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Blockchain and Transferring Real Estate Ownership Process: A Case of Bahrain

A Thesis Submitted in Partial Fulfilment of the Requirements for the M.Sc.
Degree in RealEstate Development and Property Management

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Certificate of Approval

This is to certify that the research work presented in this thesis, entitled Blockchain and Transferring Real Estate Ownership Process: A Case of Bahrain was conducted by **Yaser Mohamed Ali, UOB ID# 20091611** under the supervision of Dr. Muhammad Zubair Mumtaz, No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the Department in partial fulfillment of the requirements of the degree of Masters.

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Abstract

Background: Technology has been an integral part of our lives for many decades and is only increasing in importance. Many sectors are taking advantage of technology to enhance their products and services. Real estate is no exception; the Bahrain government and the sector stakeholders continuously work to implement the latest and most remarkable technologies to serve the Bahraini citizens best. However, some areas are not benefiting to the full extent, and it is crucial to take advantage of the available technology early to get the most out of it before it becomes outdated.

Research Objectives: This research proposes a framework for transferring property ownership in Bahrain. This study examines the current ownership transfer system and analyzes blockchain technology as an alternative to facilitate real estate business. **Methods:** This is an exploratory research that proposes a structure of blockchain for implementing the ownership transfer process in the real estate business. This proposed mechanism brings buyers and sellers together to reduce overall costs, achieve transparency, and ease the process using the platform economics. Before this, a comprehensive analysis of the current state of real estate ownership transfer in Bahrain is analyzed to find a way to improve this process by using the blockchain system. **Results:** This study employs platform economics to illustrate how blockchain technology can transfer real estate property ownership. To extend the understanding, the transferring ownership mechanism is split between Bahraini citizens and non-Bahrainis. This study proposes that new ownership transfer structures adhere to these established pathways to ensure legal compliance and applicability. Failure to do so would render the new transfer structure legally invalid. Therefore, any proposed changes or innovations in the property ownership transfer process must align with existing legal frameworks to ensure their enforceability and legitimacy. The benefit of the platform is that it provides a reliable and smooth process that is secure and virtually impossible to hack or compromise, reducing the transaction cost and providing a sense of security to all stakeholders. This will increase the willingness of the public to invest in real estate, especially foreign investors, as their biggest fear is the loss of their investment due to hacking or poor record keeping; the blockchain process will ensure that the records of their assets are kept untampered. The platform would also add to the scalability of the process, where an additional type of transaction could be done on the platform, such as exchanging assets, which is currently being done as separate transactions. The platform could treat it as one transaction, which expedites the process. **Conclusion:** Policymakers and relevant authorities may consider blockchain technology for transferring ownership of real estate property, which will help monitor the buying and selling activities of real estate property and make this sector smoother for trading. This technology will boost the confidence of buyers and sellers, allowing them to track the position of real estate property.

Publications

Dedication

I dedicate this thesis to the Kingdom of Bahrain, a nation committed to development, sustainability, and a prosperous future. May our collective efforts continue to shape a bright and sustainable future for generations.

It gives me great pleasure to dedicate this work to my honorable family, esteemed professors, and close friends who have never stopped helping and motivating me to fulfill my academic obligations.

I would also like to dedicate this research to those working in the real estate industry, trying their best to achieve the highest standards for the Kingdom of Bahrain.

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Author's Declaration

Yaser Mohamed Ali, UOB ID#20091611 hereby states that my Master thesis entitled **Blockchain and Transferring Real Estate Ownership Process: A Case of Bahrain** is my work and has not been submitted previously by me or anyone else for taking any degree from the University of Bahrain or anywhere else in the country/world. At any time if my statement is found to be incorrect even after awarding the thesis, the University has the right to withdraw my Master degree.

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Table Contents

Certificate of Approval.....	A
Abstract.....	B
Publications	C
Dedication	D
Acknowledgements	E
Author’s Declaration	F
List of Figures.....	K
List of Abbreviations	L

Chapter One

Introduction to the study

1.1 Overview.....	1
1.2 Research questions	1
1.3 Background of the study	1
1.4 Problem Statement	5
1.5 Aim of the Study	6
1.6 Significance of the study.....	7
1.7 Structure of the Thesis	8
1.8 Research scope and limitation	8

Chapter Two

Literature Review

2.1. Introduction.....	10
2.2 What is Blockchain?.....	10

2.2.1	Definition of blockchain.....	10
2.2.2	Types of blockchain.....	11
2.2.3	How does blockchain work?	12
2.2.4	How does the blockchain secure itself?	12
2.2.5	Why do transactions on the blockchain?.....	13
2.2.6	How does blockchain make the process faster?	14
2.3	Blockchain in securities markets	14
2.4	Blockchain in healthcare sector.....	18
2.5	Blockchain in supply chain management.....	21
2.6	Blockchain in voting systems	23
2.7	Smart contracts	23
2.8	Blockchain in real estate.....	25
2.9	Limitation of blockchain	26
2.10	Conclusion	27

Chapter Three

Real Estate in Bahrain

3.1	Introduction.....	28
3.2	Main regulators and authorities in Bahrain real estate	28
3.2.1	Real Estate Regulatory Authority (RERA)	29
3.2.2	Survey and Land Registration Bureau (SLRB).....	31
3.2.3	Urban Planning and Development Authority (UPDA)	31
3.2.4	Other parties involved in the real estate market.....	32

3.3	Overview of authorities involved in real estate in Bahrain	33
3.4	Process of property registration in Bahrain	34
3.5	Title deed in Bahrain	39

Chapter Four

Research Methodology

4.1	Introduction.....	43
4.2	Research design	43
4.3	What is platform economics?	44
4.4	Transaction platforms	45
4.5	Effect on the economy	45
4.6	Platform economics and blockchain in real estate	46

Chapter Five

Analysis and Discussion

5.1	Introduction.....	48
5.2	Proposing a Blockchain mechanism for transferring real estate ownership.....	48
5.3	The process of transferring real estate ownership for Bahraini citizens	52
5.4	Process of transferring real estate ownership for non-Bahraini citizens	56
5.5	Smart contracts	63
5.6	Implementation of Blockchain in real estate	63

Chapter Six

Conclusion and Recommendations

6.1	Introduction	65
6.2	Summary of research findings	65
6.3	Transition strategies.....	69

6.4	Limitations of the study	70
6.5	Recommendations for future research	70

List of Figures

Figure 1: Role of authorities involved in real estate in Bahrain

Figure 2: Flow chart of property registration in Bahrain

Figure 3: Actual title deed

Figure 4: Digital information of Actual Title deed

Figure 5: Mechanism of blockchain for transferring property ownership

Figure 6: Mechanism of blockchain for transferring property ownership for Bahraini citizens

Figure 7: Mechanism of blockchain for transferring real estate ownership for non-Bahraini citizens

Figure 8: Illustration of the distributed ledger technology applied to securities markets.

List of Abbreviations

AWS	Amazon Web Services
IOT	Internet Of Things
RERA	Real Estate Regulatory Authority
SLRB	Survey and Land Registration Bureau
UPDA	Urban Planning and Development Authority

DLT Distributed ledger Technology

ATS Alternative Trading Systems

Chapter One

Introduction to the study

1.1 Overview

This chapter presents the research background, which entails an overview of real estate in Bahrain and its history. Looking toward the future of technology, how blockchain is implemented in other industries, and how it could be implemented in real estate. Then, the problem statement highlights the research gaps in the literature warranting the need to conduct this research. The last sections focus on the significance and the aim of the study.

1.2 Research questions

How can blockchain technology be effectively utilized to create a secure, transparent, and efficient framework for real estate ownership transfer, addressing current challenges such as fraud, legal disputes, and transaction delays?

1.3 Background of the study

Real estate is a fundamental driver for any economy, as it provides one of the basic human needs, a place to live or a place to do business, not to mention all the other leisure activities that require real estate. The real

estate sector contributes to the economy through job creation, as it requires the input of many sectors, such as engineering, construction, and marketing. Its ripple effect can reach other industries, such as banking, legal, and insurance.

The housing market stability is crucial for any economy as it provides individuals with a sense of security and encourages consumer spending, which supports the financial sector by providing collateral for loans. It also creates a direct income for governments through fees and taxes, which helps fund other public sectors such as health and education. In addition, a healthy real estate market would create indirect income for the government through foreign investment, which would help the various sectors of the economy.

The real estate industry has been organized in the Kingdom of Bahrain since the 1920s. By establishing the “Topo directorate” and then the "Land Registration Directorate" in the 1960s, the improvements continued through the reign of HM King Hamad bin Isa Al-Khalifa by creating the “Survey and Land Registration Bureau” in the 2000s and then creating the Real Estate Regulatory Authority “RERA” in 2017. The central role is to ensure that the real estate industry in Bahrain is aligned with international best practice standards and to deliver a professional service cost-effectively and transparently. Updates to the organizations and laws are still regularly coming to this day to improve the sector and increase its stability and contribution to the economy.

Real estate investment is considered a cornerstone in the investment world, as it is a tangible asset that could generate stable income for investors; it also can be used as an inflation hedge as its value increases with time,

helping investors preserve their wealth. Although many people rely on real estate as an investment, they probably have other types of investments, such as diversification, which minimizes risks. Even if an investor is completely convinced in real estate investment, they will not put all their investment in real estate because real estate assets are considered illiquid assets, meaning that the real estate asset is complex to convert to ready cash without affecting its market value. It is generally accepted that when a person wants to convert a real estate asset to a cash asset, they will lose some of its value. This is because of the generally long process of transactions for real estate assets. Minimizing the illiquidity of real estate assets will make them more attractive options and beneficial as it converts one of the negative aspects of real estate to a positive one. This idea has been around for a long time; however, it was not feasible as it affected some of the security features of the transaction, making it easier for fraud and misuse.

