as revitalizing the Islamic financial market.

# Chapter Four

## **Chapter Four: Leading Model Experiences of Smart Sukuk Industry**

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### **Preface**

Blockchain technology constitutes one of the foundations for supporting the digital economy, which revolutionized the global financial services industry, within the framework of the Fourth Industrial Revolution 4.0. This technology has contributed to reduce expenses and speed up the access to financial products. Many companies tended to invest in the development of the applications based on blockchain technology, which provided a promising opportunity for emerging companies to provide financial innovations that would develop financial markets, and automate the securities working mechanism, moving to a digital era. Smart sukuk based on blockchain technology is one of these securities that can be used to mobilize capital to finance small and medium enterprises, and thus get more accessibility to the Islamic financial market, providing innovative products at low costs, which could develop their framework and productivity. Therefore, this chapter comes to present the most important pioneering experiences in smart sukuk industry taking place in Indonesia, the UAE, and Saudi Arabia; presenting their advantages, which modernize the Islamic financial market, as well as the most important challenges facing their applications such as regulatory and legal, Sharia, cyber risks, technological infrastructure. It also addresses the ways of integrating smart sukuk into the Algiers stock exchange based on these experiences. Thus, this chapter is divided as follows:

**Section one: Smart Sukuk Experience in Indonesia**

**Section Two: Smart Sukuk Experience in the GGC Countries**

**Section Three: Blockchain Application Challenges in the Islamic Financial Market**

**Section Four: The Adoption of Smart Sukuk in Algeria and its challenges**

### Section One: Smart Sukuk Experience in Indonesia

The first smart sukuk was introduced by Blossom Finance, a Fintech company founded by Matthew J. Martin in Indonesia. It is a startup that was initially founded in San Francisco before moving to Jakarta with the aim of concentrating on microfinance in Indonesia. Blossom Finance is in charge of the micro-sukuk issuance plan that would finance Indonesia's Baitulmal WA Tamwil (BMT). It presents its smart sukuk platform for the first time in an effort to automate and standardize the sukuk's accounting, legal, and payment processes, aiming to enhance the funding system of microfinance sector, which recently mostly depends on banks, and to develop the rapid access to Islamic financial services in sukuk market. In this regard, this part provides a short profile of Blossom Finance Company, and its smart sukuk issuing process using Ethereum smart contracts platform to finance Baitulmal Wa Tamwil needs.

#### 1. Blossom Finance Smart Sukuk Platform

##### 1.1. Blossom Finance Background

The idea of Blossom Finance Company goes back to the Silicon Valley venture capital startup incubator program in San Francisco, California, USA in October 2014. This startup company of financial technology is funded by Silicon Valley with the aim of dedicating an ethical financial services based on Islamic principles of equal opportunities, participation, and financial inclusion. In fact, at the beginning, Blossom Finance is an Indonesia-based Islamic Fintech that uses Blockchain to offer funding for small businesses based on crowdfunding<sup>1</sup>. In July 2015, it launched a microfinance pilot to invest in micro-businesses around Jakarta metro area. Once more in June 2016, it invested in 95 micro-businesses and earns 15.4% in 12 months as returns. In May 2018, it announced Smart Sukuk Platform at Islamic finance news conference in Kuala Lumpur, Malaysia. As, it launched its first blockchain sukuk in the world in September 2019 to fund Baitulmal WA Tamwil (BMT) in Indonesia<sup>2</sup>. It has been awarded as the most innovative use of blockchain for Islamic finance by “Islamic finance news” in 2018 and the most outstanding Islamic micro-credit company by “KLIFF”<sup>\*</sup> in 2019<sup>3</sup>.

Blossom Finance takes the sukuk industry to a new level using smart contracts, especially when its core structure is risk-sharing in nature and asset-backed. These sukuk become a perfect match for the Islamic model of crowdfunding. It is worthy to note that Blossom Finance provides funds only to microfinance institutions that operate on the principle of profit and loss sharing. Blossom's smart sukuk product will not charge any upfront fees or costs to institutions or investors, as it is normally the practice within conventional sukuk. Alternatively, Blossom only makes money if investors make profits, and it may lose if the investors fail to make any profit. This is exactly the Islamic system of sharing profits and losses collectively<sup>4</sup>.

Since 2015, Blossom Finance has been helping microfinance institutions in Indonesia to raise money from international investors to finance small businesses aiming to reduce regional

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<sup>1</sup>- Margarita Peredaryenko : FinTech, Blockchain, and Islamic Finance – Building the Future in the New Islamic Digital Economy, Emir Research, Malaysia, 2019, p 174.

<sup>2</sup>-The Official website of Blossom Finance, available at: [www.blossomfinance.com](http://www.blossomfinance.com), Consulted on 04/07/2023.

\* KLIFF stands for Kuala Lumpur Islamic Finance Forum (Malaysia). It is Islamic Finance Awards forum that recognise and acknowledge the significant efforts and contributions by individuals and institutions in developing the Islamic Banking and Finance industry.

<sup>3</sup>- Matthew J. Martin: Blossom: Halal & Ethical Investments Using Sukuk, Good returns, Great impact, no date, p 31.

<sup>4</sup>- Margarita Peredaryenko, Op.cit, p 176.

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poverty using crowdfunding platforms. Therefore, Blossom's smart sukuk principles tend to help institutions raise cost-effective, Shariah-compliant financing from global investors (foreigners) using blockchain technology<sup>1</sup>. The network of Blossom Finance contains<sup>2</sup>:

- 370,000 members and customers: They are BMT microfinance cooperative holders, and those who receive funding ;
- 900 branch locations: that provide banking facilities to local communities;
- A total of 6 326 BMT cooperative microfinance institutions.

In short, Blossom Finance is a microfinance platform that facilitates interest-free investments and promotes profit sharing among small businesses. This feature provides investors with high-yielding investment options, from which Blossom earns co-funds raised. It aims to expand financial access in developing countries. As according to the World Bank report of 2017, there is a fundamental gap in developing countries, especially Islamic countries, where the percentage of citizens who do not have banking accounts reaches to 76%, and who do not have an access to basic financial services<sup>3</sup>. Therefore, this company was established to solve the problem of the financial gap in accordance with the provisions of Islamic Sharia using the Indonesian financial market. Thus, it firstly began raising money on a crowdfunding basis, where borrowers and lenders are matched directly through Blossom blockchain platform<sup>4</sup>.

### 1.2. Sukuk Mechanism Based on Blossom Finance Platform

In Indonesia, sukuk issuance limited to government and large institutions due to the high issuing costs and complexity. Recently, Blossom Finance announced a new approach aiming to change this situation using blockchain in the issuing process.

#### 1.2.1. Smart Sukuk Structure on Blossom Finance Platform

Blossom smart sukuk platform is structured on Ethereum blockchain layer, which is created through smart contracts. As, these contracts encode business rules directly into the underlying payment process, which ensures the execution of contract terms, relating to the transfer of the ownership of assets and the payments of the owners. Blossom Company chooses three specific structures for smart sukuk as initial issuance: Mudaraba, Istisna, and Ijara smart sukuk. Mudaraba sukuk (profit-sharing sukuk) have been allocated to raise funds for small companies, while istisna and ijarah sukuk have not yet been activated, as they are intended to finance construction projects such as building hospitals or schools. Upon completion, the hospital operators will lease the facilities from sukuk investors in exchange for a specific profit margin<sup>5</sup>. For instance, figure (IV-1) illustrates the working mechanism of Blossom smart sukuk for construction projects

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<sup>1</sup> - The Official website of Blossom Finance company, Op.cit, Consulted on 04/07/2023.

<sup>2</sup>- Matthew J. Martin, Op.cit, p 24.

<sup>3</sup>- The World Bank Annual Report, 2017, p 10.

<sup>4</sup>- Matthew J. Martin, Op.cit, p 28.

<sup>5</sup>- The Official website of Blossom Finance company, Op.cit, Consulted on 04/07/2023.

**Figure (IV-1): The Working Mechanism of Blossom’s Smart Sukuk for Construction Projects.**



**Source:** The official website of Blossom Finance company, available at: [www.blossomfinance.com](http://www.blossomfinance.com), consulted on 04/07/2023.

Any institution seeking to raise funds could issue smart sukuk on Blossom platform, which enable investors to provide money in return for smart sukuk tokens., which are the digital representation of Blossom sukuk ownership. Through blockchain technology, the funds invested in sukuk will be accurately tracked to know where and for what purposes they are used by the network. This verification can be performed by encrypting and embedding the approved certificate in the blockchain in PDF form, where it cannot be tampered with or modified. Additionally, smart contracts on Blossom blockchain platform support a standard protocol called ERC20, which allows sukuk tokens to be traded globally on a variety of public cryptocurrency stock exchanges<sup>1</sup>. Therefore, investors are issued an ownership stake in smart sukuk, which represents their partial ownership in the asset, in addition to sukuk ownership terms. When the institution makes the payment, the funds are automatically distributed back to the holders of smart sukuk in form of Tokens via blockchain according to the rules of the smart contracts, without the need for traditional banks or intermediaries. Investors can also hold sukuk until their maturity dates, or they can sell their sukuk ownership to a third party. This subsequent sale to a third party is known as “a secondary trading”, as it is what distinguishes sukuk as “securitized” asset<sup>2</sup>. For the Indonesian framework, sukuk are only permissible (halal) if the real ownership of the underlying asset is legally transferred to the holders. Also, for the trading of smart sukuk in cryptocurrency, this is not permissible unless the government allows the possibility of trading. Blossom Finance points out that cryptocurrencies such as Bitcoin and Ethereum are allowed based on their attributes, but Muslims may not use them if they are banned by their local government. Therefore, Blossom smart sukuk support the issuance of sukuk in fiat currency and eliminates the need for institutions to add cryptocurrencies to their balance sheet. Blossom Finance uses Ethereum as a means of collecting and sending international

<sup>1</sup>- Dhiaeddine Rejeb, Op.cit, p14.

<sup>2</sup>- Elasrag Hussein: Blockchains for Islamic finance: Obstacles Challenges, Munich Personal RePEc Archive, 2019, p25.

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payments, and as a ledger system to maintain a record of ownership, and also a technology for trading on global stock exchanges. In short, Blossom does not issue any cryptocurrency-based sukuk, based on the fact that the cryptocurrency is volatile and does not encourage Muslims to make purely speculative investments. Therefore, all Blossom smart sukuk will be based on real projects linked to productive economic activity and the legal currency<sup>1</sup>.

### 1.2.2. Features of Blossom Finance Smart Sukuk

Blossom smart sukuk are characterized by the following<sup>2</sup>:

- Blossom's smart sukuk are based on assets rather than debt, and they entails taking on risk rather than transferring it;
- To improve efficiency, the Blossom Finance platform leverages Ethereum smart contracts and make them globally accepted. The main significance of smart sukuk is to standardize and automate the accounting, legal payments and overheads of traditional sukuk offerings; all of which will be fully supported by a licensed legal entity in the country of issuance;
- Regarding fees, Blossom will not impose any upfront fees or costs on institutions or investors concerning their microfinance smart sukuk. Instead, Blossom will receive a 20% as a share of the investor's profits, called the carried capital profit. This means that Blossom only makes money if investors succeed in making money, and it may lose if the investors fail to make any profit in the deal, and this is exactly the Islamic system of sharing profit and loses collectively;
- In terms of the pricing model, Blossom aligns its incentives with those investors in order to have a pure profit-sharing commission structure.

## 2. BMT Smart Sukuk based on Blossom Finance Platform

Indonesia is one of the largest Islamic countries in terms of population, as it faces a real problem in reducing the phenomenon of unemployment, which has led to the spread of poverty among large segments of Indonesian people. Therefore, the government is working to provide all necessary assistance to Islamic financial institutions in order to support the government's efforts and plans to alleviate poverty among its population. As part of its strategy towards a better future for the work of Islamic microfinance institutions, the authorities have legalized the work of these institutions to help them work in a transparent and professional manner. The government's efforts in this context contributed to expand the activity of these institutions and increase demand for their services. It also encouraged financial technology companies to invest in the capital market enabling a larger segment of investors to benefit from these services through their platforms.

### 2.1. Islamic Microfinance in Indonesia

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<sup>1</sup>- The official website of Blossom Finance company, Op.cit, Consulted on 04/07/2023.

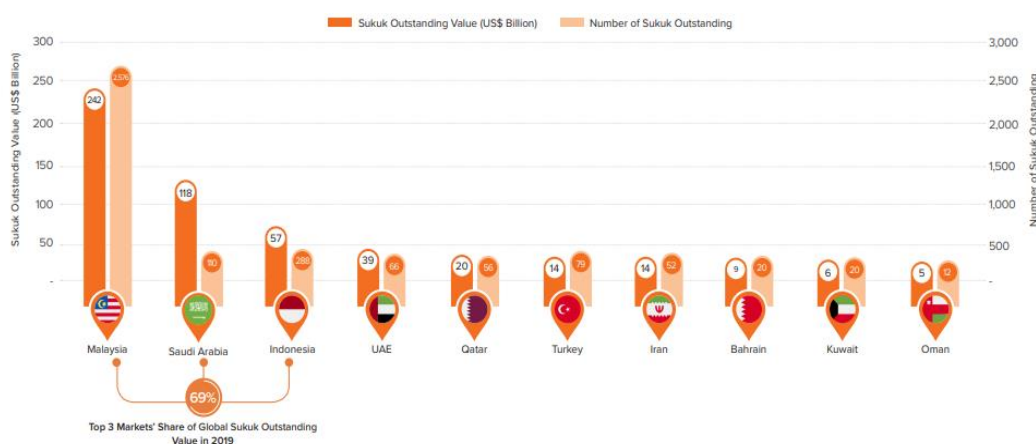
<sup>2</sup>- Ibid, Consulted on 04/07/2023.

## Chapter Four: Leading Model Experiences of Smart Sukuk Industry

Islamic microfinance institutions have become widely known over the past two decades, as institutions have played a pivotal role in combating poverty in Indonesia. These institutions assume the role of financing small projects for the poor and low-income classes. In fact, they differ in their work from traditional banks, through their participation in investor projects, and the growth of these institutions is due to their adoption of Sharia laws in their dealings with those who benefit from their services. As statistics indicate that 72% of Muslims in the world do not use banking services because they do not observe the provisions of Sharia prohibiting usury, gambling, and other taboos related to financial transactions<sup>1</sup>. Government support in Indonesia also pushed these institutions to greater success in the plan to combat poverty and improve the conditions of citizens, as the Islamic microfinance sector in Indonesia is part of the banking system, as there are approximately 5,500 financial institutions to finance small projects with a financial balance of up to US\$ 590 million. These institutions have contributed to finance small projects for many rural residents and areas where poverty and unemployment are widespread. These projects have helped residents to improve their living conditions. According to the report of the Ministry of Cooperatives and Small and Medium Enterprises in 2017, the number of small and medium enterprises in the country reached to 55.2 million. The total financing of BMT is based on the function of collecting and distributing funds in terms of zakat, takaful, charity, spending and endowment<sup>2</sup>. However, some projects require long-term capital, which makes it necessary to resort to the Islamic capital market to obtain long-term funds such as sukuk.

In fact, these micro enterprises do not have the opportunity to access the Islamic capital market due to the high cost of sukuk issuance in Indonesia, which basically its market depends on sovereign sukuk, that are of high values. The Indonesian government first issued sukuk in 2008, the issuance was based on Act No. 19 of 2008 regarding Sharia sovereign securities. Indonesia has the third largest sukuk market with markets' share of global sukuk outstanding valued at US\$57 billion in 2019 after Iran and Malaysia as shown in figure (IV-2).

**Figure (IV-2): Top Countries in Sukuk Outstanding in 2019**



**Source:** Islamic Finance Development Report: Progressing Through Adversity, 2020, p 39.

<sup>1</sup>- Amelia Ripal et al. : Analysis of Murabahah Financing Strategy in Increasing the Number of Members: A Case Study on BMT (Baitul Mal Wal Tanwil) Permata Indonesia Pekanbaru Riau, ADIJAYA, Vol.01, No.02, 2023, p 336.

<sup>2</sup>- Ibid, p 336.



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The sovereign sukuk dominate the total sukuk issuances in Indonesia due to the high cost of issuance, which prevents small investors to enter sukuk market, as sukuk are the preferred instruments for sovereign issuers in Indonesia to finance the budget deficit and maintain liquidity levels, as the total issuance of sovereign sukuk reached to US\$21 billion in 2019 that equaled to 94%, compared to non-sovereign sukuk (e.g. corporate sukuk and others), which represent 6% of the total sukuk that have issued in Indonesia<sup>1</sup>, as illustrated in figure (IV-3).

**Figure (IV-3): Countries with Largest Sovereign Sukuk Issuance in 2019**



**Source:** Islamic Finance Development Report: Progressing Through Adversity, 2020, p 39.

Therefore, Blossom in this aspect raises the idea of expanding access to sukuk market through its Ethereum blockchain platform, which is mainly derived from the idea of crowdfunding, in order to enable a larger segment of small investors to invest in sukuk market to finance their projects depending on Baitul Maal wa Tamwil (BMT), which is an Islamic microfinance cooperative based in Yogyakarta, Indonesia.