With technological advancements in the past decade, it is now possible to implement new solutions that enhance the real estate transaction process, making it more liquid and secure. Blockchain technology is arguably the best-suited technology for financial exchanges and other operations. It uses distributed ledger technology to validate information through peer-to-peer technology. It is based on a series of blocks containing data and is aligned to secure itself and make its records immutable, allowing for fast and secure transactions.

Blockchain technology is used in many sectors. It is used in the securities exchange markets to transfer stock between users and authenticate and audit transactions. Also, many stock exchanges are converting to this technology to safeguard themselves from the fast-paced technological

advancements. The healthcare sector uses distributed ledger technology to secure medical data and can link service providers in a safe environment; another benefit is using the technology to log patients' consent for operations and clinical trials.

It can also be used in supply chain management across all industries. In the medical sector, it can track the chain of custody of drugs, from factories to patients. It manages the network of organization, people and assets involved in the production and delivery process; it helps by increasing the efficiency of moving goods from the place of origin to the final customers. It will help view the uninterrupted chain of custody and transactions from the raw materials to the final sale. As it has immutable records, the process will always be clear to all stakeholders.

The technology also allows for new uses; for example, voting systems can replace the old paper system and the new electronic system as it provides an immutable and recorded system with several authentication steps that can ensure a safe and secure election. Another use is the smart contract, which are contracts directly written into code, making them automatically executable whenever the contract terms are satisfied. The benefit of smart contracts is that they are deterministic, which means that if the input is the same, the output will always be the same, so there will be no confusion in interpreting the contract terms.

The real estate industry will use the technology in four main areas: land administration, transactions, tokenization, and real estate management. The real estate industry is wide open to using blockchain, as it generally relies on old methods, which users have proven more favorable. However, they lack security, affordability, and transparency.

The real estate industry is regulated in Bahrain, and power distribution is distributed among many government authorities. The Real Estate Regulatory Authority is the main player that governs the practitioners of the industry, and it has a major effect on other authorities. The other is SLRB, which issues and registers all title deeds of all the properties in the Kingdom, but the registration process binds all real estate. The registration process is clear, although blockchain may be considered to make this process more efficient.

1.4 Problem Statement

The Kingdom of Bahrain is in a flourishing era of real estate, with the economy's growth after the COVID-19 pandemic and the rigorous efforts to provide housing solutions for mid and low-income families. The real estate transaction process has never been put under more pressure than it is being tested right now.

The land registration department is one of the oldest authorities established by the government, as they knew the importance of the ownership transfer process and the importance of record keeping. The government kept on improving by creating new establishments tailored to handle the task of property ownership transfer. These establishments significantly improved the process by implementing legislation and technologies.

With the current rapid advancement in technology, it is difficult to know which technology would be the proper selection for the future of any entity, as choosing the wrong or unsuitable solution could be costly to the entity, and even being late to adopt new technology can have the same effect.

Academic research contribution to this field is considered essential in the growth and development of any sector, as it enables stakeholders to understand the industry's current situation and see the available options and ideas that could be implemented in the future. Bahrain's 2030 vision focused on increasing productivity and the local economy's competitiveness. One of the most significant factors in achieving the vision is implementing technology in the sector. Many studies have conducted research on blockchain technology; however, research in the real estate sector is quite limited compared to other prominent sectors such as the securities market and healthcare.

This research aims to propose a structure of real estate ownership transfer and study its effects to bridge the research gap. To this end, this study suggests the structure of transferring ownership.

1.5 Aim of the Study

In recent years, the real estate sector in Bahrain has witnessed significant developments, making it an attractive avenue for investors seeking business opportunities and exploring potential ventures. The real estate sector in Bahrain is a big attraction for investors, as it is a very stable business and generates relatively higher yields. To facilitate the transferring process of real estate property, a digital transformation may ease the mechanism by lowering cost, bringing transparency, and reducing time for the registration process.

This study proposes a framework for real estate property transfer using blockchain technology. It's worth noting that all cryptocurrencies are

traded through blockchain platforms, which expedites transactions by reducing transaction time.

In earlier studies, researchers suggested that blockchain technology could be integrated into future securities markets to enhance transparency and reduce costs. In line with this argument, this study aims to propose a framework for the real estate business, leveraging blockchain technology to streamline the ownership transfer process, ultimately reducing costs, enhancing transparency, improving efficiency, and reducing processing time.

1.6 Significance of the study

The study introduces blockchain technology to streamline the real estate transaction process by proposing a framework for transferring real estate ownership using blockchain technology. As a result, this study also suggests mechanisms for transferring real estate ownership to Bahraini and non-Bahraini citizens.

Blockchain technology is relatively new and has not yet been implemented in many sectors. There is a gap in knowledge about implementing blockchain technology in the real estate sector and its potential benefits. This study aims to fill the gap by providing insight into the effectiveness of implementing blockchain technology in the property ownership transfer process.

The study would also offer practical applications of blockchain technology in the property ownership transfer process, demonstrating how it can be

implemented to streamline the process; it would give valuable guidance and understanding to the industry stakeholders.

The study would pave the way for future research in this area by proposing a blockchain-based real estate transaction framework. It would identify potential and possible avenues for further exploration and lay the groundwork for future studies and development in the real estate field.

1.7 Structure of the Thesis

There are five chapters in this thesis. The problem statement, research aims, research summary, and study significance are all presented in the first chapter. In contrast, a thorough overview of the literature on the use of blockchain technology across many industries can be found in the second chapter. In the third chapter, Bahrain's real estate market and stakeholders are explained and discussed in a better way to understand their role in the ownership transfer process. The fourth chapter discusses the methodology of the thesis. The fifth chapter summarizes the findings, conclusions drawn from the study, limitations, and recommendations for future work in chapter six.

1.8 Research scope and limitation

The scope of this exploratory research focuses on developing a conceptual framework for property ownership transfer using blockchain technology. It aims to investigate how blockchain can enhance security, transparency, and efficiency in real estate transactions by addressing issues such as fraud, administrative inefficiencies, and legal disputes. The study will explore the

potential benefits and challenges of implementing blockchain for various stakeholders, including property buyers, sellers, regulators, and legal professionals. However, several limitations may affect the generalizability and interpretation of the findings. First, the regulatory landscape for blockchain in real estate varies significantly across jurisdictions, which may limit the applicability of the proposed framework to specific regions. Second, the research will largely rely on theoretical modeling rather than large-scale empirical data, which may constrain the ability to test the framework in real-world settings. Lastly, technological adoption barriers, such as integration with legacy systems and stakeholder resistance, may influence the feasibility of widespread blockchain implementation in the real estate industry.

Chapter Two

Literature Review

2.1. Introduction

Blockchain technology has gained much attention since the introduction of Bitcoin and the cryptocurrency boom in the last decade (Smith et al., 2021). The technology has been used to create more cryptocurrencies and was explored and experimented with in many other sectors (Glaser, 2017). The following paragraphs elaborate on the blockchain and its applications in diversified fields that help make the system faster and more cost-effective.

2.2 What is Blockchain?

2.2.1 Definition of blockchain

Blockchain technology is a distributed ledger system network; a ledger is usually defined as “a book or other collection of financial accounts of a particular type.” Blockchain is a whole chain of immutable ledgers. These ledgers can record and track almost anything in value, like currency, medical records, financial transactions, and voting (Danial, 2023).

Distributed ledger technology is the heart of blockchain technology, as it enables unanimous validation of information through peer-to-peer technology, eliminating the need for a central system to maintain and update the information as the transaction happens. Transactions are

validated to a new block to the existing chain. Once the transaction is added to the block, it cannot be removed or altered.

2.2.2 Types of blockchain

There are two types of blockchain networks. Permissionless blockchain is open to the public and anybody can access and use it. Users can access the records, verify transactions, and add to the ledger, but no valid records can be changed due to the immutable characteristics of the blockchain. The most significant advantage of this type is that it is independent; even if the network's creator ceases to exist, the blockchain will still be able to run, provided computers are connected to it. That is why some networks reward users who commit computing power, known as mining. This type of network is the most transparent (Campbell, 2023). The most common use of permission less networks is mining and exchanging cryptocurrencies and public records.

The other type is permissioned blockchain; these networks are restricted to specific users. Usually, the network is under the control of a single consortium entity. It is generally smaller than public networks because the computing power is provided by the entity or the consortium instead of the public; however, the basic concept of the blockchain still exists in this type. Private networks are usually much faster than public networks because of their size limitations (Campbell, 2023). The main issue with this type of blockchain is very philosophical in the scenes because the primary value of blockchain is decentralization and the theory that fewer nodes in private networks means less security. After all, if a few nodes go rogue, the validation methods can be compromised.

2.2.3 How does blockchain work?

As the name suggests, it is a chain of blocks; each block contains specific information. Each block contains data, a hash, and the previous block's hash. The date is the date the network is used for; for example, in Bitcoin, the block contains details about the transaction, including sender, receiver, number of coins, and so on. The hash is a unique identifier that identifies a block and all its content. The last thing on the block is the previous block's hash, which creates the chain and makes it very secure. The only exception is the first block, where there is no previous block, called a genesis block.