### 2.2. Baitul Maal WA Tamwil's Smart Sukuk

Baitul Maal wa Tamwil (BMT) is an Islamic financial institution in Indonesia that supports SMEs and entrepreneurs, who are usually excluded from traditional financing supports and assumes the role of promoting financing conditions for SMEs. Originally, the BMT model was firstly created in the late of the 1990s in response to the Asian financial crisis as a way to stimulate grass-roots economic growth and job creation; the BMT's underwriting model avoids consumptive loans, electing instead to finance productive business activity with the aim of increasing family household income<sup>2</sup>. BMT in Indonesia comes in a variety of sizes with assets under management of less than US\$1 million up to and exceeding the equivalent of US\$250 million. BMTs aim to eradicate poverty by providing free savings products to the working poor and financing to small businesses in order to help entrepreneurs start or develop their businesses, as they carry out small and medium industries such as handicrafts, food, clothing, and automotive parts. In addition to bank-like products, BMTs run various social impact programs in their local communities<sup>3</sup>. Generally, Indonesia's BMT model is widely considered

<sup>1</sup>- Islamic Finance Development Report, Op.cit, p 39.

<sup>2</sup>- Muhammad Akhyar Adnan: The effectiveness of Baitul Maal wat Tamwil in reducing poverty The case of Indonesian Islamic Microfinance Institution, Humanomics, Vol. 31, No. 2, 2015, p 162.

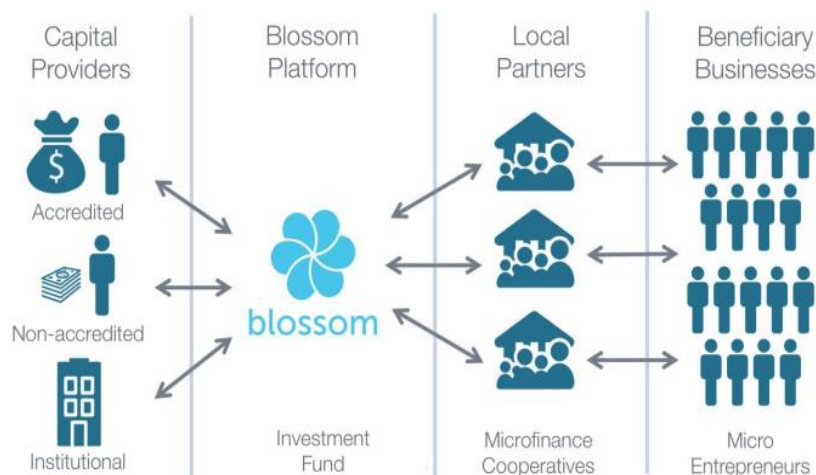
<sup>3</sup>- Ibid, p 162.

## Chapter Four: Leading Model Experiences of Smart Sukuk Industry

the most successful Islamic microfinance in the world. Therefore, given the technological development at the present time and the entry of many financial technology companies into the financial industry, these organizations had to embrace blockchain technology in order to stay up with the digital revolution and serve a broad range of investors with financial services..

In this regard, and since its public announcement in May 2018of, Blossom has focused its Smart Sukuk to finance Baitul Maal wa Tamwil institutions using Mudarabah structure on 29 September 2019, where investors receive dividend payments resulting from a portfolio of microfinance investments managed by BMT Bina Ummah\* as shown in the figure (IV-4)<sup>1</sup>. Blossom sukuk open new horizons for Islamic capital market innovation on multiple fronts as the first primary issuance on a public blockchain are representing in micro sukuk with small values. The platform supports both subscription and periodic payments made via any cryptos, tokenized asset, or fiat money. Its smart sukuk are compatible with ERC20 standards, which enable digital exchange via any existing blockchain wallets and can be easily listed on secondary markets<sup>2</sup>.

**Figure (IV-4): BMT Bina Ummah Smart Sukuk Based on Blossom Finance Platform**



**Source:** Matthew J. Martin: Blossom: Halal & Ethical Investments Using Sukuk, Good returns, Great impact, no date, p 19.

BMT Bina Ummah has raised Rp715 million (US\$50,456) through a primary sukuk issuance on blockchain via Blossom smart sukuk platform as summarized in table (IV-1)<sup>3</sup>. The raised funds, which are structured under smart mudaraba sukuk, denominated in local currency (Indonesian Rupiah), with a maturity of one year, i.e., 29 September 2020, as it is

\* BMT Bina Ummah is a model of “Baitul Maal wa Tamwil” institution founded in 1995; it has around 25,000 members (depositors).

<sup>1</sup>- The official website of Blossom Finance company, Op.cit, Consulted on 04/07/2023.

<sup>2</sup>- Elarag Hussein, Op.cit, p 25.

<sup>3</sup>- BMT Bina Ummah Report, 2020, p 01.

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used to expand funds for 234 local entrepreneurs to finance their agriculture and food distribution projects.

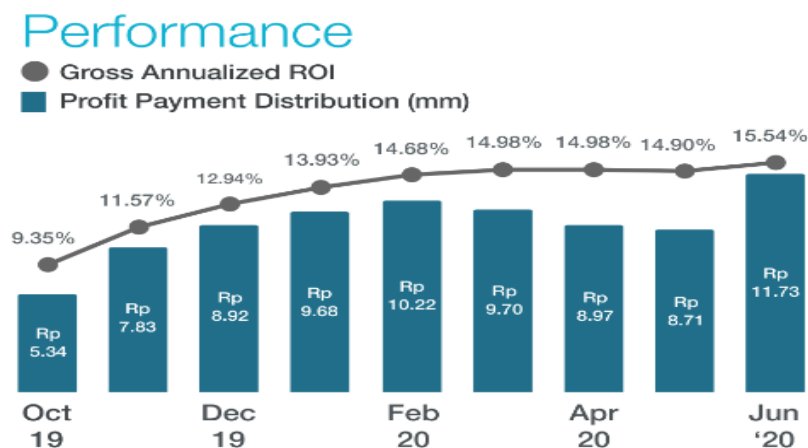
**Table (IV-1): BMT Bina Ummah Smart Sukuk Issuance based on Blossom Finance Platform**

Annual return	Beneficiaries	The goal	Period	Platform	Manner	Value	Issuer	Sukuk type
Annually 15.5%	234 local entrepreneurs	Microfinance funding	1 year	Blossom Finance	Public blockchain based on Ethereum smart contract	Rp715 Million (US\$50,456)	BMT Bina Ummah	Mudarabah smart sukuk

**Source:** by the researcher based on [www.blossomfinance.com](http://www.blossomfinance.com), consulted on 04/07/2023.

These smart mudarabah sukuk of Rp715 million have far rewarded investors with a 15.5% annualized gross return since their issuance. This represents a cumulative realized profits distribution of Rp81 million (US\$5515) for the first nine (9) months since issuance as shown in figure (IV-5).

**Figure (IV-5): BMT Bina Ummah Smart Sukuk Performance**



**Source:** BMT Bina Ummah Report, 2020, p 01.

All the investors of BMT smart sukuk are Americans and their returns are subjected to the prevailing Rupiah-Dollar exchange rate. During the height of Covid-19 crisis, the Indonesian Rupiah weakened against the American Dollar along with many other emerging market currencies. In March 2020, the average exchange rate of the Rp against the US\$ fell by 10.45% compared to the rate at issuance. Therefore, the value of their recorded profits in March reached to Rp 9.70 million, after it was in February Rp10.22 million, and it continued to decline until May at the range of Rp 8.71 million, to regain its high in June

## Chapter Four: Leading Model Experiences of Smart Sukuk Industry

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with a value of Rp11.73 million. This is due to the normal return of the financial market activity after its adaptation to the Corona pandemic<sup>1</sup>.

### 3. Significances of Blossom Smart Sukuk in the Indonesian Islamic Capital Market

In order to assess the development of the Islamic capital market based on smart sukuk in Indonesia, it is necessary to consider all the advantages achieved through the integration of blockchain into the process of the securitization and digitization (tokenization) of sukuk, as well as to review its quantitative and qualitative dimensions. Therefore, the significances of Blossom smart sukuk in Indonesian Islamic capital market could be listed below<sup>2</sup>:

- Blossom Finance has replaced the conventional sukuk with smart sukuk, Therefore, all the structuring, registration, assignments, calculating, payments, trading of sukuk will execute through blockchain protocol, i.e., Ethereum smart contracts in an indelible fixed manner, which eliminates intermediary and reduces costs;
- Platforms like Blossom's smart sukuk remove the conventional barriers making micro investments feasible, and transparent with reducing intermediary costs, which makes global finance more accessible regardless of the size or borders; which in turn enable small investors in Indonesia to benefit from micro sukuk with small financial value in order to invest in the agricultural sector, food distribution, and expand the scale of sukuk market; as in the past few years, sukuk market was monopolized by high value sovereign sukuk;
- Blossom smart sukuk highlight two growing trends in Islamic capital markets: firstly, the digital innovation using smart contract- based securitization, and secondly the increasing focus on financing small investors. As Blossom platform is the first platform that finances projects of small enterprises whose owners were previously unable to access sukuk market. Therefore, Blossom smart sukuk provide more accessibility and remove the high barriers, which prevent the entry into the Islamic capital market;
- Blossom platform supports both registration, and payments made via any cryptocurrency or tokenized asset if the issuing authority does not prevent that, in addition to the fiat currency; as well as, it offers a new model for exchanging payments in the Islamic financial market based on ERC20 standards, which enables any digital exchange via any existing blockchain wallets or secondary markets.

### Section Two: Smart Sukuk Experience in the GGC Countries

In light of the global transformation of financial technology that supports the development of the financial sector, it was necessary for the Gulf countries, in turn, to move towards applying financial technology techniques in their financial services, especially Islamic ones. Therefore, both the United Arab Emirates and Saudi Arabia took the initiative to apply blockchain technology to develop their sukuk market by adopting blockchain-based smart sukuk industry. This was demonstrated through the experiences of "Al Hilal Bank" and "Wethaq Capital

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<sup>1</sup>- The official website of Blossom Finance company, Op.cit, Consulted on 04/07/2023.

<sup>2</sup>- Ibid, Consulted on 04/07/2023.

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Markets" Company, with the aim of revolutionizing sukuk market, and improving the Islamic financial market, by automating the sukuk life cycle and expanding the scope of sukuk industry beyond the borders of the Gulf region. The first experience was launched by "Al Hilal Bank" in Abu Dhabi, as it considers the first bank platform that is used just for trading smart sukuk. However, the second experience was launched by Saudi Arabia-based "Wethaq Capital Markets" in Dubai financial market, where its platform is the first pilot platform for the issuance, distribution and management of smart sukuk. In this regard, this section introduces the two main smart sukuk experiences, indicating the opportunities of blockchain adoption into the sukuk industry, and the Islamic financial market framework work.

### 1. Smart Sukuk Experience in the UAE

In an effort to transform and revolutionize the market of sukuk, Abu Dhabi-based Al Hilal bank has adopted blockchain technology and integrated it into its infrastructure, by collaborating with the Fintech company "Jibrel Network" to realize the first global Islamic banking platform for trading smart sukuk. The process of trading sukuk in the secondary market takes place via smart contracts. The partnership between Al Hilal Bank and the UAE-based startup "Jibril highlights" highlights the success of Abu Dhabi Global Market in attracting, nurturing, and promoting innovations as the best financial technology center, confirming its continued commitment to develop and support financial technology practices in the UAE and the region. Therefore, this part presents the experience of Al Hilal smart sukuk trading platform, addressing its basic steps and use cases.

#### 1.1. HLC Smart Sukuk Platform

##### 1.1.1. HLC Platform Background

Al Hilal Bank platform (HLC) is the world's first Islamic bank platform, that executes sukuk transaction on blockchain. In September 2018, Al Hilal Bank\* has carried a transaction of sukuk based on blockchain in the secondary market to sell and settle a small portion of its US\$500 million sukuk, maturing in September 2023 in the secondary market<sup>1</sup>. It refers to the new generation of blockchain sukuk as an Asset Backed Tokens (ABT), which stands for the transformation of a real asset to a digital asset that structured on blockchain platform. It has partnered with "Jibrel Network", a Switzerland-headquartered Fintech firm, for this pilot project, aiming to sell a US\$1 million sukuk to a private investors based of Al Hilal Bank. The collaboration between the bank and Jibrel Network was achieved thanks to the creative platform that developed by Abu Dhabi Global Market (ADGM). As, it is an international platform that guarantees coordination between financial institutions in the MENA region and local and global Fintech startups in order to enhance the digital transformation in the region<sup>2</sup>. Generally, HLC platform has the main following **Objectives**<sup>3</sup>:

- Al Hilal platform is planning to transform sukuk industry through the integration of blockchain into their infrastructure, paving the way to digitize sukuk using a tangible asset backed by Tokens;

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\*Al Hilal Bank is a progressive Islamic bank established in 2007 and headquartered in Abu Dhabi (UAE) offering a wide range of client-centric Shariah compliant Wholesale Banking, Retail Banking, Treasury and Wealth Management. The Bank enjoys strong long-term credit ratings of A+ and A2. It has been recognized as the safest Islamic Financial Institution in the GCC by Global Finance in 2016 and in 2017.

<sup>1</sup>- The official website of Al Hilal Bank, available at: [www.alhilalbank.ae](http://www.alhilalbank.ae), Consulted in 31/08/2023.

<sup>2</sup>-Ibid, Consulted in 31/08/2023.

<sup>3</sup>- Al Hilal Bank Report: HLC Smart Sukuk Platform: Islamic Asset Tokenization is the Future of Islamic Finance, 2019, p 11.

## Chapter Four: Leading Model Experiences of Smart Sukuk Industry

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- The HLC platform facilitates the creation of asset backed tokens (ABT), that is a novel financial product founded on real assets that carry minimal risk;
- Based on smart contracts, this platform provides a secure type of transaction with a strong implementation of Islamic Sharia compliance; which opens the opportunities for new services such as issuance and distribution. As the Al Hilal platform is only specialized in the trading process in the secondary market, which could effectively reduce the overall costs associated with sukuk issuance and settlement.

### 1.1.2. Reasons of Assets Tokenization in HLC Platform

The following are the main reasons of trading sukuk on HLC platform<sup>1</sup>:

- The elimination of deadweight losses brought on by the information gap between investors and business owners;
- The attraction of investments by small and medium companies will decrease employment levels and poverty;
- The ability to attract long-term investments for technological development is likely leading to increased efficiency and a consequent reduction in the resource consumption.

## 1.2. HLC Smart Sukuk Platform Working Mechanism

### 1.2.1. Basic Steps of HLC Smart Sukuk

HLC platform is a blockchain trading platform, where sukuk are just getting trading using smart contracts in the secondary market, aiming to reduce intermediaries, and revolutionize the sukuk industry. For the very beginning of the platform, major targeted clients are investment banks, rating agencies, lawyers, fundraisers and accredited investors, where HLC leads them to invest their funds in a diversified sukuk portfolio consisting of Sharia compliance securities with an international investment grade credit rating and listing them on one of the world's leading stock exchanges through the following steps<sup>2</sup>:

1. Based on smart contracts, HLC platform put the tokens (the digital representation of sukuk) on stock exchanges, which are linked to its platform aiming to raise capital for real companies;
2. Users pay a fee to have an access to HLC smart sukuk platform;
3. Investors buy sukuk tokens using fiat currencies and agree on the contract terms concerning funds distributions based on the terms of HLC platform ;
4. HLC platform in turn ensures the automated distribution of the funds to sukuk holders via its platform according to the rules, which have set on smart contracts without the need of the intervention of conventional banks or any other intermediaries.

### 1.2.2. HLC Smart Sukuk Use Cases

In September 2018, HLC has put in trading three types of smart sukuk: Ijarah, Hybrid and Musharakah, these sukuk reached to US\$500 million and maturing in September 2023. The following table (IV-2) explains where these sukuk have applied.

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<sup>1</sup>- Al Hilal Bank Report, Op.cit, p 17.

<sup>2</sup>- Ibid, p 13.

## Chapter Four: Leading Model Experiences of Smart Sukuk Industry

**Table (IV-2): HLC Smart Sukuk Use Cases**

	Case 1	Case 2	Case 3
Smart Sukuk Type	Ijarah	Hybrid	Musharakah
Investment field	Real Estate	Airlines	Crowdfunding
Location	Dubai	Dubai	Dubai
Achieved Return	8%	8%	8%
Use of Proceeds	The funds were used to modernize the buildings and acquire new buildings for the purpose of using them for rent, while the rental payments are allocated to pay financial distributions to sukuk holders.	Investors' funds are used to purchase assets in order to lease them to airline company. After that, the airline company pays the rental value to the SPE company, and then distributions are allocated to sukuk holders themselves to purchase airline tickets.	Funds are collected through the HLC platform from participants and then smart sukuk are distributed to investors.

**Source:** Al Hilal Bank Report: HLC Smart Sukuk Platform: Islamic Asset Tokenization is the Future of Islamic Finance, 2019, pp 20-22.

### 1.3. Benefits of Sukuk Issuers and Holders within HLC Platform

The benefits of using HLC platform for both issuers and investors can be summarized in the table (IV-3) below.