2.2.4 How does the blockchain secure itself?

We know each block contains unique data and hash; however, this does not mean the block cannot be tampered with. Changing anything on a block would automatically change the hash, thus breaking the chain from the following blocks because the next block was chained to this block via its original hash. Another key security feature is the proof-of-work mechanism; it is an algorithm that makes sure that blocks are only considered valid when they require a certain amount of computational power to produce, so since only changing small details of the information on the block would need less amount of computing power, the block is considered invalid (Napoletano, 2024). In this situation, theoretically, someone could break the chain and recreate it block by block; however, because each proof-of-work operation requires about 10 minutes, tampering with the blockchain would take more time with bigger chains,

for example, it would take someone about ten years to manipulate the Bitcoin blockchain.

With all things considered, it is almost impossible to hack the blockchain network because the hacker would have to recreate the whole blockchain, consuming massive amounts of time, and they have to hack the majority of the network so their version of the chain can pass the peer-to-peer authentication. In short, to tamper with one block, someone must tamper with all the blocks, do the proof-of-work for each block, and take over the whole network.

2.2.5 Why do transactions on the blockchain?

There are many attributes to transactions done in blockchain. Distributed ledgers allow for real-time records, and the absence of lag in the transaction ensures that the process is efficient and safe. In addition to real-time recording, the records are permanent in the chain, and each block is permanently attached to the blockchain, ensuring that the entire transaction history is kept. With the transaction being permanent on the chain, many concerns arise concerning privacy; depending on the type of blockchain, the individual or legal entity can use pseudonymous; however, this is subject to the blockchain network requirements and validation system (Smith et al., 2021).

2.2.6 How does blockchain make the process faster?

Blockchain makes transactions much faster than specific traditional methods by doing away with intermediaries and replacing many manual transaction processes. Times can differ, though, and a blockchain-based system's transaction processing speed depends on several variables, including network traffic, the size of each data block, and the consensus-building process's speed (Pratt, 2023).

2.3 Blockchain in securities markets

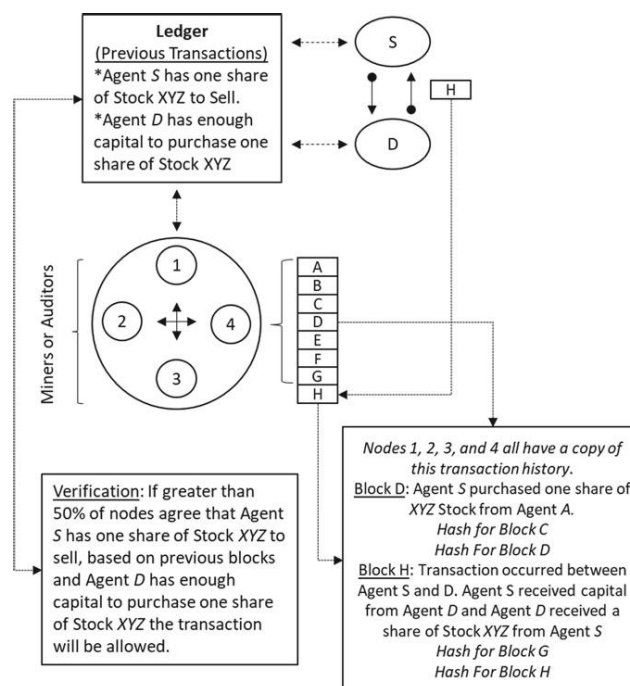
The existing securities market has some features that would logically be compared to the features of blockchain technology, such as the high number of users, the need for ownership records and the pursuit of reduced time and cost (Morgan, 2018). That is why many major global banks, and financial institutions have quickly positioned themselves in the arena, allocating resources to the development and experimentation of technology (Chang et al., 2020).

The conventional capital market system is based on a centralized structure, where a single party controls the whole network. This increases the system's vulnerability to single-level failures and attacks. Additionally, every transaction in the system has been processed by a single central third party, creating an authoritarian structure. Moreover, the traditional system requires brokers and intermediaries to act on behalf of the trader, which means each transaction needs a high processing and settlement time. The central party is also in charge of using matching algorithms in the market.

This usually lacks transparency and openness to the exchange market (Noble and Patil, 2021).

Many stock exchanges and Alternative Trading Systems “ATS” are looking into distributed ledger technology to safeguard their position in the industry, and they expect the technology to streamline the process of exchanging securities (Geranio, 2017). Experts believe that by 2027, approximately 10% of the global GDP will be held via distributed ledger technology; however, the attention is still considerably limited compared to what the technology has to offer and to the enormous efforts by the financial sector to adopt new technologies. DLT offers great potential to increase efficiency in the financial industry; many spectate that distributed ledger could be a panacea; the experts in the World Economic Forum view it as one piece of the solution to the next generation of financial services infrastructure. (World Economic Forum, 2016)

Figure 8: Illustration of the distributed ledger technology applied to securities markets. *Source (Smith et al., 2021).*



According to Geranio (2017), blockchain technology would be most beneficial for post-trading, as the technology would allow for significant reform of the current procedure of clearing, settlement and custody, the post-trading field is the least competitive and most monopolized field in the exchange market. Therefore, applying blockchain technology would tear the monopoly, providing better efficiency, shorter processing times and lower costs in the post-trading process. Mainelli and Milna (2016) explain that in practical scenarios, distributed ledgers do not eliminate the necessity of central third parties. The role of central third parties becomes more focused on tasks such as verifying identity and asset existence (notary function), handling dispute resolution, and enforcing legal obligations. According to Bhandarkar et al. (2019), replacing traditional stocks with digital stocks could at least cut the cost of commission paid to brokers by both the seller and the buyer; in addition to saving on brokerage fees, the peer-to-peer transaction would allow a speedy exchange of stocks and the track of the ownership of the stock would be stored accurately and immutably.

According to Lee (2016), creating crypto securities will remove the secrecy in much of the dark pool trading. It would allow for complete peer-to-peer transactions, removing the need for intermediaries. However, the crypto securities exchange would not replace the traditional stock market and would be an option for user displeased with the conventional system and they give a great example of how the post office still exists in a world where email is readily available.

A systematic review conducted by Noble and Patil (2021) argued that implementing blockchain technology in the securities exchange market solves most of the problems facing conventional securities exchange

markets. The distinctive features of the blockchain, such as the self-enforced validation of “smart contracts,” transparency, low transaction fees, and immutable records, create a security exchange market that outperforms the traditional system. NASDAQ introduced the LINQ blockchain technology platform for issuing and trading private company securities. It is an excellent experimental environment because the trading of private companies is limited and happens in a very small circle. Nasdaq LINQ uses blockchain technology to issue, transfer and manage private companies’ securities, this provides more efficiency and security in the issuance of private securities. LINQ utilizes distributed ledger technology to record transactions on a network of nodes transparently and securely. Also, they use self-executing smart contracts with the agreement terms written directly in the code. LINQ uses smart contracts to enforce compliance, manage transfers and carry out predefined tasks according to the terms of the securities.

As per NASDAQ (2016), businesses that want to issue private securities can digitize and represent these securities on the blockchain by using Nasdaq LINQ and creating digital tokens to represent ownership or shares in the private corporation. To transfer the ownership of the securities, they use smart contracts to authenticate the transaction and then record the transaction on the blockchain in real-time, thus making the process faster and more transparent. The embedded compliance rules in the smart contract and the immutable records make issuing and exchanging securities less prone to the risk of fraud and errors.

Deloitte has introduced their proprietary system COINIA, which is based on distributed ledger technology to aid auditors in the streamlined analysis of diverse digital assets, retrieving balances at specific block heights and

dates, and verifying ownership of addresses in bulk — a task that was previously challenging due to constraints in the design of blockchains (Geranio, 2017)

Australian Stock Exchange (ASX) decided to abandon its Clearing House Electronic Sub-Register System CHESS, which they used for the past 25 years to convert physical shares to an electronic format; the change was needed to achieve some targets such as the ability to do settlements instantly and in real-time, the immutable ledger and the ability to implement a smart contract which will reduce time and make the process of stock exchange safer and more transparent (Babones, 2017). In late 2023, ASX announced that it would scrap the project of the distributed ledger technology; as per many experts, the technology did not fail; instead, ASX did not plan the project very well as their attention was to replace the old system completely, rather than gradually going toward the new technology. The developer that ASX chose was a startup in New York called “Digital Asset”; they were not ready to take on a project of that size as per their CEO in 2020. Ultimately, ASX chose a more mature technology that would transform them seamlessly from the old technology (Kaye, 2023).

2.4 Blockchain in healthcare sector

Historically, the financial services sector has been the center of attention around blockchain's promise. Still, the healthcare sector is also facing unprecedented scrutiny and rising issues that call for a creative response that can solve security and trust issues, collaboration in the ecosystem, and efficient processing of transactions. According to Deloitte (2016),

blockchain technology can help the healthcare sector with these issues. Medical records can be safeguarded using blockchain's private-public key system, where the link between the patient's identity and their records is stored on the blockchain and can only be deciphered by the private key. High-level patient demographic and medical history data, including gender, age, vital signs, and chronic conditions, can be directly stored on the blockchain in this fashion without compromising patient identity. Predetermined data events from patient interaction can be sent to a shared blockchain within a specific network of providers to precisely determine which medications are given to patients that would provide the most value at the best price. To the patients, the providers are encouraged to share information. This is because data from all providers are kept on the blockchain. Reliable and easily accessible patient data will help providers and payers optimize medical resources and enable risk-based payment models. In a collaboration between the payer and supplier, a transparent smart claim contract can be streamlined and uploaded to a blockchain with pricing terms atomically linked to the product definition. Providers using the simplified contract can continue submitting claims using standardized electronic forms. Once the information is submitted, adjudication would occur in real-time, on a claim per claim basis and can also trigger payments automatically when certain conditions are met.