**Table (IV-3): Benefits of Sukuk Issuers and Holders within HLC Platform**

Issuers	Holders
<ul style="list-style-type: none"> <li>▪ An asset backed tokens (ABT) are securities issued on inclusive blockchain technology, that are consider as flexible Sharia Compliance raising funds;</li> <li>▪ A simple, convenient and reliable way to attract investments for long term development;</li> <li>▪ Lower cost of capital for high quality companies compared to currently available options;</li> <li>▪ A borderless and inclusive instrument opportunity that are not affected by country borders or local standards to reach investors all over the world.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Providing a kind of transparency and accountability based on a legal structure with highly automated audits and distributed governance;</li> <li>▪ A comprehensive way to invest in all kinds of real economy projects globally;</li> <li>▪ A new class of low risk future Tokens, which secured by real assets;</li> <li>▪ A blockchain based register cannot be corrupted. Thus it eliminates all the trust issues related to a register of ABT owners( smart sukuk);</li> <li>▪ Smart sukuk base on HLC platform have a zero or negative correlation with cryptocurrencies. Thus, they are a great tool to hedge risks for crypto investors.</li> </ul>

**Source:** Al Hilal Bank Report: HLC Smart Sukuk Platform: Islamic Asset Tokenization is the Future of Islamic Finance, 2019, pp. 15-16.

### 2. Smart Sukuk Experience in Saudi Arabia

Saudi Arabia ranks the second in the world in sukuk issuances after Malaysia, with the value of its issuances reaching to US\$ 50 billion in 2021. It also plans to occupy the first place in the rankings for the next few years, as it has the largest Islamic financial market in the MENA countries. In order to keep pace with the new technological development and pave the way for the Islamic financial market development in the Kingdom; and since there is a great demand for sukuk issuances in the world, it was necessary to think about a platform that provides the basic issuance and trading services in one device, as well as modernizes the infrastructure of its Islamic financial market by integrating Fintech techniques. Therefore, "Wethaq Capital Markets" Company, based in Saudi Arabia, decided to provide the first leading Islamic financial capital platform in the world for issuing, distributing and managing sukuk. This platform is built on R3-Corda blockchain, with the aim of simplifying and expanding sukuk trading beyond the borders of the Saudi financial markets. This leading experience explores the possibility of applying new technology to sukuk industry, aiming to open and expand the financial ecosystem by simplifying coordination between market participants, standardizing processes, and automating financial services management; as well as ensuring the security and transparency of the financial transactions. In this regard, this part provides a brief overview of "Wethaq Capital Markets" company and the issuing mechanism of its smart sukuk based on the R3-Corda protocol, in addition to the benefits expected from integrating this platform into the Islamic financial market in general, and the Saudi Islamic financial market in particular.

#### 2.1. Wethaq Capital Markets Platform

##### 2.1.1. Wethaq Capital Markets Background

Wethaq Capital Markets is a Fintech startup founded by Mohammed Alsehli, it is the first global Islamic capital market platform using smart clauses to issue smart sukuk. Legally, this platform is a limited joint stock company incorporated under the laws of Saudi Arabia with a commercial registration No.1010636642, and regulated by the Capital Market Authority (CMA) pursuant to a Fintech experimental permit issued on June 8, 2020. It is headquartered in Saudi Arabia, and has branches in Dubai, Abu Dhabi, and London. It serves the local market as a capital market institution, and provides Fintech consultancy on financial market infrastructures<sup>1</sup>. Wethaq Capital Markets platform is a part of the R3-Corda blockchain consortium, which is built on R3's Corda blockchain with the aim of implementing blockchain to Islamic finance. R3-Corda is an open-source project launched in 2016 by a consortium of over 40 international banks, financial institutions, and technology companies. It is built on privacy, security, and interoperability principles<sup>2</sup>, which in turn enables the provision of services in the financial sector, and helps a wide range of applications to run on a single network<sup>3</sup>, as well as ensures the secure and efficient exchange of data and value between parties. This blockchain platform can also be easily customized to meet the specific needs of each user. Therefore, Wethaq platform implements R3-Corda blockchain into sukuk market aiming to obtain a system that can<sup>4</sup>:

- Automate all the functions of registration, trustee-delegate, paying, calculation, transfer agent, certificates issuances, allocation, and management. This automation is provided

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<sup>1</sup>-The official website of the Wethaq Capital Markets company, available at: [www.wethaqcapital.sa](http://www.wethaqcapital.sa), consulted in 17/08/2023.

<sup>2</sup>- The official website of R3 Corda, available at: [www.r3.com](http://www.r3.com), consulted on 17/08/2023.

<sup>3</sup>- The official website of Corda, available at: [www.corda.net](http://www.corda.net), Consulted on 17/08/2023.

<sup>4</sup>- The official website of R3 Corda, Op.cit, Consulted on 17/08/2023.



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by setting up special smart clauses of smart contracts, which contributes to cutting time-consuming, simplifying operations and reducing costs;

- Interact with different blockchain platforms' payment gateways and settlement systems;
- Create a platform that facilitates communication between service providers, stakeholders, and market players due to the characteristics of R3-Corda protocol, which has the ability to connect multiple platforms to each other;
- Work within the current regulatory framework without the need to change it, because transactions are done through fiat currencies;
- This platform does not disrupt traditional intermediation, but it comes to cover their inefficiency, which ensures interoperability with other trading and settlement platforms.

### 2.1.2. Key Features of Wethaq Capital Markets Platform

Wethaq Capital Markets platform features the following<sup>1</sup>:

- Wethaq platform is a permissioned blockchain platform, where only people with legit access and needs can participate on the network, as well as it prevents all the unnecessary data sharing on its platform;
- The platform allows data to be shared in the network without the need to involve a central controller; which allows users to achieve consensus at the level of individual transactions rather than the entire system. In addition, R3-Corda blockchain also supports a vast range of consensus mechanisms, which provide more flexibility between participants;
- This platform is a multi-functional platform, as the issuance, trading, distribution and settlement operations are all carried out through one platform;
- The platform integrates SWIFT's payment and settlement functionality allowing investors to use traditional methods to invest in blockchain sukuk;
- This platform does not allow the use of cryptocurrencies; also, it has not a unique or native currency. Thus, transactions can deal in any fiat currency under the choice of the participants based on SWIFT gpi network;
- R3-Corda blockchain platforms have high-security standards, and that is why they continue to gain a secured place in the financial industry. This in turn ensures the security of Wethaq capital Markets platform.

By the end of 2019, Wethaq capital markets as a Fintech company that aims to facilitate the financial industry in the Gulf area, issued Ijarah smart sukuk experiment launched from Dubai International Financial Center, this pilot automates all sukuk lifecycle processes using a single platform. This was conducted under the supervision of the Dubai Financial Services Authority (DFSA). Where, it achieves the innovation testing license from the DFSA with the generous support of The Dubai International Financial Center (DIFC) ecosystem. As a large number of startups are launched from the Dubai International Financial Center, and this is due to the multiple financial services it provides, as well as being an area that does not impose taxes on corporate profits. Therefore, Wethaq pilot model is a great step to develop sukuk structure and

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<sup>1</sup>- The official website of Corda, Op.cit, Consulted on 17/08/2023.

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modernize trading mechanisms in the Islamic financial market by implementing blockchain applications.

### 2.2. Sukuk Working Mechanism based on Wethaq Capital Markets platform

In light of Saudi Vision 2030\*, which was launched in April 2018 to enhance financial technology services under the supervision of the Central Bank of Saudi Arabia in cooperation with the Capital Market Authority under the program of the financial sector development, relying on financial technology, with the aim of transforming Saudi Arabia into a destination of a financial services innovation and raising the contribution of small and medium enterprises to the gross domestic product from 20% to 35%<sup>1</sup>. Therefore, Wethaq decided to offer one platform for all parties involved to communicate, collaborate, and execute an end-to-end sukuk transaction, while automating sukuk services and connecting investors directly to these issuances, and offers custody depository and secondary market services. It is a solution built on R3 Corda intending to streamline and expand the sukuk market. As Wethaq launched an experiment exploring the possibility to apply a new blockchain technology to sukuk industry. This platform developed new smart Ijarah sukuk based on smart clauses, and it settles payments using SWIFT gpi network. Therefore, this part provides the working mechanism of Wethaq platform and its potential prospects in restructuring sukuk industry.

#### 2.2.1. Wethaq Sukuk Issuing Process

The first platform for issuing smart sukuk in Saudi Arabia was launched from Dubai with the aim of expanding the scope of sukuk trading outside the borders of the Saudi financial market. This is done through the link between Wethaq trading platform and the Dubai International Market. Thus, in November 2019, it issued its first pilot sukuk under the supervision of the Dubai Financial Services Authority<sup>2</sup>. This comes after the Fintech permit (pilot permit for financial technology) that Wethaq obtained from the Saudi Capital Market Authority to begin offering securities to investors using Wethaq blockchain platform that supports the issuance, distribution and management of sukuk<sup>3</sup>. It is presented as an alternative structure for issuing, distributing, and managing conventional sukuk in Islamic capital markets as shown in the figure (IV-6).

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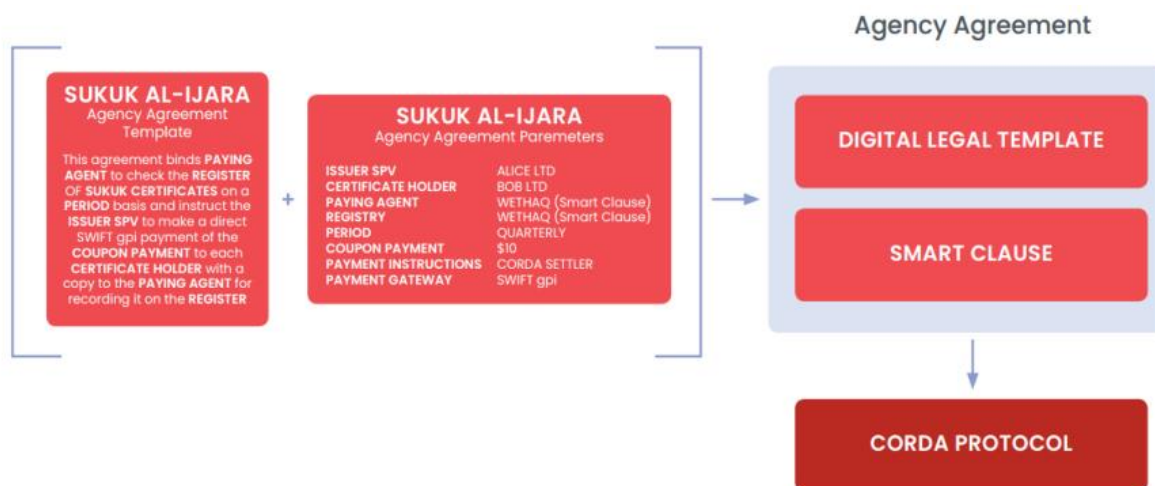
\*Vision 2030 is a strategy introduced as a roadmap that is based on the following three pillars: a vital society, a thriving economy, and an ambitious nation, aiming to improve the effectiveness of the government and creating opportunities for growth and investment by opening the Kingdom of Saudi Arabia to the outside world.

<sup>1</sup>- Amal Khairy Amin Muhammad, Mahmoud Mohamed Abdel Hakim Zaim: Smart Sukuk issuance platforms to finance small and medium enterprises in Saudi Arabia: Opportunities and Challenges, GIEM, Vol.128, 2023, p 118.

<sup>2</sup>-The official website of the Wethaq Capital Markets company, Op.cit, Consulted on 17/08/2023.

<sup>3</sup>-Ibid, Consulted on 17/08/2023.

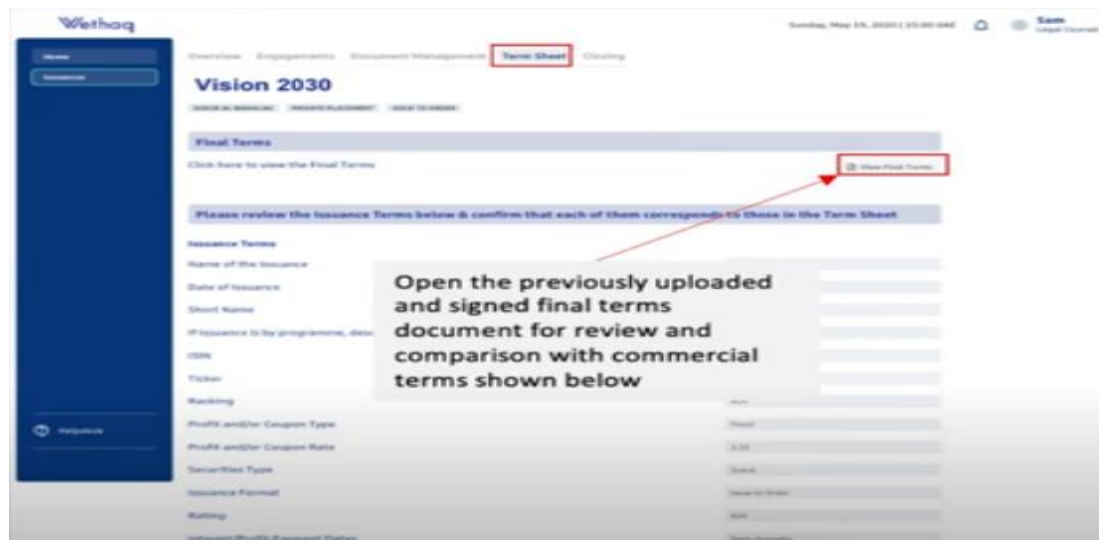
**Figure (IV-6): Ijarah Smart Sukuk Based on Wethaq Capital Market Platform**



**Source:** The official website of the Wethaq Capital Markets company, available at: [www.wethaqcapital.sa](http://www.wethaqcapital.sa), consulted on 23/08/2023.

This pilot program demonstrates how sukuk issuance could be easily made by applying Corda blockchain to an issuing process that is recently been manual, unstandardized and fragmented. This agreement looks for testing Wethaq platform concerning the issuing mechanism of ijara sukuk based on Corda protocol, which provides secure treatments as well as smart clause codes ensuring a complete protection from any tampering<sup>1</sup>. Therefore, it is worthy to illustrate the framework of Wethaq Capital Markets platform through the figure (IV-7) and figure (IV-8)

**Figure (IV-7): The Agreement Process based on Wethaq Platform- First Stage-**



**Source:** The official website of the Wethaq Capital Markets company, available at: [www.wethaqcapital.sa](http://www.wethaqcapital.sa), consulted on 28/08/2023.

<sup>1</sup>- Peter Michalopoulos Structuring Complex Financial Products on Corda: The Sukuk Case Study, 2019, available at: <https://medium.com/inside-r3/innovating-in-sukuk-capital-markets-fbc69c295be2>, consulted on 17/08/2023.

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The figure (IV-7) above describes the term sheet tab, where all parties open the previously uploaded document, and negotiate the terms of the issuance. After that, they agree on it and sign the final terms document, and review it, making a comparison with commercial terms using “smart clauses”, which are parts of a contract that help in tracking the differences between different contract versions to prevent any abuses or manipulations during the conclusion of the contracts<sup>1</sup>.

**Figure (IV-8): The Agreement Process based on Wethaq Platform- Second Stage-**



**Source:** The official website of the Wethaq Capital Markets Company, available at: [www.wethaqcapital.sa](http://www.wethaqcapital.sa), consulted on 28/08/2023.

The figure (IV-8) in turn demonstrates the close of the operation and the signoff of all relevant parties with the ability to review all relevant documents, and the due diligence from previous stage. Then, status is updated when each one confirms his signoff to conclude the automated sukuk processing, where all data are shared between all parties in a secured manner<sup>2</sup>.

In fact, Wethaq Capital Markets platform does not start working yet. However, it is expected to have 70 annual issuances by 2024, and offer a global distribution network that operates secondary market operations through its platform. As its issuances will be expecting to range from 50 million Saudi riyals to 500 million Saudi riyals; mainly they will be issued and offered privately on its platform<sup>3</sup>. In addition, its smart issuances are programmed to be rolled across multiple locations in the GCC countries to deliver optimal performance in multiple countries across the region, as well as it plans to connect its platform to the trading platforms, and stock exchanges in the European Union, and the Malaysian market in the next few years. Moreover, this platform will automate and integrate Sharia guidelines of sukuk while providing the essential transparency needed for all parties<sup>4</sup>.

### 2.2.2. Features of Wethaq Smart Sukuk

Since Wethaq platform is built on R3-Corda blockchain, it acquires all the characteristics of the distributed registries of R3-Corda. Therefore, Wethaq sukuk feature the following:

**a. High security degree:** R3-Corda distributed ledgers are characterized by a high degree of privacy and security. This is what distinguishes it from Ethereum platforms, as Ethereum grants

<sup>1</sup> The official website of the Wethaq Capital Markets Company, Op.cit, Consulted on 28/08/2023.

<sup>2</sup> Ibid, Consulted on 28/08/2023.

<sup>3</sup> Ibid, Consulted on 28/08/2023.

<sup>4</sup> Ibid, Consulted on 28/08/2023.

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data access to everyone who has access to the blockchain network. In contrast, on R3-Corda, the participants do not have the right to access unless the participants in the network are pre-selected (predefined), which enables them to only get access to their ledgers, without giving an access to the outside parties. This what levels up the degree of the security on R3-Corda applications<sup>1</sup>. Therefore, Wethaq sukuk ensure a high degree of security for all dealers.