According to Haleem et al. (2018), clinical trials could benefit from blockchain technology's immutable log of patient consent. Regulators can monitor clinical trial standards to ensure the study complies with national informed consent laws (Javaid et al., 2022). This is important, mainly because the most frequent form of clinical fraud has been the creation of fake informed consent forms, which suggest that in order to stop this, a

certain degree of authentication is needed (Gupta, 2013). Moreover, the technology can improve medical practitioners' and researchers' transparency, auditability, and accountability (Deloitte, 2016).

Another benefit of the blockchain immutable records is the ability to track the chain of custody of drugs from manufacturer to patient; a startup company called Chronicled is developing a product that creates a chain of custody, showing where a drug is produced and where it has been since, and if the drug is distributed to the patient. The immutability of blockchain helps prevent the theft and misuse of pharmaceuticals (Radocchia, 2018). The same concept of tracking drugs could be applied to medical devices; in this case, the monetary savings are apparent. Bendavid, Boeck and Philippe (2011) did a study on one of the hospitals in Kent, UK, where they implemented RFID trackers on the hospital equipment's this helped in finding devices that cost \$147,000 that the hospital did not know they still owned. Implementing blockchain technology with RFID or other technology will create an immutable record that displays the device's current location and past locations over its lifetime and all associated information needed for each machine. Comparing a blockchain approach to conventional location tracking systems reveals several advantages. The most evident of them are the Blockchain's tamper-proof and immutability. This prevents unauthorized users from erasing or altering a device's location history. The shrinkage and theft of medical devices have become multimillion-dollar issues in the UK (Audit Scotland, 2001). A study conducted by Deloitte (Karwiecek, 2022) suggests that although blockchain technology is still in its infancy, it offers several advantages. A trustworthy, blockchain-enabled health information exchange can facilitate the transition to value-based care, produce fresh insights into population

health, and provide longitudinal patient health views. Health departments will then obtain insights for improved food safety, drug safety, vaccine quality, and medical device security through increased transparency, trust, and data access. Blockchain's promise has broad ramifications for all parties involved in the healthcare system. Using this technology to its fullest could link disparate systems, allowing for the generation of insights and improved evaluation of care value. A national blockchain network might boost productivity and help patients receive better medical care in the long term. Katuwal et al. (2018) proposed an improvement in telemedicine, where blockchain can be introduced to create a trust layer between patients and healthcare professionals. The technology can verify identity and data integrity while maintaining traceability and transparency. A platform where patients and professionals can be matched safely and securely can create a global healthcare marketplace that will balance the global supply and demand of healthcare providers and professionals.

2.5 Blockchain in supply chain management

Supply chain management supervises and manages a network of organizations, people, and assets in producing and delivering goods. Supply chain management aims to effectively move goods and services from the place of origin to the final consumer. The term “supply chain management” was popularized after COVID-19 struck in 2020 when ordinary people felt the effects of breaks in the supply chain. Now, consumers and companies are looking to technology to mitigate any bottlenecks in the supply chain that would stop consumers from receiving the items they want. However, the supply chain is constantly affected by

political tensions, droughts that affect shipping time, and cyber-attacks. However, supply chain executives must anticipate and proactively address supply chain risks. In the past, they depended on redundancies to mitigate risks; even though some redundancies are still required, implementing blockchain in supply chain management would significantly reduce the risks with its transparency and immutability (Henry, 2023).

Blockchain-based supply chains will help identify products in five critical areas: the nature of the product, the quality, the quantity, the location, and the ownership. Customers can now view the uninterrupted chain of custody and transactions from the raw materials to the final sale, all thanks to the blockchain, eliminating the need for a reliable central organization to run and manage this system. As transactions take place on these many blockchain information dimensions, this data is updated in ledgers in a verifiable manner (Seberi et al., 2018).

IBM and Maersk have their own blockchain based platforms that record all transfer processes in actual time, which will help businesses reduce the cost of document sharing and authentication. Carrefour, the French retail giant, uses blockchain technology to trace its milk production, which permits safe information sharing along the supply chain between manufacturers, suppliers, and consumers. Consumers and business associates can do quality checks and identify the different parties involved in the milk supply chain by scanning the QR code on Carrefour Quality Line milk bottles (Wang et al., 2020).

2.6 Blockchain in voting systems

Many proposals have been made on the implementation of blockchain in voting systems (Ben Ayed, 2017) proposed a blockchain voting system where the system will provide authentication where only the registered can cast a vote; anonymity is something that is associated with voting, so the system will not allow any link between voter's identification and the ballots. Based on their study, a blockchain-based voting system will be able to publicly verify and distribute information in a manner that is impossible to corrupt.

Other electronic voting systems have a single controller that oversees the whole process, which creates a bottle neck in the system and, in theory, is very susceptible to hacking (Jafar et al., 2021). Blockchain can make a secure and reliable voting system through its transparent and immutable characteristics.

2.7 Smart contracts

Smart contracts are self-executing contracts; the terms of the contract are written directly into lines of code. They also use distributed ledger technology to conduct trusted transactions (Ethereum.org, 2023). Traditional agreements depend on a trusted third party to authenticate and operate, which results in higher costs. The blockchain smart contract does not manage or rely on a single entity, which allows it to lower transaction costs. Ethereum is the most common blockchain platform for smart contracts because it supports more advanced and customized contracts (Alharby and Moorsel, 2017).

The primary purpose of smart contracts is to automatically execute the terms of an agreement as soon as the predetermined conditions are satisfied. Therefore, a lower transaction cost is required because there is no need for a third party to execute the conditions of the agreement (Szabo, 1997).

Smart contracts must be deterministic; the output will always be the same if the input stays the same; if it is non-deterministic, then the output result will probably be different on different nodes on the system, which will not reach consensus from the nodes, essentially rejecting the transaction (Christidis and Devetsikiotis, 2016).

External data from the real world from outside the blockchain are probably needed to execute the smart contract; therefore, a secure and trusted data bridge mechanism is necessary to feed information to the blockchain (Khan et al., 2021). According to Zheng et al. (2020), the smart contract has many application cases; the most promising is the implementation of smart contracts on the Internet of Things (IOT), where “things” can interact with each other using smart contracts rather than referring manually to a centralized server. Smart contracts can also help in the finance sector, where they can help speed up the processing times and reduce settlement periods. A third proposed use is in public information, such as the public bidding process, where smart contracts can automate the bidding process and provide a transparent auditing process.

2.8 Blockchain in real estate

The real estate sector can benefit from blockchain technology in land administration, transactions, tokenization, and real estate management. Much blockchain literature is focused on land administration and real estate tokenization and less on transaction and real estate management (Sarri, Vimpari and Junnila, 2022).

Spielman (2016) encourages using a better real estate transaction system, as the title deed is the heart of the real estate transaction; it is preferable to make the process of transferring title deeds faster, safer, and more reliable (Andolfatto, 2018).

According to the American Land Title Association, in nearly all real estate transactions, there is at least one title defect that must be corrected before transferring the title, and these defects are very costly to the property owner, which leads buyers to take out title insurance which is another cost on the buyer. This allows blockchain to simplify the process (O'Brien, 2023).

Blockchain technology in real estate is relatively new, while there is significant theoretical research on the potential benefits of blockchain in real estate, empirical studies that document actual implementations and their outcomes are limited. Most of the research is focused on pilot projects or theoretical models, and there is a lack of in-depth, case studies that examine blockchain's effectiveness, challenges, and affect in real-world real estate markets over time.

Some countries started to adopt blockchain in real estate markets, Dubai started to use blockchain in rental contracts which are connected to several

authorities and utilities in Dubai. And since the announcement more feature has been added to the system. However, full implementation is yet to be completed, as many procedures requires 3rd party interactions

2.9 Limitation of blockchain

No technology would come without its shortcomings; a significant obstacle facing blockchain technology is that it cannot simultaneously handle large transactions. Bitcoin can only handle seven transactions per second because of the block size limitation. In comparison, VISA can handle 4,000 transactions per second, and it has been tested to handle 47,000 transactions per second in 2013 (Beck, 2016). However, as per Bhandarkar et al. (2019), using smart contracts can lead to a considerable jump in the number of transactions per second as it eliminates the need for miners, significantly reducing the processing time. One thousand six hundred transactions per second can be done this way, bringing blockchain closer to the numbers produced by VISA. This is crucial for voting systems, as millions will vote in one day (Al-Shaibani, Lasla and Abdallah, 2020).

Security risks, including vulnerabilities to cyberattacks and smart contract exploits, also pose a threat, as demonstrated by past high-profile hacks (Conti, Kumar, Lal, & Ruj, 2018). Moreover, the energy consumption of blockchain networks, especially those using proof-of-work mechanisms, has raised environmental concerns, further complicating its implementation (Sedlmeir et al., 2021).

2.10 Conclusion

In conclusion, the chapter has provided a comprehensive overview of blockchain technology, defining it as a decentralized, distributed ledger that ensures transparency, security, and immutability of data. By explaining how blockchain operates through a network of nodes that validate and record transactions in blocks, the chapter underscores its potential to revolutionize various industries. In the securities market, blockchain enhances the efficiency and security of trading, clearing, and settlement processes. In healthcare, it improves data management, ensuring the secure sharing of medical records while maintaining patient privacy. The supply chain management sector benefits from increased transparency and traceability, enabling more efficient and reliable tracking of goods. Lastly, in real estate, blockchain simplifies property transactions by reducing the need for intermediaries and providing a transparent, tamper-proof record of ownership. The chapter highlights how blockchain's unique attributes are being harnessed to drive innovation and efficiency across these diverse fields.

Chapter Three

Real Estate in Bahrain

3.1 Introduction

The Kingdom of Bahrain has experienced notable growth in its real estate sector after discovering oil, especially in the last twenty years with His Royal Highness, the Crown Prince and Prime Minister's vision of 2030. Various factors influence Bahrain's real estate market, including government initiatives, economic conditions, and regional trends.