**b. Fast Settlement System:** Wethaq sukuk have a special cash settlement system, because their infrastructures are developed on R3-Corda protocol, which integrates the payment and settlement function via SWIFT gpi\*, that allows the use of fiat currency and maintains the basic structure of sukuk, which in turn avoids the risk of dealing with cryptocurrencies, which guarantee a type of fast, secure, and transparent settlement process<sup>2</sup>.

**c. Smart Clauses:** In addition to the use of smart contracts, which are codes that define the terms of an agreement between two parties, Wethaq sukuk are also based on “smart clauses”, which automate certain aspects of transactions, and help in tracking the differences between different versions of contract documents to prevent any abuses or manipulations during the conclusion of contracts, which in turn ensures once more the security, and the transparency of Wethaq sukuk. In addition, the employability of smart clauses provides the opportunity to ensure Sharia compliance by embedding the terms of the Sharia principles of sukuk within the structure itself. Once all parties agree on the terms of the contract, the tokens are executed automatically<sup>3</sup>. All these processes generally help to reduce costs and facilitate the manual process, by replacing it with the automated process. From the aforementioned smart sukuk experiences, the following table (IV-4) summarizes the difference between the three blockchain platforms.

**Table (IV-4): Differences between Blossom Finance, HLC and Wethaq Capital Markets Platforms**

	Blossom Finance	HLC	Wethaq Capital Markets
Country	Indonesia	The UAE (Abu Dhabi)	Saudi
Issuer	Blossom Finance	Al Hilal bank	Wethaq Capital Markets
Cooperation with	-	Jibrel Network	R3-Corda
Target group	Small and medium-sized companies	Investment banks, rating agencies, lawyers, fundraisers and private investors.	The mid-sized firms seeking to access the global markets
The technology relied on	Ethereum Smart contracts	Smart contracts	Smart contracts and Smart clauses

<sup>1</sup>- The official website of R3 Corda, Op.cit, Consulted on 17/08/2023.

\* SWIFT gpi (gpi stands for Global Payments Innovation): is a new initiative from SWIFT, it was developed to improve the experience of making a payment via the SWIFT network for both customers and banks. SWIFT gpi combines the traditional SWIFT messaging and banking system with a new set of rules. Any bank that joins gpi has to follow these rules, which include transparency of fees, end-to-end payment tracking, and confirmation of credit to the recipient's account.

<sup>2</sup>- Peter Michalopoulos, Op.cit, Consulted on 17/08/2023.

<sup>3</sup>- Ibid, Consulted on 17/08/2023.

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Platform functions	Issuance,	Trading	Issuance, distribution, trading
Access rights	Permission less	Permission less	Permissioned
Settlement manner	ERC-20	Smart contract	Swift gpi
Based-Currency	Fiat	Only Fiat	Only Fiat
Cryptocurrency use permission	Yes/No Depends of state view	No	No
Sukuk type	Mudharabah	Ijarah, Hybrid and Musharakah	Ijarah

**Source:** By the researcher based on the aforementioned information.

In fact, the market is in dire need of innovation, especially after the impact of the COVID-19 pandemic on the global financial landscape, which in turn has fostered the rapid integration of these new technologies into our financial world. As, in addition to the three pioneering experiments in the smart sukuk industry, the Bahrain-based startup "INABLR" announced in September 2021 its intention to launch an investment platform based on blockchain technology for sukuk trading, with the support of the Central Bank of Bahrain Laboratory, to begin actual work within the next few years<sup>1</sup>. Also, in September 2021, the financial market of Malaysia in turn began initial tests of the possibility of investing in the new generation of sukuk, after it has passed a good experience in digital sukuk issuance in 2020, aiming to raise 500 million Ringgit during the global COVID-19 pandemic. Which are electronic representations of conventional sukuk. In short, they are paper- driven, but their trading process is going electronically<sup>2</sup>.

### 2.2.3. The Potential Prospects of Wethaq Smart Sukuk in the Islamic Financial Market

In fact, the first blockchain sukuk pilot of the Islamic capital market, that affiliated to the Saudi Wethaq company, aims to expand the trading of smart sukuk in the Gulf countries, as well as the European markets has not start its work as a real platform yet. However, the potential prospects of modernizing the issuing mechanisms of sukuk through Wethaq platform, and the Islamic financial market may witness after blockchain implementation could be summarized as follows:

- Wethaq's pilot issuance could mark an important milestone in the development of Fintech solutions for sukuk transactions in the Islamic capital market, as it will lead to a full automated offering across the capital market, from primary issuances, securities services, and the secondary market trading in the next few years<sup>3</sup>.
- The main feature provided by Wethaq to the Islamic financial market is the high degree of security concerning people's data, since Wethaq is built on R3-Corda, which ensures high-security standards of the traded sukuk<sup>4</sup>.
- Wethaq will facilitate tasks that may be carried out by a number of banks and clearing entities, all of which incur significant fees and costs. Therefore, the Islamic financial

<sup>1</sup>- أمل خيرى، أمين محمد: منصات إصدار الصكوك الذكية بواسطة تقنية سلاسل الكتل لتمويل المنشآت الصغيرة والمتوسطة في المملكة العربية السعودية: الفرص والتحديات، بحث مشارك في برنامج دعم الأبحاث في المالية الإسلامية - ساما البنك المركزي السعودي، 2022، ص 29.

<sup>2</sup>-Saeed A. Bin-Nashwan et al.: what Motivates Retail Investors to Invest in Government-Issued Digital Sukuk during COVID-19?, Journal of Islamic Accounting and Business Research, 2022, p 01.

<sup>3</sup>- The official website of the Wethaq Capital, Op.cit, Consulted on 17/08/2023.

<sup>4</sup>- The official website of R3 Corda, Op.cit, consulted on 17/08/2023.

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market based on smart sukuk will be characterized by efficiency and transparency throughout sukuk life cycle from beginning to end<sup>1</sup>.

- Wethaq platform tends to simplify operations, reduce intermediaries, automate the performance of contractual obligations, and expand the scope of sukuk trading outside the Saudi financial market, using smart clauses on the blockchain platform, and ensuring the reliability of the contract terms and avoiding any tampering kind. It will also ensure the automated integration of Sharia guidelines while providing the necessary basic of transparency for all parties<sup>2</sup>.
- The use of SWIFT gpi proves the interactions with cash settlement innovations, where it guarantees sukuk holders the freedom to use fiat currencies instead of using the encrypted ones, tracks their properties, and settles their transactions for near real-time payments without moving; as SWIFT network connects more than 10,000 financial institutions over the world. Therefore, it could say that this platform will provide multiple options of transaction settlement in the Islamic financial market<sup>3</sup>.

### Section Three: Challenges of Smart Sukuk Experiences Application in the Islamic Financial Market

Although there are many advantages of using blockchain technology, and its modern applications in financial institutions, such as: providing secure financial services at low costs, ease of procedures related to financial transactions without the need for intermediaries. However, the challenges that stand in the way of adopting this technology cannot be ignored at the level of contract and transaction settlement, especially with regard to Islamic financial market services and products. Therefore, this section highlights the regulatory, legal, Sharia, cyber risks, and technological infrastructure challenges of sukuk structuring experiments on blockchain technology.

#### 1. Regulatory and Legal Challenges

Generally, financial market products cannot be issued without the approval of regulatory authority, the same for Islamic capital market; it cannot issued sukuk without the approval of the securities commission of the respective countries<sup>4</sup>. In fact, one of the main reasons why the regulatory authority supervises the financial market is to ensure that investors are protected, and the activities of the market are organized in a manner, which is acceptable and ethical. However, one of the characteristics of blockchain sukuk is that there is no centralized regulatory authority to supervise all aspects of the issuance, then there is a possibility of breaching some of the current consumer protection standards and contract terms used in financial markets<sup>5</sup>. Another main issues regarding blockchain usage is about how network operators will comply with national provisions on professional confidentiality. In addition, the legal enforceability of smart contracts in case of there are

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<sup>1</sup>- Peter Michalopoulos, Op.cit, Consulted on 17/08/2023.

<sup>2</sup>- The official website of the Wethaq Capital, Op.cit, Consulted on 17/08/2023.

<sup>3</sup>- Ibid, Consulted on 17/08/2023.

<sup>4</sup>- Aldi khusmufa Nur Iman, Sirajul Arifin, Op.cit, p 165.

<sup>5</sup>- Sherin Kunhibava et al., Op.cit, p 128.

no laws that organize their structuring, which could be another main regulatory issue of blockchain implementation. Therefore, the challenges that are facing smart sukuk and blockchain in general are to find legislation that will regulate their work and adaption in financial aspects<sup>1</sup>. Nevertheless, in most countries, the legislative bodies did not issue clear laws and legislations that control the financial transactions based on the modern blockchain technology<sup>2</sup>. Thus, the financial institutions could not use this technology on a large scale before the existence of clear rules and regulations that control the rights of all parties on one hand, and regulate the working mechanism on the other hand, even though, some other countries such as China, Germany, and Japan have made good efforts in this concern and issued some guidelines and laws, which are considered the beginning of the solution. Also, Fintech startups should closely work with government agencies and regulators to ensure that the legal and regulatory framework supports the use of blockchain applications. Therefore, in setting up a blockchain, many other complexities need to be addressed to create more sophisticated solutions for multi-functions and multi-time accessibility, while complying with various regulations. In short, continuous updates of laws and regulations are required by regulatory authorities to ensure the successful implementation of any blockchain projects.

### 2. Sharia Challenges

To ensure that sukuk are Sharia compliant products, there is a need for a competent Sharia advisor or Sharia committee to endorse their structures in accordance with applicable Sharia rules, as it is required in any other Islamic financial product<sup>3</sup>. When blockchain-based sukuk are structured, the same requirement needs to be followed, as Sharia compliance for sukuk structuring is essential for the validity of the whole sukuk. Unlike conventional securities, smart sukuk only need one blockchain-based structure for all the issuances regardless of the different issuing objectives; where, the relationship between the issuer and holders also remains as debtor and creditor. Accordingly, the structure would remain uniform in all issuances. However, sukuk structures are depending on the type of the underlying Sharia contracts that used to structure it, as the steps involved will vary with each type of contract, as differences should appear in each structure. For this reasons, the presence of a Sharia advisor or Sharia committee is required in each step of sukuk issuance, including a blockchain-based sukuk<sup>4</sup>. Therefore, blockchain sukuk require endorsement of the structure by a Sharia committee, and it would be challenging to have a uniform smart sukuk structure for all types. This means that even in blockchain-based sukuk, the financial cost involved in obtaining Sharia adviser services cannot be eliminated as the absence of a Sharia adviser leads to Sharia non-compliance risk<sup>5</sup>. Moreover, in Islamic finance, Sharia compliance with digital currencies is an issue that has not been unanimously fixed among scholars. While most Sharia scholars do not provide the legality or validity of digital currency, others also have the opposite viewpoint<sup>6</sup>. Therefore, if digital currencies are used for blockchain sukuk, then their legal and Sharia acceptance will be an issue. However,

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<sup>1</sup>- Nurul Izzati Septiana, Hilda Sanjayawati, Op.cit, p 129.

<sup>2</sup>-Omar Alaeddin et al.: Implementing the Blockchain Technology in Islamic Financial Industry: Opportunities and Challenges, Journal of Information Technology Management, 2021, Vol.13, No.03, p 103.

<sup>3</sup>- Securities Commission Malaysia Report, 2019, p 15.

<sup>4</sup>- Ibid, p 58.

<sup>5</sup>-Sherin Kunhibava et al., Op.cit, p 128.

<sup>6</sup>- Aldi khusmufa Nur Iman, Sirajul Arifin, Op.cit, p 167.



developments are underway on the acceptance of digital currencies as a legal tender as the Central Bank of China did. Furthermore, for Malaysia, the Malaysian Sharia Advisory Council had in June and July 2020 decided that digital assets are Sharia compliant if the Securities Commission approves them as securities. This definitely opens up possibilities for blockchain sukuk<sup>1</sup>. Thus, to ensure that sukuk are issued in accordance with Sharia, issuers need to employ a competent Sharia advisor to inspect the blockchain programming in order to ensure that they are in accordance with the requirements of the underlying Sharia contracts<sup>2</sup>. In short, Sharia compliance considers the main pillar of Islamic financial institutions products and activities, as it deals only with approved contracts by Sharia regulations, and any new application that may be used to execute the contracts should go through compatibility and legal commitment to the correct implementation mechanism. Therefore, every Islamic financial institution shall ensure the Sharia compliance of any new technology or mechanism; whether it is blockchain or any new technology, as the use of smart contracts is a good thing for institutions, but it is necessary to review the mechanism of the contracts and its correct sequence, as well as the mechanism for setting conditions, approving and implementing them, and other matters that guarantee the safety of the Sharia and legal aspects in the Islamic financial transactions<sup>3</sup>.

### 3. Cyber Risks Challenges

Although the blockchain is a difficult technology to hack, the possibility of being hacked is potential. Being an online application, blockchain/ smart sukuk are exposed to cyber risks such as hacking or other cyber threats. Therefore, one of the most prominent challenges of using the blockchain in financial transactions and services is the security issues. The customer's data in financial transactions and its protection are among the most important concerns of Fintech institutions. Thus, using the new financial technology applications and transferring all data through these applications could have a possible threat of hacking or losing, which may use to control customer accounts, and lead to lose hundreds of millions due to the robberies. Therefore, it is important to work on the security side of these technologies and study any possibility of a vulnerability

in which pirates may target customer data or assets through Identity theft, hacking, and online fraud<sup>4</sup>. The new financial technologies consider as a fertile environment for passing suspicious deals. Therefore, currently all the focus is on mechanisms for monitoring and controlling any financial process conducted through modern means and cryptocurrencies. Thus, any financial institution shall guarantee the safety of operations on the one hand, and know the other party that deals with it before it begins dealing through these technologies. Otherwise, this exposes them to violations that may result in loss of hundreds of millions and penalties that may affect those institutions because of their classification within the institutions dealing with suspicious activities<sup>5</sup>. Moreover, there exist vulnerabilities in smart contracts, where potential coding errors and any undetected errors have the potential to be exploited. Therefore, an extensive security analysis is needed before the issuance of sukuk to ensure their secure framework<sup>6</sup>. Furthermore, in a public blockchain, the default mode

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<sup>1</sup>- Sherin Kunhibava et al, Op.cit, p128.

<sup>2</sup>- Nurul Izzati Septiana, Hilda, Op.cit, p 129.

<sup>3</sup>-Omar Alaeddin et al, Op.cit, p 105.

<sup>4</sup>- Ibid, p 104.

<sup>5</sup>-Ibid, p 104.

<sup>6</sup>- Nurul Izzati Septiana, Hilda Sanjayawati , Op.cit, p 129.

for any transaction visibility is openness and transparency; this means that anyone could trace the path of any transaction including the value it holds, its origin and destination address, which facilitates the hacking process<sup>1</sup>. In fact, sukuk could not be always traded outside the public blockchain, in order to expand the scope of trading, which in turn may affect the security of these instruments. Therefore, some jurisdictions have attempted to address this issue through regulations. For instance, the securities commission of Malaysia has issued distinct regulations on cyber risks, i.e., the guidelines of cyber risk management in 2018, which applied to all capital market operators or entities. These Guidelines were undertaken to enhance and improve cyber risk management within the industry and from all variety of sources, including regular monitoring and review of cyber security issues on regulated entities<sup>2</sup>. This includes preventing and detecting cyber incidents and promptly reporting violations to the Securities Commission of Malaysia. With regard to the use of public blockchain technology, the confidentiality in transactions has been addressed by encrypting values, and it is also possible to hide identities through zero-knowledge proof systems, which enable the real identity to be hidden from those who are outside the network<sup>3</sup>.

#### 4. Technological Infrastructure Challenges

Adopting the blockchain technology is associated with having a high technological infrastructure, which in turn related with high costs. Smart sukuk as one of the blockchain products are related to two main costs that are facing their implementation in Islamic financial market, representing in the operating costs and the costs of shifting from the current mechanism to the new mechanism<sup>4</sup>:

- The operating costs of blockchain such as the electricity cost needed by the continuous operations to verify the validity of the transactions is one of the largest costs that result from the use of this technology, as well as the cost of computers that the mining process needs, which should be in high specifications, especially the fast processors. Also, the cost of storing data and information, and the cost of having a network that could process a large volume of transactions.
- The costs of switching from the old system to the new system, as most financial institutions currently have many systems that they have invested in, costing hundreds of millions. Therefore, moving to a new mechanism means abandoning all those programs and mechanisms, and wasting the exorbitant cost that these institutions paid from prior to acquire these programs make a new cost to them.

As a starting point, each blockchain product needs to have its own technological infrastructure, or what it could call its own ecosystem, mainly represented in<sup>5</sup>:

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<sup>1</sup>- Elasrag Hussein, Op.cit, p29.

<sup>2</sup>- Omar Alaeddin et al, Op.cit, p 105.

<sup>3</sup>- Elasrag Hussein, Op.cit, p 30.

<sup>4</sup>- Omar Alaeddin et al., Op.cit, p 106.

<sup>5</sup>- Elasrag Hussein, Op.cit, p 28.

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- Complete technology stack, including infrastructure, middleware, and software applications, internet;
- Startups that innovate by creating new products and forging new markets;
- Solutions and services providers that deliver end-to-end implementation for enterprises;
- Funders and venture capital that take risks alongside the entrepreneurs and scientists;
- Developers and technologists who work on core, and extended technology pieces;
- Users who are conditioned to try products, both as consumers and enterprise customers.

### Section Four: The Adoption of Smart Sukuk in Algeria and its Challenges

Numerous studies have proven the role of sukuk, and how they contribute to finance development processes and revitalize financial markets in many countries, especially the Malaysian experience, as one of the leader in sukuk industry. Also, the transformation that affected the financial sector as a result of the Fourth Industrial Revolution, and the adoption of financial technology by many countries, which imposed it on many economies, making them moving from a traditional economy towards a digital economy; where, there is a shift from traditional sukuk to smart sukuk. Algeria in turn as one of the countries that is looking for an alternative financing instruments outside the hydrocarbon sector has become obligated to keep pace with these developments, and try to benefit from their advantages to develop its financial sector. Thus, this section highlights the possibility of adopting smart sukuk in Algeria, taking in consideration blockchain implementation, as well as presenting the pillars that could support sukuk industry in the Algerian stock exchange.

#### 1. The Application of Blockchain in Algeria

The financial sector is considered the most and fastest sectors that has affected by blockchain and other Fintech techniques, which have brought a radical transformation in the structure of financial services and products. Therefore, blockchain technology has gotten a great interest by countries and governments. Algeria, in turn, and since the end of 2021, has adopted a roadmap to apply financial technology techniques, especially blockchain, in both banking and insurance sectors.

##### 1.1. The Financial Technology Laboratory in Algeria

According to the 2018 financial law, Algeria has outright banned the first use of blockchain technology—that is, cryptocurrencie, stating thta.: "The purchase, sale, use, and possession of so-called virtual currency are prohibited"<sup>1</sup>. However, with the spread of blockchain applications in the financial sector, especially the banking and insurance sectors, Algeria, in turn, has adopted an action plan to apply financial technology at the level of its financial sectors, starting with the banking and insurance sectors. Therefore, The Commission of the Organization and Supervision of Stock Exchange Operations (COSOB) organized, on 29 September 2021, the sixth symposium of its scientific council on the theme of "innovation in finance: the FinLab". On this occasion, COSOB and the Algerian Union of Insurance and Reinsurance Companies was signed a constituent contract of the first financial laboratory (FinLab) in the financial center

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<sup>1</sup>-Abdelouahed Mohamed, Op.cit, p 395.

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of Algiers, called "GIE-Algeria FinLab"<sup>1</sup>. This Financial Laboratory is the result of the collaboration between the ministry of finance, the Bank of Algeria, COSOB, and public insurance companies, with the aim of enabling start-ups and project leaders in the Fintech sector to develop their solutions to modernize banking and insurance services while moving towards financial inclusion. This laboratory, which launched in the form of an Economic Interest Grouping (EIG) must lead to a common reflection within the financial sector to promote technological innovation and adapt regulations, if it is necessary for imposing the financial technologies in the finance and insurance sectors. As, its objective is to promote and develop the financial system, via the dematerialization and digitization of the procedures, and at the same time to explore the ways that firstly promote blockchain, and later on the applications of Artificial Intelligence, and Internet of Things in the financial sector<sup>2</sup>. Through this approach, project leaders will be put in contact with financial institutions, which are in need of financial innovations in order to improve their services, as these financial institutions are organized in the form of an Economic Interest Group (EIG). The founding members of Algeria Finlab are the Commission for the Organization of Stock Exchange Operations (COSOB), the Central Reinsurance Company (CCR), the Algerian Insurance and reinsurance (CAAR), the Hydrocarbons Insurance Company, the Algerian Transport Insurance Company (CAAT), the Algiers Stock Exchange, the Algerian Insurance Company (SAA), and the start-up accelerator "Algerian venture"<sup>3</sup>.

### 1.2. Requirements of Blockchain Application in Algeria

It is worthy to be noted that the first application of blockchain in Algeria will be on the banking and assurance sectors, and after that it will be spread into other financial services including Algerian stock exchange. In this regard, the process of implementing blockchain in Algeria needs special requirements that organize its application in order to avoid illegal activities, therefore the following requirements are taken in consideration in the FinLab roadmap<sup>4</sup>:

**a. Regulations and Laws:** The application of blockchain requires the enactment of legislations and laws that regulate its working mechanism. Therefore, the Algerian government will provide a regulatory and legal framework that regulate and enhance the Fintech ecosystem, which in turn facilitate the entry of startups into the world of finance and business;

**b. Information Technology Infrastructures and Clouds:** They refer to the hardware and software elements needed to enable data processing and storage. They include computing power (servers), networking, and storage, as well as an interface for users to access their virtualized resources. Which allow enterprises to avoid the need of a single centralized provider. Instead, they can rely on a distributed network of computers that are not under the control of any specific company;

**c. Qualified Human Resources:** Dealing with financial services based on blockchain requires trained and qualified human resources, who could process a complex and huge amount of data. In addition to provide permanent accompaniment of business incubators and accelerator. As Incubators focus on early-phase startups that are in the product-development phase, and do not

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<sup>1</sup>- The official website of the Algiers Stock Exchange, available at: [www.cosob.org](http://www.cosob.org), Consulted on 02/08/2023.

<sup>2</sup>- The official website of the Algiers Stock Exchange, available at: [www.cosob.org](http://www.cosob.org), Consulted on 02/08/2023.

<sup>3</sup>- Ibid, Consulted on 02/08/2023.

<sup>4</sup>- COSOB Report: DZ Finlab Ecosystem and Roadmap, 2020, p 01.

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have a developed business model. In contrast, accelerators focus on speeding up the growth of the existing companies.

### 2. Smart Sukuk as a Financing Alternative in Algeria

Generally, sukuk within all types (conventional or smart) could be a strategic option and a financing alternative for economic development processes in Algeria, especially for small and medium enterprises, due to the important resources they provide for mobilizing savings, as well as managing liquidity. However, there are obstacles facing the application of this industry in Algeria.

#### 2.1. Legal and Regulatory Challenges of Smart Sukuk Industry in Algeria

Smart sukuk principally are conventional sukuk that are structured on blockchain platform using smart contracts protocol. Therefore, smart sukuk adoption in Algeria could face the same legal challenges that had faced for years by the conventional sukuk, as follows:

**a. The Absence of an Organized Legal and Legislative System of Sukuk in Algeria:** The absence of a legal and legislative framework that regulates the working mechanism of sukuk industry in Algeria constitutes an obstacle and a major challenge that discouraged dealing with them. Among these obstacles and challenges are the following:

- **Money and Credit Law:** Referring to Money and Credit Law concerning the law No. 90-10 of 1990, which amended by the decree No. 03-11 of August 26, 2003, relating to the credit and cash, in which, this law dealt with the legal rules related to the money and credit, the monetary process, as well as the structure, the work of the Bank of Algeria, its organization and operations, the powers of the Bank of Algeria and the loan and cash council, banking regulations, monitoring banks and financial institutions, the exchange and movement of capital and penalties<sup>1</sup>. As by that the legislator has dealt with the movement of money market in Algeria in light of the rapid development of new cases in the national economy service, where we notice a complete absence of Islamic financing contracts on the basis of which sukuk are issued. Even though, Algeria took an important step to shift towards the Islamic banking by opening Islamic windows after the issuance of the regulation No. 20-02 on 2020/03/23<sup>2</sup>, aiming to diversify financing sources, and absorb the existing monetary mass in the parallel market. Also in response to a large segment of Algerian society that prefers Islamic financial services to traditional banking services<sup>3</sup>. However, it has not taken a serious step towards sukuk industry yet; perhaps the biggest obstacle that faces the application of sukuk in Algeria is the absence of a legal recognition, which covers the framework of the Islamic financial industry comprehensively, especially at the level of financial legislation that is directly related to the financial work.
- **Algiers Stock Exchange:** The Committee of the Regulation and Supervision of Stock Exchange Operations refused to include sukuk under the name of “Islamic bonds” among the movable values listed and traded in its financial market, justifying by the lack of a legal basis that regulates their framework. In addition to the absence of the

<sup>1</sup> - بن زارع حياة، عائشة عبد الحميد: تحديات إصدار الصكوك الإسلامية في الجزائر، مجلة الاقتصاد الإسلامي العالمية، العدد 95، 2020، ص 109.

<sup>2</sup>-Regulation No. 02-20 (2020), Banking Operations Related to Islamic Banking by Banks and Financial Institutions, The Official Journal of the Republic of Algeria No. 16, dated on 03/24/2020.

<sup>3</sup>- خطوي منير، بن موسى اعمر: النوافذ الإسلامية كآلية لتفعيل الصيرفة الإسلامية في الجزائر، مجلة إضافات اقتصادية، المجلد 05، العدد 02، 2021، ص 80.

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special purpose company system under which these instruments are structured and issued<sup>1</sup>.

- **Algerian Commercial Law:** Algerian Commercial Law was issued pursuant to order No. 59-75 dated on 26 September 1975, it includes the amended and supplemented Commercial Law, as the Algerian Commercial Law does not allow the issuance of investment sukuk as they represent property rights of equal value without their holders having the status of shareholders<sup>2</sup>. The movable values that the law permits joint stock companies to issue are shares or investment certificates that represent the company's capital, and/or bonds of various types that represent its debts. Although investing in a stock does not contradict the provisions of Islamic Sharia, but it also does not constitute an alternative to sukuk<sup>3</sup>.

**b. Algerian Tax Law:** The issue of legalized sukuk is absent in the Algerian tax law. Generally, sukuk are composed of several different forms and returns, unlike stocks and bonds; where sukuk are built on financial formulas that transfer ownership, which may lead to unfair tax treatment comparing to their traditional counterpart. Thus, the issuance of sukuk based on sales formulas, such as a forward sale, Salam and Istisna in accordance with Sharia rules as a kind of transferring ownership of objects may lead to unfair tax treatment of these instruments, comparing to their traditional counterpart, that is, if the tax provisions related to sales contracts are applied to them, such as value-added tax, the fee of professional activity, registration fee, and the tax on total income and the tax on corporate profits, could affect the competitiveness of their performance compared to their traditional counterpart stocks that represent a part of the capital<sup>4</sup>.

**c. The Organizational and Institutional Aspect of the Application of Islamic Finance:** It is noticeable that Algeria still does not yet have national Islamic banks, and what was established was partially done with the effort of some businessmen and Islamic banks in the Arab countries, as the Algerian financial market is currently active with two Islamic banks, and only one Takaful insurance company, which an effort that was not accompanied by an effective role of the state. In addition, Algeria did not benefit from the financing capabilities of the investment funds and Takaful insurance institutions concerning the operations related to the completion of infrastructure projects and the structural base. In contrast, it was totally dependent on rentier returns from non-renewable energy sources in its major projects execution<sup>5</sup>.

**d. Lack of Qualification and Training:** Also among the obstacles, there is the lack of qualified, trained and experienced human cadres in the field of Islamic finance in general and sukuk industry in particular. Perhaps this is due to the following factors<sup>6</sup>:

<sup>1</sup>- أحمد بن خليفة، حفوطة الأمير عبد القادر: مساهمة الصكوك الإسلامية في تحسين عجلة التنمية في الجزائر "تجربة السودان نموذجاً"، مجلة اقتصاديات الأعمال والتجارة، العدد 03، 2017، ص 177، 178.

<sup>2</sup>- أحمد بن خليفة، حفوطة الأمير عبد القادر: مساهمة الصكوك الإسلامية في تحسين عجلة التنمية في الجزائر "تجربة السودان نموذجاً"، مجلة اقتصاديات الأعمال والتجارة، العدد 03، 2017، ص 177، 178.

<sup>3</sup>- بن زارع حياة، عائشة عبد الحميد، مرجع سبق ذكره.

<sup>4</sup>- عبد الحق بادا: الصكوك الإسلامية في الجزائر: بين التنظير والتطبيق، مجلة الاستراتيجية والتنمية، المجلد 11، العدد 04، 2021، ص 163.

<sup>5</sup>- آمال بن فالمي، محميدة أوكيل: متطلبات اعتماد الصكوك الإسلامية في الجزائر على ضوء التجربة الماليزية، مجلة التنمية والاستشارات والبحوث للمجلد 07، العدد 01، 2022، ص 77.

<sup>6</sup> حوات أوبوكر، ضويفي حمزة: متطلبات التوجه نحو إصدار صكوك إسلامية في الجزائر-دراسة استطلاعية-، مجلة شعاع للدراسات الاقتصادية، المجلد 07، العدد 01، 2023، ص 411.

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- The lack of specializations and programs of Islamic finance in various stages of the higher education;
- The Algerian state, represented by the Central Bank and the Ministry of Finance, did not adopt the idea of implementing Islamic instruments, as well as issue laws governing their trading in the financial market.

### 2.2. The Basic Mechanisms of Smart Sukuk Adoption in Algeria

Implementing sukuk industry in general, whether traditional or smart, in Algeria requires several mechanisms, which are as follows:

- It is necessary to provide an appropriate and special legal and legislative framework that allows the issuance and trading of sukuk, by defining sukuk in Monetary and Credit Law, setting a legal definition of them, and defining the characteristics of their issuance and trading;
- Determining an appropriate tax base for sukuk, as well as providing tax incentives to attract investors<sup>1</sup>.
- Developing the Algerian Stock Exchange and establishing a special secondary market for trading sukuk, as well as providing legislative and legal bodies that regulate and facilitate the process of issuing sukuk, with regard to the extent to which institutions respect the legal rules of the process of issuing and trading sukuk;
- Training qualified human cadres by including the Islamic financial industry as one of the majors in higher education institutions<sup>2</sup>.

In fact, currently, the Algerian environment is not qualified to adopt the issuance of sukuk since the absence of a legal and legislative framework that could regulate this process. However, the success of a legal and legislative adoption of sukuk, as well as the implementation of blockchain technology in Algeria will easily enable smart sukuk structuring on blockchain. In addition to the possibility of benefit from them as a financing alternative for small and medium enterprises in Algeria. This in turn supports the Islamic finance industry, and increases financial investments in Algeria. However, principally, the process of issuing smart sukuk in Algeria moving from the phase of paper-based sukuk to paperless-based sukuk will not be an easy process. As, most of the countries that have taken an approach in this field are countries; which have a significant experience in the field of sukuk issuance, and they also have a good career in Islamic finance. Therefore, Algeria in turn must try to benefit from the pioneering experiences in this field, led by Malaysia, as well as the Gulf states, or even the neighboring country Tunisia; since the first Tunisian experience in the field of sukuk was in 2013, when the Tunis Stock Exchange signed in the sixth of March 2013 a cooperation protocol with “Nasdaq Dubai” in the United Arab Emirates, as it issued sovereign sukuk on Dubai Stock Exchange with the aim of raising an amount of one billion Tunisian dinars (US\$400 million), aiming to finance the Tunisian economy in order to reduce the state budget deficit, and financing urgent public projects during the development plan that extends from 2016 to 2020<sup>3</sup>.

Therefore, Algeria will inevitably should take a practical and real approach in the field of traditional sukuk issuance in order to gain an experience in this field, through either sovereign

<sup>1</sup> - حوارات أبو بكر، ضويفي حمزة، مرجع سبق ذكره، ص 411

<sup>2</sup> - آمال بن فالمي، محبدة أو كيل، مرجع سبق ذكره، ص 77.

<sup>3</sup> - علي سعيد: الصكوك الإسلامية بتونس خطوة على الدرب الصحيح، مجلة المجلس العلمي للبنوك والمؤسسات المالية، العدد 52، 2016— ص 84.

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sukuk or investment sukuk oriented to national or international investors. Hence, it could have the possibility to shift to the digitization phase of blockchain-based sukuk. This will only realise through the rehabilitation of the Algiers stock exchange to localize this distinctive type of investment financing products within the framework of a series of financial and economic reforms that define the framework of the Islamic finance in Algeria.



### Summary

In fact, smart sukuk based on any blockchain platform eliminate intermediaries and reduce costs through the full-automated process. Blossom Smart sukuk considers as the first smart sukuk that finance projects of small enterprises whose owners were previously unable to access the sukuk market in Indonesia. Therefore, Blossom smart sukuk provides more accessibility and removes the high barriers to enter the Indonesian Islamic capital market, as well as its platform supports both registration and payments made via any cryptocurrency or tokenized asset if the issuing authority does not prevent that, in addition to the fiat currency. In addition, it offers a new model for exchanging payments in the Islamic financial market based on ERC20 standards, which enables digital exchange via any existing blockchain wallets or secondary markets.

Aiming to revolutionize sukuk market and keeping pace with the new technological changes, the UAE and Saudi Arabia in turn take a step to the adoption of the new generation of sukuk taking place within the two main experiences of HLC and Wethaq Capital Markets platforms. HLC platform is the first Islamic bank platform in the world that uses blockchain technology for the resale and settlement of sukuk. This initiative was the first time that blockchain has been used worldwide to execute sukuk transaction. Also, Wethaq Capital Markets platform is considered as the first Islamic financial market pilot that used blockchain for a full automated issuance, distribution and trading process of smart sukuk using smart clauses to execute transactions and SWIFT gpi to settle payments. This latter guarantees sukuk's holders the freedom to use fiat currencies instead of using the encrypted ones, and helps in tracking their properties. These two pilots aim to facilitate sukuk trading process while ensuring faster, lower costs, and more efficient transactions, which contribute to the development of the working mechanism of the Islamic financial market, and the expansion of its scale out of the Gulf financial markets.