3.2 Main regulators and authorities in Bahrain real estate

As in any country, the structure of regulators is set up in the best way to help the sector grow and develop to help establish the grand vision of the establishment. The Real Estate Regulatory Authority (RERA) has the most impact on real estate in Bahrain, where they have control over all practitioners in the sector and greatly affect other related authorities. Second is the Survey and Land Registration Bureau (SLRB), which issues all title deeds and transfers ownership from the seller to the buyer. It also marks the title deeds for mortgages and holds. The Urban Planning and Development Authority (UPDA) does not directly control the real estate sector; however, it dramatically impacts it, as they are responsible for creating master plans, planning, and zoning in the Kingdom. Their action

will significantly affect the real estate market regarding values and transactions. Many other regulators and authorities have some impact on the real estate market; however, it is not direct and only in their specialization.

3.2.1 Real Estate Regulatory Authority (RERA)

The Real Estate Regulatory Authority was established to help deliver the goals of Bahrain's 2030 vision. RERA's primary responsibility is ensuring Bahrain's real estate sector adheres to global best practices and provides expert services economically and transparently. (RERA, 2023)

To assist the real estate sector, enhance consumer protection, and streamline real estate services, RERA will collaborate closely with government agencies and industry partners to oversee the creation of a national real estate policy. The authority aims to deliver effective and fair regulation in the real estate market, promote economic growth and investment in Bahrain, protect the rights of Bahraini people, and create a better life for every Bahraini.

RERA is a regulatory authority working to create a robust regulatory environment for real estate by developing the necessary solid legislative infrastructure to manage growth and development. RERA will provide a robust regulatory framework for buyers, developers, brokers, and sales agents and improve real estate transaction standards. RERA exists to assist Bahraini real estate professionals in meeting globally acknowledged benchmarks in the industry. The RERA licensing standards are compliant with global best practices. RERA is not involved in real estate transactions; however, they oversee the whole process, regulating and licensing

professionals in the sector, which will lead to a more streamlined transaction process and protect the rights of all involved parties. (Law 27, 2017)

The big picture goal of RERA is to create a stable real estate market that would add to the kingdom's economy and attract investors and individuals to contribute to the real estate market. By collaborating with different agencies and authorities, RERA can pinpoint recurring problems and propose new solutions to enhance the real estate market. (Decree 69 ,2017)

Introducing new technologies and systems in the real estate market would require the blessing, if not the approval of RERA; they would study the effects on the real estate market and see if it would be beneficial or would negatively affect the market. A great example is the real estate information bank "Aqari," which RERA released; all the information is contributed by agencies and authorities other than RERA. This shows that RERA is paving the way to a better future for the sector. The same would be true for blockchain; the introduction of blockchain in real estate would require the approval of RERA, as they will study the potential effects of introducing blockchain to the real estate market. This would mean that blockchain real estate should be used in a broader area than just transactions of properties; for example, it would be used to generate information for Aqari to enhance the available data. (Aqari, 2024). Bahrain boasts a robust technology infrastructure, positioning the country as a leader in digital transformation. The Real Estate Regulatory Authority (RERA) continuously works to integrate new technologies into the real estate sector, driving innovation and efficiency in its operations.

3.2.2 Survey and Land Registration Bureau (SLRB)

The organizational structure of SLRB was established in 2003 after merging the Survey Directorate with the Land Registration Bureau. Its main objective is to protect the stability of real estate property ownership and strengthen and support property reliance and related credit issues. (SLRB 2018).

The Land Registration Bureau was one of the oldest directorates in Bahrain; the government recognized the importance of monitoring property registration, mapping, and surveying. And its importance in protecting public and private property ownership. By keeping official records of ownerships and transactions. Today, as many mapping and surveying tasks are being delegated to third parties, SLRB's main objective is property registration. (SLRB 2018).

3.2.3 Urban Planning and Development Authority (UPDA)

UPDA does not usually come to mind when discussing real estate in Bahrain; however, it dramatically impacts real estate. Their main objective is to direct urban development in Bahrain in an orderly manner and build an urban future to support growth in various sectors. These goals are achieved through planning, replanning, zoning and rezoning of urban areas; these actions directly affect the real estate market, as they might change existing zoning and planning, requiring owners to renew their title deeds to reflect the updated property lines. It is well in UPDA's power to replan an area and change the shapes and areas of existing lands to suit their grand vision. (Decree, 2007)

Another role of UPDA is approving the division of lands and condos; any single land that the owner wishes to divide into several plots must get the approval of UPDA to do so. SLRB will not issue title deeds without the approval of UPDA; even RERA cannot proceed with the application without UPDA's approval. The other thing is the issuance of title deeds for condos and townhouses, which require similar procedures, with UPDA being the critical authority that passes the application. This is not to diminish the role of RERA but to enhance its vision; the approval of UPDA is set with its vision to support growth, which is one of RERA's goals.

3.2.4 Other parties involved in the real estate market

Many parties are involved in real estate and interact with the leading players, such as RERA, SLRB, and UPDA. The main one that comes to mind is the municipalities, which connect the authorities and property owners, as they have the most authority to interact with the owners. The Ministry of Housing is another player that has a partial impact, as UPDA is now under the ministry umbrella, and the ministry has a big say regarding decisions regarding residential properties, representing a major portion of the real estate market in Bahrain.

The private sector plays an important role, as many government authorities delegate some of their responsibilities to the private sector. RERA depends on the private sector to educate and train real estate professionals, SLRB depends on private sector surveys, and UPDA uses the private sector to design and implement its master plans.

3.3 Overview of authorities involved in real estate in Bahrain

As discussed before, many players exist in the real estate sector in Bahrain. Figure 1 configures the players of the real estate business in Bahrain and shows how they are connected with each other under one umbrella. RERA is the leading authority in real estate; it has direct control over real estate practitioners, “brokers, developers, and valuers,” and they are responsible for regulating the relationship between practitioners and sellers and buyers; their role includes regulating owner associations.

SLRB in our context, is only responsible for issuing the title deeds for the properties transferred between buyers and sellers. They can involve financial institutions who finance the transactions, and they mark the title deeds as mortgaged to protect the rights of the financial institutions. UPDA is usually not heavily involved in transferring title deeds unless the property is in an area where replanning or rezoning occurs. With UPDA, the municipalities and the Ministry of Housing are strongly connected as they share major objectives.

The private sector is involved with almost all the players, as the government is trying to downsize its workload and focus on being in a supervisory role.

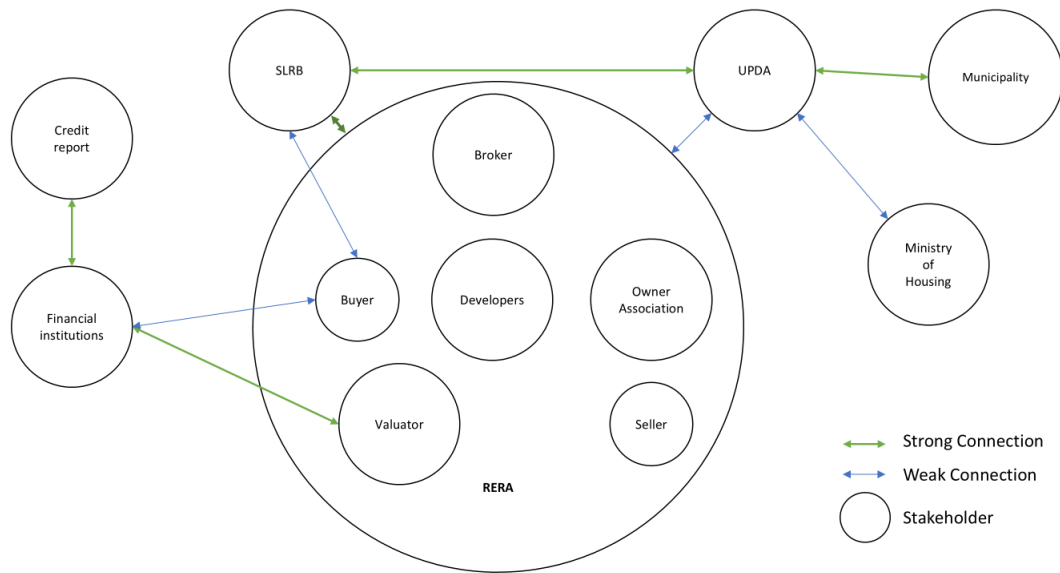


Figure 1: Role of authorities involved in real estate in Bahrain

3.4 Process of property registration in Bahrain

According to (Law 13, 2013) the first step of property ownership transfer is almost identical worldwide; there are many ways in which a real estate deal can be completed. The most straightforward way is when the buyer and seller meet directly, and the payment is made directly between the two parties. That simple transaction could be complicated by adding a brokerage agent who would intermediate between them; more than one agent can be involved. The most common way of property deals is through brokerage agents and the involvement of banks to finance the deal. The buyer would contact a real estate broker to find the appropriate property; the agent would either look through his inventory of properties and contacts

or reach out to a fellow agent to broker the deal. Once they find the appropriate property, they will sign an initial sales agreement where both parties agree on the terms.

Then, the buyer would reach out to the bank for financing. The bank would have its own requirements and the Central Bank of Bahrain would impose its rules also; the main rule regarding real estate financing is that the funding should not exceed 65% of the buyer's income if the buyer is an individual, for companies there are no rules from Central Bank of Bahrain (CBB); however, some types of companies cannot own properties. According to Bahrain rules, the bank would do its own valuation and credit risk with the Benefit company. Once everything is clear, the process moves to the final notarized agreement stage.