Despite the several benefits provided by blockchain technology in sukuk industry in particular, and the development of the financial market in general, mainly the reduction of the overall costs including intermediaries, as well as the provision of a high degree of security in financial transactions. However, its application faces many challenges, representing in: regulatory, legal, cyber risk, technological infrastructure challenges. These are considered as the main challenges that are facing the full implementation of blockchain sukuk in the Islamic financial market, and whenever one of them is exist, this leads to a delay in the process of applying smart sukuk in the financial market.

Algeria as one of the countries that is looking for an alternative finance outside the hydrocarbon sector, has become obligated to keep pace with the new technologies of the fourth industrial revolution and try to benefit from the adoption of financial technology in its stock exchange through the issuance of smart sukuk. Therefore, in terms of blockchain application, since the end of 2021, Algeria has adopted a roadmap for applying financial technology techniques, especially blockchain, in both the banking sector and the insurance sector as a first stage to implement Fintech techniques in its financial sector. In terms of sukuk industry, Algeria still has legal and regulatory challenges concerning sukuk issuance. Therefore, it is hard to talk about smart sukuk issuance in Algeria without having a good experience in the conventional sukuk processes. In fact, Algeria will inevitably have to take a practical and real approach in the field of traditional sukuk issuance in order to gain experience in this field, afterward it may have the possibility to shifting to the digitization phase of smart sukuk.

# Conclusion

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One of the aims of the Fourth Industrial Revolution is to reshape the global financial industry landscape, introducing revolutionary changes in financial transactions and services, which are standing on a massive adoption of technologies and digitization. Therefore, it was imperative to modernize this sector in order to stay up with technical advancements in the global financial sector by implementing a variety of contemporary instruments and internet-based technologies; which represented by financial technology techniques, especially blockchain technology. In this regard, Islamic financial markets developed their instruments and embraced new ideas and innovations in order to keep up with the quick technical advancements occurring in the global financial industry. Among these technologies is smart sukuk, often known as blockchain sukuk, which is one of the most important innovations that have been produced through the combination between blockchain technology and sukuk structure. As, smart sukuk have the potential to become the future of sukuk industry and may contribute to the spread of sukuk on a wider scale, leading to the expansion of Islamic finance. Smart sukuk do not only provide simple integration of technology into Islamic finance, but also touch upon a completely new structure of the new Islamic digital economy, which will serve as a channel for economic prosperity such as growth, job creation and strengthening the Islamic economy. In light of that, this study showed how could the Islamic financial market benefit from the implementation of one of the most important applications of financial technology, which is blockchain in structuring smart sukuk, representing a decentralized system that enables transactions to be settled at low cost, with absolute transparency, and security in an immutable distributed ledger.

- ❖ **First: Hypotheses Testing Results:** Through the study, the hypotheses were proved as follows:
  - First hypothesis is true, as blockchain technology is one of the modern financial technologies with multiple characteristics and benefits, its key characteristics representing in immutability, transparency, decentralization and security. As, the main idea behind blockchain is to distribute the validation authority of the transactions to a community of the nodes/computers (network), and to use the cryptographic techniques to guarantee the immutability of the transactions. Moreover, its main benefits are decentralization, cost effectiveness, traceability and auditability;
  - Second hypothesis is true, since blockchain technology has changed the working mechanisms of many financial services and transactions by reducing costs and increasing the scope of trust between dealers. As its main applications (cryptocurrency and smart contracts) offer many opportunities for the financial industry, representing in reducing settlement costs and accelerating payments. For instance, cross-border payments and financing projects based on crowdfunding are the main financial implementations based on cryptocurrency. However, insurance and international trade are financial operations based on smart contracts. Similarly, supplychain and settlements in financial markets are based on both of them, cryptocurrency and smart contracts;
  - Third hypothesis is also true, as automating the stages of securitization process makes sukuk processing easier, more flexible, and less expensive. As, sukuk digitalization (tokenization) provides an automated process of sukuk structuring in terms of sukuk issuance, trading and settlement. Sukuk tokenization, which is based on smart contracts, has decreased the number of middlemen and the total cost of transactions without sacrificing the legitimacy of the sharia framework of sukuk;

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- Fourth hypothesis is true, since using blockchain technology for the issuance, distribution, management and trading of sukuk provides an ongoing streamlining process of standardization, cost reduction and transparency that helps in the development of sukuk industry, which in turn develops the working mechanisms of Islamic financial market, as it is proven by Blossom Finance, HLC, and Wethaq Capital Markets sukuk platforms.
  
- ❖ **Second: Study results:** In light of what was discussed in the four chapters of this thesis, the following results were reached:
  - Blockchain is a digital database and requires a network of computers to function. On blockchain, transactions are coded into blocks, which are connected to each other in the form of chains. This technology allows the users to record and share a common view of a system's state across a distributed network, and makes the online transfer of assets more secure than the traditional payment system;
  - A blockchain transaction commences when a participant notifies the network regarding the terms and conditions that regulate the transactions between the two involved parties;
  - Transfers must go through a mining process in order to add blocks to the ledger. During this process, network members automatically take on the role of authenticators, using a validation system to validate and protect the transaction against double spending. This process aids in building trust amongst interested parties using a decentralized public ledger and cryptographic algorithms, which ensure that transactions cannot be altered;
  
  - The main blockchain's applications in financial sector are cryptocurrency and smart contracts. Cryptocurrency, particularly, bitcoin is the first application of blockchain by Satoshi Nakamoto dates back to 2009. They are decentralized currencies, which save costs, settlement time, and avoid double spending and third party involvement. However, cryptocurrency faces various challenges regarding its regulatory framework and legality as a legal tender, which led to the creation of central bank digital currencies (CBDCs) by the central banks in different countries around the world as a legal digital tender;
  - Smart contracts in turn are a preprogrammed system based on blockchain layers, among their main features are: accuracy, transparency, security and cost reduction. However, their limitations are presenting in: immutability, the scalability of transactions, contract secrecy and legal adjudications and enforceability;
  - The Islamic financial market, as an integral part of the Islamic financial system, plays an important role in financing investments, and although its functions are similar to traditional financial markets, the way it is structured may differ from the structure of traditional financial markets.
  - Sukuk are one of the most knowing Islamic financial instruments, that provide a financing system matching different investors' needs based on different sukuk types and structures;
  - Recently, sukuk market faces many challenges such as the lack of standardization, limited accessibility, and lack of transparency, and different operating costs, which could delay its potential growth. Therefore, blockchain technology was adopted as a solution to address and confront these challenges, giving birth to a new generation of sukuk, which called blockchain sukuk or smart sukuk;
  - Smart Sukuk are the digital generation of sukuk based on blockchain technology. Their unique structure seeks to use technology to provide more efficient and transparent way

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- to issue and manage sukuk in a manner, that is compatible with Islamic Sharia principles, and to enable SMEs to issue their own sukuk based on technology;
- Digitizing sukuk through blockchain remedies certain inefficiencies associated with sukuk transactions, as structuring sukuk on blockchain platform can increase transparency of assets-backed sukuk movements and cash flows, in addition to reducing costs and the intermediaries numbers in sukuk processing;
  - The utilization of blockchain technology and smart contracts have promise in promoting the digital revolution within the industry of sukuk, moving from paper-based sukuk to paperless sukuk, i.e., smart sukuk, which expands the sukuk issuance and develop the Islamic financial market working mechanism. Smart contracts in turn help in solving the problem of sukuk structuring and sukuk standards, as they have been executed when fixed sukuk conditions are met;
  - The first issuance experience of smart sukuk dates back to Blossom Finance platform in Indonesia, providing two type of sukuk structure, mudarabah and ijarah smart sukuk. Its main aim is to finance projects of small enterprises, whose owners were previously unable to access sukuk market in Indonesia, providing more accessibility and removes the high barriers. Its platform supports both registration and payments made via any cryptocurrency or tokenized asset if the issuing authority does not prevent that, in addition to fiat currency. Also, it offers a new model for exchanging payments in the Islamic financial market based on ERC20 standards, which enables digital exchange via any existing blockchain wallets or secondary markets;
  - HLC platform is the first Islamic bank platform in the world to leverage blockchain technology for the resale and settlement of sukuk in Abu Dhabi, the UAE. This was the first time that blockchain has been used worldwide to execute sukuk transaction. The initiative resulted from the collaboration of Al Hilal Bank and Jibrel Fintech network aiming to revolutionize sukuk market and to facilitate their trading process with ensuring faster, low costs, and more efficient transactions;
  - Wethaq Capital Markets platform based on R3-Corda blockchain is a Saudi Arabia-based platform that provides an automating process of the issuance, distribution, and management of sukuk, using smart clauses and SWIFT gpi settlement system, which allows the use of any fiat currency without requiring the use of cryptocurrency, and making the participants directly interact with each other on the platform due to the characteristics of R3-Corda protocol, which has the ability to connect multiple platforms to each other, in an effort to invest in the Saudi, Emirati, Malaysian and European financial markets;
  - Blossom Finance, HLC, and Wethaq Capital Markets are smart sukuk platforms experiments, whose purpose is to remove the obstacles that prevent entry into the Islamic capital markets, especially small and medium-sized enterprises, in an effort to achieve greater financial inclusion, as they aim to use blockchain technology to increase sukuk market transparency, and to facilitate sukuk trading process, ensuring secure, faster, low costs, and more efficient transactions, and expanding an ecosystem that simplifies coordination between market participants, standardizes and automates the overall financial operations;
  - Smart sukuk adoptions are facing some challenges representing in regulatory and legal challenges, that are related to the guidelines that organize the sukuk structuring on blockchain; sharia challenges, which are related to the extent to which the sukuk structure conforms to the provisions of Islamic Sharia; cyber risks challenges are related the security of participants' data and properties, which could hacked on blockchain; and

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technological infrastructure challenges, which are related to infrastructure costs of blockchain integration;

- In Algeria, the Financial Market Control Commission (COSOB), in cooperation with the Federation of Algerian Insurance Companies, launched blockchain laboratory. This considers as the most important step of Fintech adoption in Algeria. However, no activity has been detected so far;
- Concerning, smart sukuk adoption in Algerian financial market, principally, we cannot talk about smart sukuk in Algeria before the actual implementation of traditional sukuk on the Algiers stock exchange. Even if blockchain technology is integrated into the Algerian financial market, the success of adopting smart sukuk depends on the real listing of sukuk on Algiers stock exchange, and gaining a significant experience in this field in terms of securitization process, and its working mechanism. After that, it comes the stage of structuring sukuk on blockchain and moving to the digitalization and tokenization phase of sukuk;
- In general, we cannot consider blockchain merely as a technology that provides a decentralized ledger. However, it considers as a solution that provides a trust, transparency, and cost effective for all financial transactions. As, it is not only considered as a means to develop sukuk industry or the Islamic financial market, but rather it has the potential to develop the financial industry as a whole.

❖ **Third: Suggestions:** Based on previous results, a number of suggestions and solutions can be extracted for those interested in blockchain technology and its applications in the financial sector, which could summarize in the following points:

- Taking advantage of the benefits achieved from smart sukuk platforms experiences in Indonesia, the UAE, and Saudi Arabia in restructuring sukuk market, and integrating blockchain technology in order to develop and accelerate the pace of Islamic financial market working system, which could provide less expensive financing alternatives, especially for small investors;
- The cooperation between Islamic countries to achieve the development of the Islamic financial market, and thus the Islamic financial industry, through exchanging successful experiences between them, and encouraging investment between countries in this field to transfer and exchange expertise;
- Smart sukuk innovation could be a cornerstone in expanding participation in the capital market among Arab countries. Therefore, the central banks of these countries could develop sovereign sukuk infrastructure to facilitate liquidity management and raise financing to support development in the Arab world;
- Preparing qualified human cadres in financial technology techniques, who could keep pace with more innovative applications generally in financial sector, and particularly in the Islamic financial through a Fintech academic formation, or training programs specialized in this field;
- Issuing more regulatory laws to ensure the application and regulation of transactions based on blockchain or other financial technology techniques in order to protect their users;
- Preparing a regulatory and legislative ecosystem in Algeria that support the integration of sukuk industry to Algiers stock exchange, as well as working for accelerating the adoption of financial technology techniques, which could boost both movement of capitals and indirect foreign investments.

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- ❖ **Fourth: Study Prospective:** Through the study of this topic, with its results and suggestions, it became clear that there are several topics related to the topic of our research that need further research. They are considered as a scientific research gap that we could not cover in our study due to the vastness of this topic. Therefore, the following topics are recommended for future research projects:
- Requirements of financial technology application in Algeria based on leading Fintech experiences'benefits;
  - Cryptocurrency and its impact on the monetary policy and the stability of the global monetary system;
  - Central banks digital currencies (CBDCs) as a strategic solution to cryptocurrency risks on monetary policy.
  - Using blockchain technology in enhancing Islamic financial industry.
  - Requirements for the integration of sukuk into the Algiers stock exchange under regulation of 2020/02.

# List of References



## List of References

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### First: English References

#### ❖ Book

1. Ahcene Lahsasna, et al.: Forward Lease Sukuk in Islamic Capital Markets, Springer Nature, Switzerland, 2018
2. Andreas M. Antonopoulos: Mastering Bitcoin: Unlocking Digital Currency, O'Reilly, the United States of America, 2015.
3. Antony Welfare: Commercializing Blockchain: Strategic Application in the Real World, Wiley, 2020.
4. Aries Wanlin Wang: Crypto Economy: How Blockchain, Cryptocurrency and Token Economy are Distrupting the Financial World, Racehorse Publishing, United States of America, 2018.
5. Belaj Badr: Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger, Packt Publishing, Birmingham, United Kingdom, 2018.
6. Brian Kettel: Introduction to Islamic Banking and Finance, Wiley, Great Britain, 2011.
7. Burgess K., Colangelo J: The Promise of Bitcoin and the Blockchain; Consumers' Research: Washington, USA, 2015.
8. Cosmin Novac: A brief introduction to Bitcoin, Independently Published, Germany, 2019.
9. David Lee Kuo Chuen, Digital currency: Bitcoin, Innovation, Financial instruments and Bid data, Springer Nature, Switzerland, 2018.
10. Debajani Mohanty: Ethereum for Architects and Developers, Springe, New York, 2018.
11. Erik Hofmann et al.: Supply Chain Finance and Blockchain Technology, Springer, Switzerland, 2018.
12. Faizal Karbani: Mastering Islamic Finance, Pearson Education, Great Britain, 2015.
13. Garrick Hileman, Michel Rauchs: Globaliz Block chain Benchmarking Study, Cambridge Centre for Alternative Finance, United Kingdom, 2017.
14. Hanudin Amin et al.: The Islamic Money Market, Islamic Financial Institutions and Markets, London, United Kingdom, 2013.
15. Hazik Mohamed, Hassnian Ali: Blockchain, Fintech, and Islamic Finance, the Deutsche National bibliothek, Berlin, 2019.
16. Imran Bashir: Mastering Blockchain, Packt Publishing, Birmingham, United Kingdom, 2018.
17. Joseph J. Bambara, Paul R. Allen: Blockchain- A Practical Guide to Developing Business, Law, and Technology Solutions-, McGraw-Hill Education, The United States of America, 2018.
18. Junaid Haider, Muhammad Azhar: Islamic Capital Market- Sukuk and its Risk Management in the Current Scenario-, School of Business publication, Sweden, 2010.
19. Kyle Burgess, Joe Colangelo: Promise of Bitcoin and the Blockchain, Consumers' Research, Washington, USA, 2015.
20. M. Kabir Hassan, Mervyn K. Lewis: Hand Book of Islamic Bnaking, Edward Elgar Publishing Limited, 2007.
21. Mahdi H. Miraz, David C. Donald: Application of Blockchain in Booking and Registration Systems of Securities Exchanges, the IEEE International Conference on Computing, Electronics & Communications Engineering, University of Essex, United Kingdom, 2018.
22. Makoto Yano et al.: Blockchain and Crypt Currency Building a High Quality Marketplace for Crypt Data, Springer Nature, Singapore, 2020.

## List of References

---

23. Margarita Peredaryenko: FinTech, Blockchain, and Islamic Finance – Building the Future in the New Islamic Digital Economy, Emir Research, Malaysia, 2019.
24. Merunas Grincalaitis: Mastering Ethereum, Packt Publishing, United Kingdom, 2019.
25. Michael G. Solomon: Ethereum, Wiley, New Jersey, 2019.
26. Mohd Azmi Omar et al.: Fundamentals of Islamic Money and Capital Markets, Wiley, Singapore, 2017.
27. Mohd Ma'Sum Billah: Islamic Products: Principle, Instruments and Structure, Palgrave Macmillan, United Kingdom, 2019, p 217.
28. Mohd Ma'Sum Billah, Halal: Cryptocurrency Management, Springer Nature, Switzerland, 2019.
29. Nafis Alam et al: Fintech and Islamic Finance: Digitalization, Development, and Disruption, Springer Nature, Switzerland, 2019.
30. Nishith Pathak, Anurag Bhandari: IoT, AI, and Blockchain for NET, Springer, New York, 2018.
31. Pierluigi Martino: Blockchain and Banking how Technological Innovations are shaping the Banking Industry, Springer Nature, Switzerland, 2021.
32. Richard Ozer: Ethereum - The insider Guide to Blockchain Technology, Cryptocurrency and Mining Ethereum, Springer, Switzerland, 2017.
33. Rodrigo da Rosa Righi et al.: Blockchain Technology for Industry 4.0, Springer Nature, Singapore, 2020.
34. Rosario Girasa: Regulation of cryptocurrencies and blockchain technologies: National and International Perspectives, Springer Nature, Switzerland, 2018.
35. Sean Stein Smith: Blockchain, Artificial Intelligence and Financial Services: Implications and Applications for Finance and Accounting Professionals, Springer Nature, Switzerland, 2020.
36. Shaik V. Akram et al.: Adoption of blockchain technology in various realms: Opportunities and challenges, Wiley, 2020, P 2.
37. Shiho Kim, Ganesh Chandra Deka: Advanced Applications of Blockchain Technology, Springer Nature, Singapore, 2020.
38. Simon Archer, Rifaat Ahmed Abdel Karim: Islamic Capital Markets and Products- Managing Capital and Liquidity Requirements Under Basel III-, Wiley, Chichester, United Kingdom, 2018.
39. Velid Efendic, Fikret Hadžic, Hylmun Izhar: Critical Issues and Challenges in Islamic Economics and Finance Development, Springer Nature, Switzerland, 2017.
40. Vincenzo Morabito: Business Innovation through Blockchain: The B<sup>3</sup> Perspective, Springer Nature, Switzerland, 2017.
41. Xiwei Xu et al.: Architecture for Blockchain Applications, Springer Nature, Switzerland, 2019.
42. Yano Makoto et al.: Blockchain and Crypt Currency, Springer, Singapore, 2020.
43. Ying Chang Liang: Blockchain for Dynamic Spectrum Management, Springer, 2020
44. Zamir iqbal, Abbas mirakhor: An Introduction to Islamic Finance-Theory and Practice, Wiley, Singapore, 2011.

### ❖ Articles

1. Abdelouhed Mohamed: Challenges of Applying Blockchain Technology to the Algerian Financial Accounting System, Journal of El-Maqrizi Economic and Financial Studies, Vol.05, No.02, 2021.

## List of References

---

2. Abdul aziz Abdullah et al.: Risk in Funding Infrastructure Projects through Sukuk or Islamic Bonds, *International Review of Management and Business Research*, Vol.03, No.02, 2014.
3. Abhishek Gupta, Stuti Gupta: Blockchain Technology Application in India Banking Sector, *Delhi Business Review*, Vol.19, No.02, 2018.
4. Ahmed Afif Monrat et al.: A survey of blockchain from the perspectives of applications, challenges, and opportunities, *IEEE Journal*, 2019.
5. Ahmet Ulusoy, Mehmet Ela: Secondary Market of Sukuk: An Overview, *International Journal of Islamic Economics and Finance Studies*, Vol.04, No.02, 2018.
6. Aldi khusmufa Nur Iman, Sirajul Arifin: The Advantages and Challenges of Implementing Sukuk through Blockchain Technology, *An-Nisbah, Jurnal Ekonomi Syariah*, Vol.08, No.02, 2021.
7. Alexander Savelyev: Contract law 2.0: 'Smart' contracts as the beginning of the end of classic contract law, *Information & Communications Technology Law*, Vol.26, No.02, 2017.
8. Ali Ihsan Ozdemir et al.: Assessment of blockchain applications in travel and tourism industry, *Quality and Quantity: International Journal of Methodology*, Vol.54, No.05, 2020.
9. Amal Khairy Amin Muhammad, Mahmoud Mohamed Abdel Hakim Zaim: Smart Sukuk issuance platforms to finance small and medium enterprises in Saudi Arabia: Opportunities and Challenges, *GIEM*, Vol.128, 2023.
10. Amelia Ripal et al. : Analysis of Murabahah Financing Strategy in Increasing the Number of Members: A Case Study on BMT (Baitul Mal Wal Tanwil) Permata Indonesia Pekanbaru Riau, *ADIJAYA*, Vol.01, No.02, 2023.
11. Amira El Sayed El Gendy : Impact of the use of smart contracts on the efficiency of Islamic banking, *Journal of Financial, Accounting and Managerial Studies*, Vol.06, No.02, 2019.
12. Andri Soemitra et al : Islamic Perspective On Money Market and The Operation of Sharia Money Market, *Jurnal Ilmiah Ekonomi Islam*, Vol.07, No. 03, 2021.
13. Arati Baliga et al: Performance Evaluation of the Quorum Blockchain Platform, *Persistent Systems journal*, 2018.
14. Arshdeep Bahga, Vijay K. Madiseti: Blockchain Platform for Industrial Internet of Things, *Journal of Software Engineering and Applications* , Vol.09, No.10, 2016.
15. Babas Mounira: Blockchain Sukuk Industry... A Revolution in the World of Model A as Experience Platform Wethaq - Sukuk Investment, *Journal of Financial, Accounting and Managerial Studies*, Vol.09, No.02, 2022.
16. Babas Mounira: Blockchain Technology Applications in the Islamic Financial Industry -The Smart Sukuk of Blossom Finance's Platform in Indonesia Model, *Economic Sciences, Management and Commercial Sciences Review*, Vol.13, No.2, 2020.
17. Bahareh Lashkari, Petr Musilek: A Comprehensive Review of Blockchain Consensus Mechanisms, *IEEE Access*, Vol.04, 2016.
18. Ben S. C. Fung, Hanna Halaburda: Central Bank Digital Currencies: A Framework for Assessing Why and How, *Currency Department, Bank of Canada Publication*, 2016.
19. Benalkama Malika: Sukuk Tokenization: Successful Experiences, *Journal of Studies in Economics and Management*, Vol.04 No.01, 2021.
20. Benzekkoura Laounia : Sukuk and economic development (Prospects and Challenges) Refer to the experience of Malaysia, *Journal of Economics and Human Development*, Volume 10, No.2, 2019.
21. Binghui Wu, Tingting Duan: The Application of Blockchain Technology in Financial markets, *Journal of Physics: Conference Series*, Vol.1176, No. 04, 2018.

## List of References

---

22. Chaibou Issoufou: Islamic Money Market and Application of Third party guarantee for Economic Development, *Humanities & Social Sciences Reviews*, Vol.07, No 2, 2019.
23. Choi Tsan-Ming: Supply chain financing using blockchain: impacts on supply chains selling fashionable products, *Annals of Operations Research*, 2020.
24. Christian Cachin: Architecture of the Hyperledger Blockchain Fabric, *IBM Journal*, 2016.
25. Christophe J. Godlewski et al.: Sukuk Vs Conventional Bonds: a stock market perspective, *Journal of Comparative Economics*, Vol. 41, 2013.
26. Dattani Janvi, Sheth Harsh: Overview of Blockchain Technology, *Asian Journal of Convergence in Technology*, 2019.
27. Dennis NG, Griffin Paul: The wider impact of a national cryptocurrency, *Global Policy, Research Collection Lee Kong Chian School Of Business*, 2018.
28. Dhar Suparna, Bose Indranil: Smarter banking: Blockchain technology in the Indian banking system, *Asian Management Insights*, 2016.
29. Dhiaeddine Rejeb: Smart Contract's Contributions to Mudaraba, *Tazkia Islamic Finance and Business Review*, Vol.15, No.01, 2021.
30. Dikilitaş Yılmaz, Onur Toka Kazım, Sayar Ahmet: Current Research Areas in Blockchain, *European Journal of Science and Technology*, 2021.
31. Durgha Moorthy: A study on rising effects of cryptocurrency in the regulations of Malaysian legal system, *International Journal of Business, Economics and Law*, Vol.15, No.04, 2018.
32. Ebelogu Christopher et al.: Cryptocurrency (Blockchain) Technology as a Means of Leveraging the Nigeria Economy, *International Journal of Advances in Scientific Research and Engineering (IJASRE)*, Vol.5, 2019.
33. Elasrag Hussein: Blockchains for Islamic finance: Obstacles Challenges, *Munich Personal RePEc Archive*, 2019.
34. Essia Ries Ahmed et al.: Islamic Sukuk: Pricing Mechanism and Rating, *Journal of Asian Scientific Research*, Vol.04, 2014.
35. Evans Olaniyi: Blockchain Technology and the Financial Market: An Empirical Analysis, *School of Management & Social Sciences*, 2018.
36. Fatima Alsubaei: Blockchain Adoption in the Gulf States, *Middle East Institute*, 2019.
37. Fayaz Ahmed Lone, Siraj Ahmed: Islamic finance: More expectations and less disappointment, *Investment Management and Financial Innovations*, Vol.14, No.01, 2017.
38. Francisco Climent et al.: The Investment Performance of U.S. Islamic Mutual Funds, *Sustainability*, 2020.
39. Gani Ibrahim Musa et al.: The Impact of Islamic Capital Market on Malaysian Real Economy, *Jurnal Ekonomi Malaysia*, Vol.54, No.02, 2020.
40. Gautam Vora: Cryptocurrencies: Are Disruptive Financial Innovations Here?, *Modern Economy Journal*, 2015.
41. Gupta Abhishek, Stuti Gupta: Blockchain technology application in indian banking sector, *Delhi Business Review*, Vol.19, 2018
42. Haider Dhia Zubaydi et al.: A Review on the Role of Blockchain Technology in the Healthcare Domain, *Electronics Review*, Vol.08, 2019.
43. Hatem A. El-Karanshawy et al.: Ethics, Governance and Regulation in Islamic Finance, *Developing Inclusive and Sustainable Economic and Financial Systems*, Vol.04, 2015.
44. Hossein Kakavand, Nicolette Kost De Sevres: The blockchain Revolution: An Analysis of Regulation and Technology Related to Distributed Ledger Technologies, *Electronic Journal*, 2017.

## List of References

---

45. Hussein Elasrag: Blockchains for Islamic finance: Obstacles Challenges, Munich Personal RePEc Archive, 2019.
46. Ida Syafrida et al.: Securities Issuance Considerations as an External Funding Source for Sharia Commercial Banks, *Economica: Jurnal Ekonomi Islam*, Vol.01, No.02, 2020.
47. Imam Wahyudi, Gandhi Anwar Sani: Interdependence between Islamic capital market and money market: Evidence from Indonesia, *Borsa Istanbul Review*, Vol.32, No.47, 2014.
48. J. Leon Zhao et al.: Overview of business innovations and research opportunities in blockchain and introduction to the special issue, *Financial Innovation*, 2016.
49. Janis Bauvars: Applicability of Blockchain Technology in Securities Settlement, *Complex Systems Informatics and Modeling Quarterly*, 2020.
50. Janvi Dattani, Harsh Sheth: Overview of Blockchain Technology, *Asian Journal of Convergence in Technology*, Vol.07, No.01, n.d.
51. Jonas Grob et al.: The Digital Euro and the Role of DLT for Central Bank Digital Currencies, Frankfurt School Blockchain Center, 2020.
52. Ketut Ariadi Kusuma and Anderson Caputo Silva: Sukuk Markets A Proposed Approach for Development, Policy Research Working Paper, 2014.
53. Koulu, Riikka: Blockchains and Online Dispute Resolution: Smart Contracts as an Alternative to Enforcement, *Journal of Law, Technology & Society*, Vol.13, No.01, 2016.
54. Koulu, Riikka: Blockchains and Online Dispute Resolution: Smart Contracts as an Alternative to Enforcement, *Journal of Law, Technology & Society*, Vol.13, No.01, 2016.
55. Lee David Kuo Chuen et al.: Cryptocurrency: A new investment opportunity?, *Journal of Alternative Investments*. 2018.
56. Lennart Ante et al.: Blockchain-Based ICOs: Pure Hype or the Dawn of a New Era of Startup Financing? *Journal of Risk and Financial Management*, 2018.
57. Marina Niforos: Blockchain in Development— A New Mechanism of ‘Trust’?, The International Finance Corporation report: BLOCKCHAIN Opportunities for Private Enterprises in Emerging Markets, 2019.
58. Martin Valenta, Philipp Sandner: Comparison of Ethereum, Hyperledger Fabric and Corda, Frankfurt School Blockchain Center, 2017.
59. Matthew J. Martin: Blossom: Halal & Ethical Investments Using Sukuk, Good returns, Great impact, no date.
60. Md Nazmus Saadat et al.: Blockchain based Crowdfunding Systems, *Indonesian Journal of Electrical Engineering and Computer Science*, Vol.15, No.01, 2019.
61. Michael Kumhof, Clare Noone: Central Bank Digital Currencies: Design Principles and Balance Sheet Implications, Bank of England, 2018.
62. Mohammed Aatur Rahman et al.: Cryptocurrency Integration Challenges in Blockchain for Financial Institution, *Asian Journal of Electrical and Electronic engineering*, Vol.01, No.02, 2022.
63. Mohammed Jashim Uddin and Md. Nezum Uddin, Scenario of Islamic money market instruments in some selected Muslim countries: A lesson for Bangladesh, *IIUC Business Review*, Vol.05, 2016.
64. Mubashar Iqbal, Raimundas Matulevicius: Corda Security Ontology: Example of Post-Trade Matching and Confirmation, *Baltic J. Modern Computing*, 2020.
65. Mufti Muhammad Abu-Bakar: Shariah Analysis of Bitcoin, Cryptocurrency, and Blockchain, Blossom Report, 2017.

## List of References

---

66. Muhammad Akhyar Adnan : The effectiveness of Baitul Maal wat Tamwil in reducing poverty The case of Indonesian Islamic Microfinance Institution, *Humanomics*, Vol. 31, No.02, 2015
67. Muneeza Aishath, et al.: The Application of Blockchain Technology in Crowdfunding: Towards Financial Inclusion via Technology, *International Journal of Management and Applied Research*, 2018, Vol.05, No.02, 2018.
68. Mustafa Raza Rabbani: Fintech innovations, scope, challenges, and implications in Islamic Finance: A systematic analysis, *International Journal of Computing and Digital Systems*, 2020.
69. Mustafa Raza Rabbani: Fintech innovations, scope, challenges, and implications in Islamic Finance: A systematic analysis, *International Journal of Computing and Digital Systems*, 2020.
70. Nida Khan et al.: Tokenization of Sukuk: Ethereum Case Study, Preprint submitted to *Global Finance Journal*, 2020.
71. Nor Razinah Binti Mohd. Zainet al.: Smart Contract in Blockchain: An Exploration of Legal Framework in Malaysia, *Intellectual Discourse*, Vol.27, No.02, 2019.
72. Novita Sari: The Impact of Islamic Capital Market Development on Economic Growth: the case of Indonesia, *Journal of Smart Economic Growth*, Vol.03, No.02, 2018.
73. Nurul Izzati Septiana, Hilda Sanjayawati: Sukuk on Blockchain: Application, Advantages, and Challenges, *JHIBIZ*, Vol05, No.02, 2021.
74. Ola Al-Sayed, Money Market Instruments in Conventional and Islamic Banks, *European International Journal of Science and Humanities*, Vol.1, No.3, 2015.
75. Olena Bondarenko et al.: The possibilities of using investment tools based on cryptocurrency in the development of the national economy, *Baltic Journal of Economic Studies*, Vol.05, No.02, 2019.
76. Omar Alaeddin et al.: Implementing the Blockchain Technology in Islamic Financial Industry: Opportunities and Challenges, *Journal of Information Technology Management*, Vol.13, No.03, 2021.
77. Osama Hamza: Smart Sukuk Structure from Sharia Perspective and Financing Benefits: Proposed Application of Smart Sukuk through Blockchain Technology in Islamic Banks within Turkey, *European Journal of Islamic Finance*, Second Special Issue, 2020.
78. Patki Aarti, Vinod Sople: Indian banking sector: blockchain implementation, challenges and way forward, *Journal of Banking and Financial Technology*, 2020.
79. Qassim Nasir: Performance Analysis of Hyperledger Fabric Platforms, *Security and Communication Networks Journal*, 2018.
80. Raphael Auer et al.: Central bank digital currencies: motives, economic implications and the research frontier, Monetary and Economic Department, Bank for International Settlements, 2021.
81. Raqiya Ahmed Al Hilali1, Hothefa Shaker: Blockchain Technology's Status of Implementation in Oman: Empirical Study, *International Journal of Computing and Digital Systems*, Vol.01, 2021.
82. Reade Rya, Mayme Donohue: Securities on Blockchain, *The Business Lawyer*, Vol.73, 2018, p 92.
83. Ronny Hans et al.: Blockchain and Smart Contracts: Disruptive Technologies for the Insurance Market, *Ebusiness and Ecommerce Digital Commerce (sigebiz)*, 2017.
84. S. Nakamoto: "Bitcoin: A Peer-to-Peer Electronic Cash System," *Tech. Rep.*, 2008.
85. Saadat Md Nazmus et al.: Blockchain based crowdfunding systems, *International Journal of Electrical Engineering and Computer Science*, 2019.