Security approval is required for expatriates and some Bahrainis. Expatriates can only own real estate in freehold zones and must issue a security approval to proceed with the transaction. This process is done with the SLRB. GCC citizens can own real estate everywhere; however, they must issue security approval before proceeding with the transaction; the authorization is issued by SLRB or the governorate, depending on the property location. For Bahrainis, there are some specific areas in which they must issue security approval to proceed with the transaction, and these areas are exact and updated regularly.

The notarized sales agreement is an integral part of the property transfer process; as per Bahraini law, only a notarized contract is valid in a court of law. In addition, the property cannot be registered in the new owner's name without a notarized contract. In Bahrain, there are two types of notaries, private and public; both serve the same purpose, the only difference is the

time and fees. The notarization process starts with the notary checking if the title deed is clear using the SLRB system. This process ensures that the title deed is not mortgaged, on hold, or in any legal issue. In addition, in the case of companies, the notary will check if the company statutes allow them to transfer their properties. This ensures that the notarized agreement is based on a valid title deed. The notary then proceeds with the contract, explaining the terms of the contract to both parties and checking if the receiving party is eligible to own property in Bahrain and in the specific area; after they sign the agreement, the notary is legally obligated to send a copy to the SLRB and keep a copy in his records.

Registering the property under the new owner's name starts in the Survey & Land Registration Bureau "SLRB". The new owner must submit an online application to the SLRB web portal; the application will include all supporting documents including the notarized sales agreement from the previous step.

Although the process is digitized, it is not automated. Once the application is submitted, an employee in SLRB will have to check the application and the documents; if they are the right documents and correspond to the right property, the application is passed on to the next stage.

The second stage is valuation, which determines the value of the property. This serves two purposes. The first is to ensure that the property value of the registration fee of "1.7% in the first 60 days or 2% after that" is calculated correctly, as some people try to misguide SLRB by writing a lower amount in the sales agreement to evade paying a higher amount of the registration fees. This is usually done only for cash buyers, as banks will evaluate the previous steps. The second purpose is to monitor the

prices of properties in the Kingdom and gauge the real estate market and its effects on the economy, and in theory, this can help prevent the market from crashing. If the deal price is in the margin of the evaluation price, then the application moves forward to the next stage. If not, the SLRB will make a second valuation with an internal committee to review the price and give the valuation on which the registration fees will be based.

The next stage is the technical inspection, where an employee will check the property conditions, legally and physically. They will check if the title deed is on hold or if it was mortgaged; although the notary has done this step, the time between these two steps would allow the status of the title deed to be changed. The physical condition of the property is usually not checked unless there is suspicion by the inspector; the more common problem occurs with buildings where one or more buildings are crossing the property. In that case, SLRB will inform the new owner about the issue.

When the application passes the valuation and technical inspection, the new owner will be alerted to pay the fees and physically present all the original documents they already submitted in the online application. An employee in SLRB will check the document against the documents submitted online. If they match, the new owner can pay the fees at the register. After the payment, the owner will have to take the payment receipt and the application file to the head of the section for the final signature.

The application is finished, a new title deed case number will be issued, and a final inspection of the documents will be performed to ensure all information is correct and matches the record. Finally, the new owner will be contacted to collect their title deed. Once the new owner collects the title deed, they are entitled to the full extent of the law to do whatever they

want with the property. Figure 2 exhibits the process flow of property registration in Bahrain.

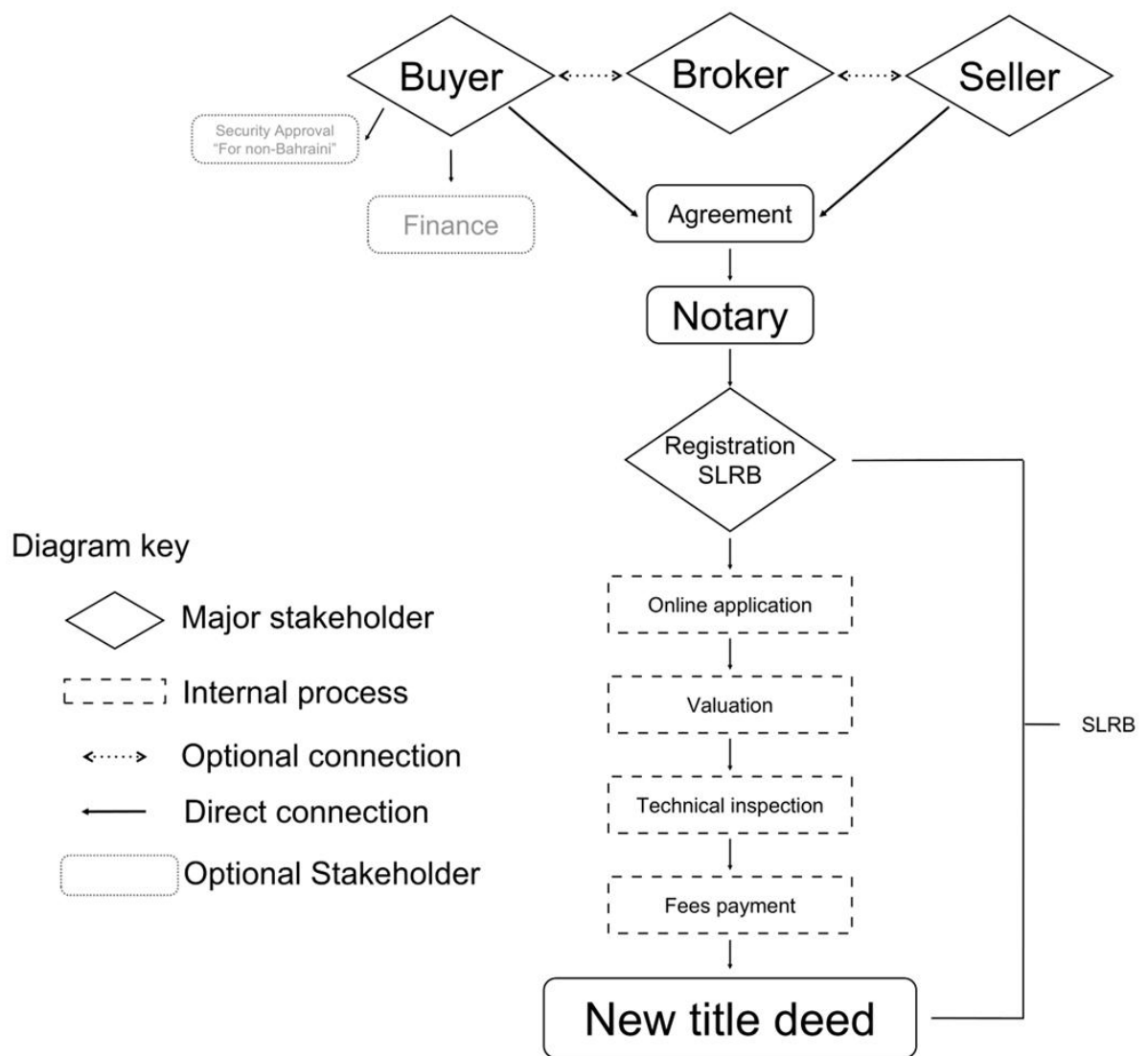


Figure 2: Flow chart of property registration in Bahrain

3.5 Title deed in Bahrain

The current title deed is a hybrid between physical and digital; the SLRB issues a physical title deed to the owner and keeps a digital copy on their servers; the physical title deed includes a QR code that takes the user to the digital deed to see the available information. The title deed contains the following information: the title deed number, which is unique to each title deed issued by SLRB; this number is fixed for each title deed and does not change unless the title deed is changed for any reason; however, it will not change if the owners is changed.

The second piece of information is the case number and year, which is unique to each title deed and changes with every transaction on that property. The third piece of information is the type of property, and it just indicates the property type, whether it is land, villa, apartment, etc. The parcel number is a reference number used to identify and locate the property with other government authorities; for example, it is used in municipalities to determine the property's zoning, while it is used to identify the coordinates of the property in the urban planning and development authority. This number is fixed for the property's lifetime; unless the property is physically changed, the parcel number will stay the same. The fourth and fifth pieces of information are the location and the area of the property; these are also fixed unless a major rezoning is happening, where a property would be considered in a new area or block while the area stays the same.

Items eight to eleven are related to the notarized sales agreement. The notary issues the contract number, referencing the notarized sales agreement. The date of the agreement is self-explanatory. The contract

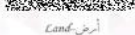
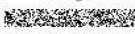
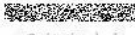
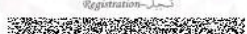
price is the price mentioned in the sales agreement unless the valuation is determined to be different, as explained previously. And then, there is the previous owner and the new owner. Figures 3 and 4 exhibit the actual title deed and digital position of actual title deed.

Kingdom of Bahrain
Survey & Land Registration Bureau



مملكة البحرين
جهاز المساحة والتسجيل العقاري

Title Deed وثيقة ملكية

Title Deed Number		رقم الوثيقة
Cate & Year Number		رقم القاتر والسنة
Property Type	Land أرض	نوع العقار
Parcel Number		رقم العقار
Location		المكانة
Registration Type	Registration تسجيل	نوع التسجيل
New Owner/s		المالك (ين) الجديد

ويجوز طريق هذه الوثيقة من أن يطلب تسجيل العقار المذكور أعلاه المسجل بالوثيقة رقم 

Terms of Conditions

- This title deed constitutes operation and related previous title documents.
- Area and boundary of this property is as depicted part of this title deed.
- This title deed is the only legal document to approve the ownership and all the rights of the property. This title deed must be submitted to SLRB for all related actions.
- Any changes to this title deed are illegal unless agreed and by SLRB in part of Land Registration Bureau.
- Please use the QR code below to access more registration and survey information of this property.
- This title deed is governed by related prevailing laws and executive regulations of the Kingdom of Bahrain.



أحكام وشروط الوثيقة

- تعتبر هذه الوثيقة بمثابة بيان عن ملكية العقار ولا يمكن تعديلها أو تغييرها من دون موافقة الجهاز.
- مساحة وحدود العقار هي كما هي مرسومة في هذه الوثيقة.
- هذه الوثيقة هي الوثيقة القانونية الوحيدة التي تعترف بالملكية وجميع الحقوق المتعلقة بالعقار.
- يجب تقديم هذه الوثيقة إلى الجهاز المسجل العقاري لجميع الإجراءات المتعلقة بالعقار.
- أي تغييرات في هذه الوثيقة غير قانونية ما لم يتم الاتفاق عليها مسبقاً مع الجهاز المسجل العقاري.
- يرجى استخدام الرمز QR أدناه للوصول إلى مزيد من المعلومات المسجلة والتسجيلية لهذا العقار.
- تخضع هذه الوثيقة للقوانين واللوائح المعمول بها في مملكة البحرين.

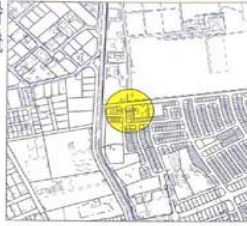


مدير عام التسجيل العقاري
General Director of Land Registration



رئيس جهاز المساحة والتسجيل العقاري
President Survey and Land Registration Bureau

خريطة الموقع



مقياس الرسم 1 : 10000

الدولة العام

الشارع

رقم القاتر

رقم العقار

نوع العقار

رقم المساحة المسجلة

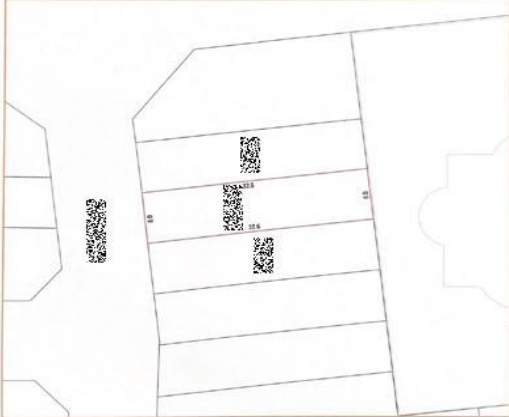
رقم القيد

يتميز هذا العقار بتسجيله كعقار حر ملكية خاصة

الملك

الملك

خريطة التقسيم



الملك

الملك

Figure 3: Actual title deed

41

**Survey & Land
Registration Bureau**



Signature (توقيع)

General Director of Land
Registration

مدير عام التسجيل العقاري



**Survey & Land
Registration Bureau**

Signature (توقيع)

President of Survey & Land
Registration Bureau

رئيس جهاز المساحة والتسجيل العقاري



Title Deed Number		رقم الوثيقة
Case Number & Year		رقم المقدمة
Property type	أرض	نوع العقار
Parcel No		رقم العقار
Location		المنطقة
Property Area		المساحة
Registration Type	شقة - تسجيل عادي	نوع التسجيل
Contract Number		رقم العقد
Contract Date		تاريخ العقد
Contract Price		سعر العقد
Previous owner		اسم المالك منه
New Owner (shares)		اسم المالك اليه (أسهم)
Total Shares		مجموع الأسهم

Ownership Comments وصف الملكية

وجه تحرير هذه الوثيقة هو أن طلب تسجيل العقار المذكور أعلاه المسجل بالوثيقة رقم طلب تسجيل العقار المذكور أعلاه المسجل بالوثيقة رقم				
SLRB Remarks – ملاحظات جهاز المساحة والتسجيل العقاري				
Action Date تاريخ القيد	Applied Action نوع القيد	Reference/Contract No. المرجع/رقم العقد	Case No./Case Year سنة المقدمة / رقم المقدمة	Notes if any الملاحظات
	Mortgage رهن			رهن هذا العقار لصالح التجاري بتاريخ
	Mortgage Release فك رهن			شطب الرهن بتاريخ

Documents مستندات

Deed Map	Download	خارطة الوثيقة
Survey Certificate	Download	شهادة مسح
Download documents link will be available only for 30 minutes. Fresh request to download can be made anytime.		

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- يُبطل جميع الوثائق السابقة لهذا العقار. - مساحة وحدود العقار بالخارطة المبينة بظهر هذه الوثيقة. - هذه الوثيقة هي السند القانوني الوحيد لإثبات ملكية العقار الوارد بها أو أي حق عيني آخر متعلق به، ولهذه الوثيقة حجية مطلقة قبل الكافة. يجب تقديم هذه الوثيقة إلى جهاز المساحة والتسجيل العقاري عند طلب تسجيل أي معاملة تتعلق بالعقار الوارد بها. - تغيير أي بيان من بيانات هذه الوثيقة من اختصاص جهاز المساحة والتسجيل العقاري وحده، وببطل ما يخالف ذلك ولا يعتد به فضلاً عن وقوعه تحت طائلة القانون. - يرجى مسح رمز الاستجابة السريع أدناه للاطلاع على اسم المالك (المالك)، والحقوقي العينية، وحقوقي الارتفاق، والتأثيرات، والمعلومات المساحية وخريطة العقار لبقية الطوابق (إن وجدت).	- All the previous title documents have become invalid. - Deed map of this title is available at the reverse side. - This title deed is the only legal document to approve the ownership of the property mentioned above. - Any disposal of land or real rights is invalid until registered in the Survey and Land Registration Bureau. - Records in Survey and Land Registration Bureau are the conclusive evidence of the ownership. - Please scan the QR code below to view owner(s) name, real rights, easements, notifications, survey information and property plans for the remaining floors (if available).
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Figure 4: Digital information of Actual Title deed

Chapter Four

Research Methodology

4.1 Introduction

This chapter explains about the platform economics, which illustrates the process to be used for internet technologies such as cloud computing, big data, and the internet of Things (IOT). Many companies establishing these platforms are the leaders in developing, designing, and implementing the sets of platforms, connecting consumers with service providers. These platforms are designed to reduce transaction costs and achieve new types of integration with traditional industries. This research will use the platform economics to propose a framework of real estate ownership transfer.

4.2 Research design

This research is exploratory in nature, focusing on the implementation of blockchain technology in the real estate sector in Bahrain, an area with limited prior studies. Exploratory research is essential in this context because blockchain, while promising, presents new and uncharted challenges and opportunities for the real estate market. By investigating the potential applications, regulatory implications, and adoption barriers specific to Bahrain, this research aims to uncover critical insights that will inform future strategies. In a nascent field like blockchain, exploratory research provides the groundwork necessary to facilitate informed decision-making and successful implementation.

4.3 What is platform economics?

A new economic paradigm, "platform economics," is powered by digital platforms that serve as middlemen and link various user groups, including consumers, service providers, and developers. With the development of the Internet and the use of different digital technologies, a new business model has evolved. It not only delivered value without boundaries or other restrictions, but it also radically altered the way value can be shared.

A platform consisting of three main areas, the first is the core platform which is a central digital infrastructure facilitating interactions and transactions between multiple user groups. The second part is the participants of the platform are categorized as supply-side and demand-side. These user groups interact with the core platform to create value. The third is Value Exchange which is the transactions and interactions (e.g., property purchases) between users that the platform facilitates. The more users that engage in these exchanges, the greater the network effects and platform value.

Platforms usually serve multiple groups of users, companies such as Amazon, Facebook, Google, and Uber. These platforms connect buyers, sellers, drivers, riders, advertisers, and users. These companies are platforms and provide the necessary infrastructure that other platforms are built on, such as Amazon with its Amazon Web Services (AWS), which provides tools and infrastructure to develop more platforms. Which is a platform that connects suppliers with consumers (Kenney and Zysman, 2016).

Many technologies are involved in the platform economics; cloud computing, big data, IOT, and algorithms are essential to the platforms, as they provide the bridge between the digital and the real world, and they also offer the users the ability to connect with the perfect match on the other side (Xue, Tian and Zhao, 2020).

4.4 Transaction platforms

There are many types of platforms, such as innovation platforms, where owners use the platform to enhance the platform by using third parties that can develop products and services to sell to other businesses. The primary type of platform is the transaction platform, or two-sided platform, where the platform is the place where two parties are introduced to each other to complete transactions (Kenney and Zysman, 2016). Using the platform economics, Smith et al. (2021) illustrated how blockchain technology can be used for trading securities in the U.S. They were also of the view that the process will help to reduce cost, bring transparency, faster execution of transactions, increase efficiency and remove the involvement of intermediaries.

4.5 Effect on the economy

These platforms are revolutionizing economic activity, changing the perception of value and how companies create value for their customers. The platform economy depends on the internet, data, and computation. This allows the platform owners to make a vital decision: either tax the

transaction to make money or use the advertisement as a money generator for the platform.

Platforms develop digital ecosystems as they get bigger. Platforms want to cover as much of the customer experience as possible, provide ever-better services and goods to their users, and encourage them to stay on their platform(s) inside the ecosystem for as long as possible. Amazon is a prime example of this, having recently invested in numerous platforms within its popular marketplace. Amazon provides games, films, music, and even grocery stores. As a result, a network of platforms known as the digital ecosystem was created, allowing for endless consumer interactions and guaranteeing that they participate fully in the ecosystem and spend their money there.