## List of References

---

86. Saeed A. Bin-Nashwan et al.: what Motivates Retail Investors to Invest in Government-Issued Digital Sukuk during COVID-19?, *Journal of Islamic Accounting and Business Research*, 2022.
87. Saheed Abdullahi Busari, Sikiru Olanrewaju Aminu: Application of blockchain information technology in Sukuk trade, *Journal of Islamic Accounting and Business Research*, 2019.
88. Sankaranarayanan G, Kumar Rajagopalan Kamal: Usage of blockchain technology in banking sector and its implication on Indian economy, *Alochana Chakra Journal*, 2020.
89. Sarah Iftikhar, Irum Saba: Blockchain Based Smart Sukuk as Shariah Compliant Investment Avenues for Islamic Financial Institutions in Pakistan, *Journal of Finance & Economics Research*, Vol.05, 2020.
90. Sarthak Gaurav: The Market for Cryptocurrencies an Ode to F A Hayek, *Economic & Political Weekly*, 2019.
91. Satoshi Nakamoto: Bitcoin: A Peer-to-Peer Electronic Cash System, White paper, 2008.
92. Shah Tejal, Shailak Jani: Applications of blockchain technology in banking & finance. Vadodara, *Journal of Management Studies Faculty, India*, 2018.
93. Sheila Ainon Yussof, Abdullah Al-Harthy: Cryptocurrency as an Alternative Currency in Malaysia: issues and challenges, *Islam and Civilisational Renewal*, N.d,
94. Sherin Kunhibava et al.: Sukuk on blockchain: a legal, regulatory and Sharī'ah review, *ISRA International Journal of Islamic Finance*, Vol.13 No.01, 2021.
95. Sherin Kunhibava et al.: Şukūk on blockchain: a legal, regulatory and Sharī'ah review, *International Journal of Islamic Finance*, Vol.11, No.1, 2021.
96. Silas Nzuva: Smart Contracts Implementation, Applications, Benefits, and Limitations, *Journal of Information Engineering and Applications*, Vol.09, No.05, 2019.
97. Sonny Zuhuda, Afifah binti Sayuti: hither policing cryptocurrency in Malaysia? , *The International Islamic University Malaysia Law Journal*, Vol.25, No.02, 2017.
98. Soonduck Yoo: Blockchain based financial case analysis and its implications, *the Asia Pacific Journal of Innovation and Entrepreneurship*, Vol.11, No.03, 2017.
99. Soonpeel Edgar Chang : Legal Status of Cryptocurrency in Indonesia and Legal Analysis of the Business Activities in Terms of Cryptocurrency, *journal of kegal studies*, Vol.06, No.01, 2019.
100. Taehyun KO, Jaeram Lee, Doojin Ryu: Blockchain Technology and Manufacturing Industry: Real-Time Transparency and Cost Savings, *Journal of Sustainability*, Vol.10, 2018.
101. Tarik Dogru, Makarand Mody, Christie Leonardi: Blockchain Technology and its Implications for the Hospitality Industry, *Boston hospitality review*, 2018.
102. Tejal Shah, Shailak Jani: Applications OF Blockchain Technology in Banking and Finance, *Journal of Management Studies*, Parul University, Vadodara, India, 2018.
103. Tommaso Mancini Griffoli et al.: Casting Light on Central Bank Digital Currency, *International Monetary Fund*, 2018.
104. Treleaven Philip, Gendal Brown Richard, Yang Danny: Blockchain Technology in Finance, *Journal of Computer society*, Vol.50, No. 09, 2017.
105. Vijeta Banwari: Cryptocurrency-scope in India, *International Research Journal of Management Sociology & Humanity*, Vol.8, 2017.
106. Vitalik Buterin: A next generation smart contract & decentralized application platform, White paper, 2013.
107. Wim Raymaekers: Cryptocurrency Bitcoin: Disruption, challenges and opportunities, *Banking and Treasury Markets Journal*, 2014.
108. Xiao Fan Liu et al.: Knowledge Discovery in Cryptocurrency Transactions: A Survey, *IEEE Access*, Vol.09, 2021.

## List of References

---

109. Zachary A. Smitha, et al.: Blockchain and the Future of Securities Exchanges, Artificial Intelligence and Blockchain for Future Cyber security Applications, 2021.
110. Zibin Zheng et al.: Blockchain challenges and opportunities: a survey, Journal Web and Grid Services, Vol. 14, No.04, 2018.

### ❖ Conference Interventions

1. Karl J. O'Dwyer, David Malone: Bitcoin Mining and its Energy Footprint, The 25th International Conference on Information and Communications Technologies, Limerick, Ireland, 26–27 June 2014.
2. Radu Stancu: The Notions of Blockchain and Smart Contract from the Point of view of the Intellectual Property Right, The 13th edition of the international conference European Integration Realities and Perspectives, 2018.
3. Tareq Muhammad Aziz Elven: Cryptocurrency and Constituency: Understanding the Existence of Bitcoin and Its Regulation in Indonesia, International Program for Law and Sharia, Faculty of Law, Universitas Muhammadiyah Yogyakarta, Daerah Istimewa Yogyakarta, Indonesia, 2019.
4. Vijaya Kittu et al.: Status Check on Blockchain Implementations in India, International Conference on Technological Innovations in Management Ecosystem, Visakhapatnam, 2018.

### ❖ Reports

1. Accounting and Auditing Organization for Islamic Financial Institutions in its Shari'ah Standard No. 17, Investment Sukuk, Bahrain, 2007.
2. Accounting and Auditing Organization for Islamic Financial Institutions in its Shari'ah Standard No. 10, Bahrain, 2017.
3. Al Hilal Bank Report: HLC Smart Sukuk Platform: Islamic Asset Tokenization is the Future of Islamic Finance, 2019.
4. BMT Bina Ummah Report, 2020.
5. COSOB Report: DZ Finlab Ecosystem and Roadmap, 2020.
6. Deloitte Report, 2017.
7. Deloitte report, 2021.
8. Deloitte Report: Blockchain applications in banking, 2016.
9. Deloitte Report: Blockchain applications in insurance, 2016.
10. European Central Bank report, 2021.
11. International Islamic Financial Market Sukuk Report, 2022.
12. Islamic Finance Development Report: Progressing Through Adversity, 2020.
13. Islamic Financial Services Council: Capital adequacy requirements for sukuk, sukuk and real estate investments, Standard No.07, 2009.
14. Kumar Arnab et al: Blockchain, The India Strategy Report, India, 2020.
15. Report of the United Kingdom department of International trade: How Blockchain will reshape the financial services industry, United Kingdom, 2017.
16. Report of the United Nations: blockchain implementation in Latin America and the Caribbean, 2021.
17. Securities Commission Malaysia Report, 2019.
18. The auditing and consulting firm (PwC) Report: "Time for Trust", 2022.
19. The International Organization of Securities Commissions: Islamic Capital Market Fact Finding Report, 2004.



## List of References

20. The World Bank Annual Report, 2017.
21. United Nation Report: Harnessing blockchain for sustainable development: Prospects and Challenges, 2021.

### ❖ Websites

1. Peter Michalopoulos Structuring Complex Financial Products on Corda: The Sukuk Case Study, 2019, available at: <https://medium.com/inside-r3/innovating-in-sukuk-capital-markets-fbc69c295be2>, Consulted on 17/08/2023.
2. The official Tracking Cryptocurrency web site, available at: [www.coinmarketcap.com](http://www.coinmarketcap.com), consulted on 15/09/2023.
3. The official website of Al Hilal Bank, available at: [www.alhilalbank.ae](http://www.alhilalbank.ae), Consulted on 31/08/2023.
4. The official website of Blossom Finance Company, available at: [www.blossomfinance.com](http://www.blossomfinance.com), consulted on 04/07/2023.
5. The official website of Corda, available at: [www.corda.net](http://www.corda.net), Consulted on 17/08/2023.
6. The official website of R3 Corda, available at: [www.r3.com](http://www.r3.com), consulted on 17/08/2023.
7. The official website of Statista, available at: [www.statista.com](http://www.statista.com), consulted on 24/08/2022.
8. The official website of the Algiers Stock Exchange, available at: [www.cosob.org](http://www.cosob.org), consulted on 02/08/2023.
9. The official website of the Financial Center of Abu Dhabi, available at: [www.adgm.com](http://www.adgm.com), Consulted on 31/08/2023.
10. The official website of the Islamic Fintech News, available at: [www.ifnfintech.com](http://www.ifnfintech.com), consulted on 19/08/2023.
11. The official website of the Wethaq Capital Markets Company, available at: [www.wethaqcapital.sa](http://www.wethaqcapital.sa), consulted on 17/08/2023.
12. The official website PwC, available at: [www.pwc.com](http://www.pwc.com), consulted on 24/08/2022.

### ❖ Laws and Regulations

1. Law No. 11-17 dated Rabi' Al-Thani 08, 1439 AH, corresponding to December 27, 2017 AD, which includes the Finance Law for the year 2018, Algerian Official Journal. No. 76 issued in December 28, 2017.
2. Regulation No. 02-20 (2020), Banking Operations Related to Islamic Banking by Banks and Financial institutions, The official journal of the Republic of Algeria No. 16, dated on 03/24/2020.

### Second: Arabic References

#### ❖ الكتب

1. أحمد شعبان محمد على: الصكوك الإسلامية ودورها في تحقيق التنمية الاقتصادية، دار التعليم العالي، الإسكندرية، 2014.
2. أدهم إبراهيم جلال الدين: الصكوك والأسواق المالية الإسلامية ودورها في تمويل التنمية الاقتصادية، دار الجوهرة للنشر والتوزيع، القاهرة، 2014.

## List of References

3. أسامة محمد الفولي، زينب عوض الله: "اقتصاديات النقود والتمويل"، دار الجامعة الجديدة، مصر، 2005.
4. أنطوان الناشف، خليل الهندي: "العمليات المصرفية والسوق المالية"، المؤسسة الحديثة للكتاب، لبنان، 2000.
5. زناقي فارس محمد، الصكوك الإسلامية: الإطار النظري والشرعي وكيفية التطبيق، دار المطبوعات الجامعية، الإسكندرية، 2014.
6. زياد جلال الدماغ: الصكوك الإسلامية ودورها في التنمية الاقتصادية، دار الثقافة، عمان، الاردن، الطبعة الاولى، 2012.
7. شعبان محمد إسلام البرواري: بورصة الأوراق المالية من منظور إسلامي: دراسة تحليلية نقدية، دار الفكر، سوريا، 2002.
8. عادل عبد الفضيل عيد: الصكوك الاستثمارية: دراسة مقارنة، دار التعليم العالي، الإسكندرية، 2003.
9. محفوظ جبار: البورصة وموقعها من أسواق العمليات المالية، الجزء الأول، دار هومة، الجزائر، 2002.
10. محمد سعد عامر: الأصول الشرعية في الاقتصاد الإسلامي، مؤسسة شباب الجامعة، الإسكندرية، مصر، 2018.
11. محمد صبري هارون: أحكام السواق المالية الأسهم والسندات عمان - الأردن، دار النفائس الطبعة الثانية 2009.
12. يوسف حسن يوسف: الصكوك المالية وأنواعها، دار التعليم العالي، الإسكندرية، مصر، 2014.

### ❖ المقالات

1. أحمد بن خليفة، حفوطة الأمير عبد القادر: مساهمة الصكوك الإسلامية في تحسين عجلة التنمية في الجزائر "تجربة السودان نموذجاً"، مجلة اقتصاديات الأعمال والتجارة، العدد 2017، 3.
2. أمال بن فالمي، محيدة أوكيل: متطلبات اعتماد الصكوك الإسلامية في الجزائر على ضوء التجربة الماليزية، مجلة التنمية والاستشراف للبحوث والدراسات، المجلد 07، العدد 01، 2022.
3. باهي نوال، أيمن فريد: الصكوك المالية الإسلامية كبديل متاح لتمويل عجز الموازنة العامة في الجزائر في ظل الأوضاع الراهنة، مجلة شعاع للدراسات الاقتصادية، العدد الرابع، الجزائر، 2018.
4. بريش رابح، سنوساوي فاطنة: تأثير التعامل بالعمولات الرقمية المشفرة على السياسة النقدية-البتكوين نموذجاً-، مجلة المقريري للدراسات الاقتصادية والمالية، المجلد 6، العدد 02، 2022.
5. بن زراع حياة، عائشة عبد الحميد: تحديات إصدار الصكوك الإسلامية في الجزائر، مجلة الاقتصاد الإسلامي العالمية، العدد 95، 2020.
6. بن معتوق صابر: تحديات التعامل بالعمولات المشفرة-البيتكوين نموذجاً، المجلة الجزائرية للبحوث الاقتصادية، المجلد 20، العدد 03، 2020.
7. حوات أبوبكر، ضويفي حمزة: متطلبات التوجه نحو إصدار صكوك إسلامية في الجزائر-دراسة استطلاعية-، مجلة شعاع للدراسات الاقتصادية، المجلد 07، العدد 01، 2023.
8. خطوي منير، بن موسى اعمر: النوافذ الإسلامية كآلية لتفعيل الصيرفة الإسلامية في الجزائر، مجلة إضافات اقتصادية، المجلد 05، العدد 02، 2021.
9. راضية لسود، سامية بولعسل: تجارب عالمية ناجحة في إصدار الصكوك الإسلامية لتمويل التنمية المستدامة وآفاقها في الجزائر، مجلة نماء للاقتصاد والتجارة، المجلد 01، 2018.

## List of References

10. طوالبية نهاد، بملول لطيفة: الصكوك الإسلامية كبديل تمويلي لتحقيق التنمية الاقتصادية وسد العجز الموازي-ماليزيا أنموذجا-، مجلة البشائر الاقتصادية، المجلد5، العدد 2019، 2.
11. عبد الحق بادا: الصكوك الإسلامية في الجزائر: بين التنظير والتطبيق، مجلة الاستراتيجية والتنمية، المجلد 11، العدد 04، 2021.
12. العرابي مصطفى وآخرون: دور الصكوك الإسلامية في تمويل الاقتصاد-ماليزيا نموذجا-، مجلة البشائر الاقتصادية، المجلد الثالث، العدد1، 2017.
13. علي سعيد: الصكوك الإسلامية بتونس خطوة على الدرب الصحيح، مجلة المجلس العلمي للبنوك والمؤسسات المالية، العدد 52، 2016.
14. عمر عبو: دور الصكوك الإسلامية في تنشيط سوق الأوراق المالية الإسلامية، الأكاديمية للدراسات الاجتماعية والإنسانية، العدد 18، الجزائر، 2017.
15. مصطفى بوعقل: التوجه الحديث للعملة المالية في ظل تكنولوجيا سلسلة الكتل، مجلة الاقتصاد الدولي والعملة، المجلد02، العدد 04، 2019.
16. نعاس صلاح الدين، بن سانية عبد الرحمان: العملة الافتراضية بتكوين ومعنويات المستثمرين، أية علاقة؟، مجلة الاستراتيجية والتنمية، المجلد10، العدد01، 2020.

### ❖ مداخلات

1. أمل خيرى، أمين محمد: منصات إصدار الصكوك الذكية بواسطة تقنية سلاسل الكتل لتمويل المنشآت الصغيرة والمتوسطة في المملكة العربية السعودية: الفرص والتحديات، بحث مشارك في برنامج دعم الأبحاث في المالية الإسلامية – ساما البنك المركزي السعودي، 2022.
2. سليمان ناصر، ربيعة بن زايد: الصكوك الإسلامية كأداة لتمويل التنمية الاقتصادية، ومدى إمكانية الاستفادة منها في الجزائر، بحث مقدم إلى المؤتمر الدولي حول منتجات وتطبيقات ابتكار والهندسة المالية بين الصناعة المالية التقليدية والصناعة المالية الإسلامية، يومي 05 و06 ماي 2014 م، كلية العلوم الاقتصادية والتجارية وعلوم التسيير، جامعة فرحات عباس، سطيف1، الجزائر.
3. كمال توفيق حطاب: نحو سوق مالية إسلامية، المؤتمر العالمي الثالث للاقتصاد الإسلامي، جامعة أم القرى، مكة المكرمة، المملكة العربية السعودية، 2005 م.
4. معطى الله خير الدين، شرياق رفيق: الصكوك الإسلامية كأداة لتمويل مشاريع التنمية الاقتصادية، ورقة بحثية مقدمة في إطار المنتدى الدولي حول مقومات تحقيق التنمية المستدامة في الاقتصاد الإسلامي جامعة قلمة يومي 03 و04 ديسمبر 2012.
5. نريمان مسعود بورغدة: عقود البلوك تشين) العقود الذكية (من منظور قانون العقود، المحلة الجزائرية للعلوم القانونية، السياسية والاقتصادية، المجلد56، العدد02، 2019.

### ❖ أطروحات الدكتوراه

## List of References

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1. بن قادة الشيخ: دور الصكوك الإسلامية في تطوير التمويل الإسلامي وتحقيق التنمية الاقتصادية-دراسة التجربة الماليزية(2008-2017)، أطروحة مقدمة ضمن متطلبات نيل شهادة دكتوراه علوم، تخصص علوم اقتصادية، جامعة غرداية، الجزائر، 2017.
2. شافية كتاف: دور الأدوات المالية الإسلامية في تنشيط وتطوير السوق المالية الإسلامية د-راسة تطبيقية لتجارب بعض الأسواق المالية العربية-، أطروحة مقدمة كجزء من متطلبات نيل شهادة دكتوراه علوم في العلوم الاقتصادية، جامعة سطيف 1، الجزائر، 2013-2014.