Given the preceding, this research uses platform economics to illustrate and structure the process of blockchain technology for transferring real estate property in Bahrain. Platform economics assist in explaining various steps required to complete the transaction and provide a detailed framework of networks.

4.6 Platform economics and blockchain in real estate

Platform economics could play a pivotal role in implementing a blockchain framework for property ownership transfer by creating an ecosystem where buyers, sellers, regulators, and service providers interact seamlessly. In a blockchain-based platform, the economics of network effects would drive adoption as more users (buyers, sellers, and real estate agents) increase the platform's value, making it a trusted marketplace for property transactions. Blockchain enhances transparency, security, and efficiency by enabling decentralized verification and smart contracts, which eliminate

intermediaries and reduce transaction costs. A well-designed platform incentivizes participation through rewards or lower fees, creating a scalable, efficient marketplace for transferring property ownership securely and in real time.

Chapter Five

Analysis and Discussion

5.1 Introduction

This chapter presents the blockchain process required to transfer real estate ownership in Bahrain. Broadly, this chapter is divided into three sections. First, a general mechanism for transferring real estate properties using blockchain is explained. However, this framework is subdivided into transferring real estate property for Bahraini and non-Bahraini citizens using blockchain technology.

5.2 Proposing a Blockchain mechanism for transferring real estate ownership

The real estate market operates uniquely, mixing intermediate and search markets. Although the blend is an intermediate market, most users want to reduce costs, while intermediaries charge the seller and buyers for their services. Thus, buyers and sellers are looking for alternatives that reduce their burden. The intermediate provides essential services for all parties, and to reduce their costs. Blockchain technology can potentially disrupt intermediation by eliminating the need for intermediaries' services, such as record-keeping and security certification (Wang et al., 2020). Disintermediation focuses on platform economics, particularly in two-sided markets where agents interact through intermediaries, impacting

each other's outcomes. Using a platform to do real estate transactions could be beneficial, as it has been implemented in some securities exchange markets and helped reduce transaction costs by streamlining the process and increasing the liquidity in the market.

Figure 5 proposes a blockchain mechanism for transferring property ownership in Bahrain. The platform consists of two parts; the first is where buyers and sellers meet and negotiate the terms of the agreement. This can be done with one buyer and one seller or multiple buyers, sellers, and agents working together to complete the deal. Many parties related to the deal can use blockchain technology in their industries; for example, banks and credit unions could automate the process of vetting and providing financial services and facilities. The same could be said for other parties, such as real estate companies and regulators in the real estate industry.

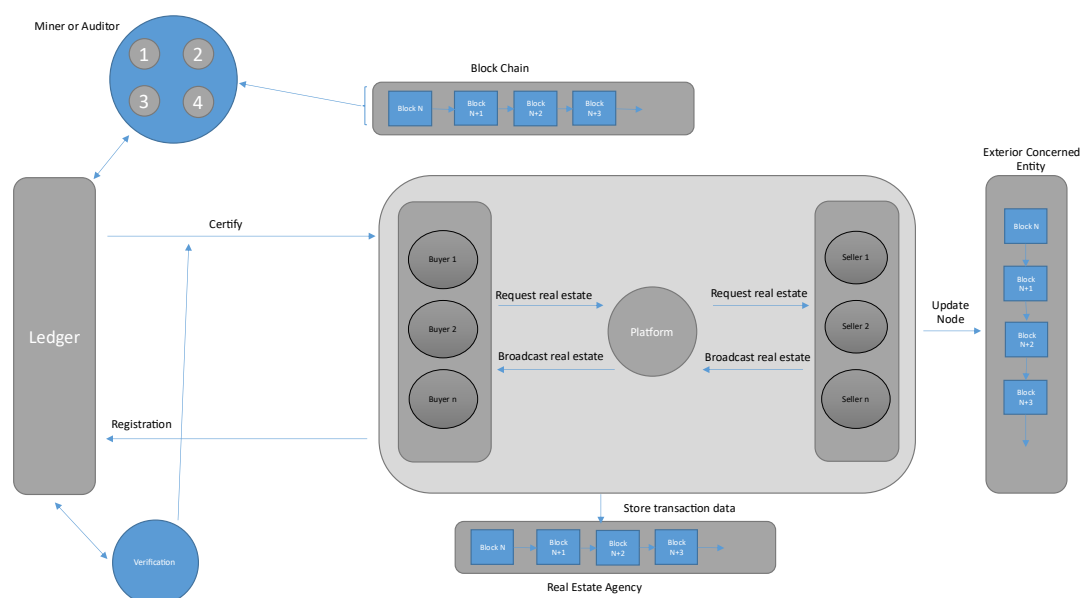


Figure 5: Mechanism of blockchain for transferring property ownership

The second main party is the real estate registration process; as a concept, real estate ownership is saved in a ledger, and the issuing entity checks the ledger when issuing any title deed. In the platform, this is represented by the distributed ledger and the miners, where miners authenticate the transfers and edit the ledger so blocks can be added to the blockchain. A further step could be added by using another verifier, the second verifier is not essential to the process and will not stop it; however, it can find inconsistencies and check for fraud. It is usually added to a sensitive transfer process where extra caution is needed.

Most real estate deals are done through an agent or broker; direct deals do happen, but the number of these deals is insignificant compared to the deals with agents. The agent's job is to satisfy the needs of buyers and sellers; each one would approach the agent to seek assistance in selling or buying real estate. The agent's most important job is to close the deal. Closing the deal means that the parties agreed on terms. Once that happens, a final agreement must be signed, whether a traditional notarized agreement or a smart contract containing all the necessary information and would be faster for all parties.

With the final contract signed, the actual transaction could start, transferring money and transferring ownership. This extremely critical step involves trusting the other party to complete their end of the deal. Transferring money, funds, or whatever is to be exchanged for real estate is more accessible than transferring real estate, as it entails many steps necessary for the transfer to be completed. Moreover, the funds transfer can be verified and confirmed with relative ease. The transfer of real estate is more complex, as many conditions must be met for the transfer to be completed, as explained previously.

Transferring real estate means changing the ledger, and changing the ledger requires the approval of at least 51% of the nodes on the system; the nodes use miners to authenticate the transaction; as their name suggests, they mine for information to authenticate the transaction. The miners are responsible for verifying and changing to the blockchain; for a real estate transaction to be completed, many items must be audited and confirmed by at least 51% of the nodes on the network. First, the agreement must be verified, whether a smart contract or a conventional one; if the contract is valid, then the next step can be taken. The case number and year are used to verify if the title deed is the latest, as with every transaction on the property, the case number is changed, and any previous case number and deed are considered null and void.

If the case number and deed are valid, then the title deed number will verify if the title deed is clear of any mortgage or hold; its status must be free; if it is not, the transaction is invalid. The property type is used as an extra layer of authentication to ensure the transaction is done on the agreed property. The parcel number is used to do the same thing with an additional feature, where the parcel number is used to verify with other authorities to check if the property is clear with them, as sometimes the property is under the process of repossessing or rezoning, this will ensure that the buyer receives the property as intended.

The contract price will be checked against similar transactions to ensure the price is inflated or deflated. The contract price will be used later to determine the property registration fees. The final auditing will be done on the property owner; the owner must be the same in the notarized sales agreement and the title deed.

Next, the analysis of property ownership using blockchain technology is split into Bahraini and non-Bahraini citizens.

5.3 The process of transferring real estate ownership for Bahraini citizens

This section explains the process of transferring real estate ownership for Bahraini citizens using the blockchain technology. The first part of the platform is the same in all types of transactions because it consists of the same components. Buyers and sellers meet and negotiate the terms of the agreement either directly or through a broker. Working with natural persons, legal persons, or a mix of them, as the law permits non-Bahraini legal persons to own property in the same way it permits natural non-Bahraini persons.

The second main party is the real estate registration process; as a concept, real estate ownership is saved in a ledger, and the issuing entity checks the ledger when issuing any title deed. In the platform, this is represented by the distributed ledger and the miners, where miners authenticate the transfers and edit the ledger so blocks can be added to the blockchain. A further step could be added by using another verifier, the

Other concerned parties and stakeholders related to the deal can use blockchain technologies in their industries, such as banks and credit unions, that could use it to automate the process of vetting and providing financial services and facilities in addition to the real estate companies and real estate regulators. As the concerned persons are Bahraini citizens, the platform can be linked to concerned entities in Bahrain such as the Ministry

of Justice and the Ministry of Interior or mainly the Ministry of Housing. Bahraini citizens receive housing subsidies and the ministry must have accurate information about the eligible citizens. Moreover, it could be linked to other entities concerned with the process, or, as SLRB sees fit, some entities might use the data for research and development purposes.

After completing the agreement on the deal terms and obtaining any required approvals from the concerned authorities, the notarized sales agreement can be completed using a smart contract, which helps by inputting all the necessary data into the contract and obtaining the legal consent of all parties. The smart contract's accurate and immutable properties would benefit both parties by speeding up the notarization process and protecting them in the future, as the contract can only execute the agreement as it was coded. Also, the registration process would be more efficient as the information in the contract is accurate. The immutable and precise feature of the smart contract would also be helpful for the government in administering the subsidies provided to the citizens. The instant execution of the contract can trigger any application or turn off any provided subsidies.

The second main part is the real estate registration process; the real estate ownership is saved in the ledger of the issuing entity, and the issuing party will check the ledger before issuing any new title deed. In the platform, the distributed ledger and the miners do the same job. The miners will authenticate the transfer of ownership and edit the ledger so a new block can be added to the blockchain. A second verifier is beneficial in the case of non-Bahrainis as the information comes from sources outside the realm of the Bahraini authorities. Further authentication helps find inconsistencies and fraud.

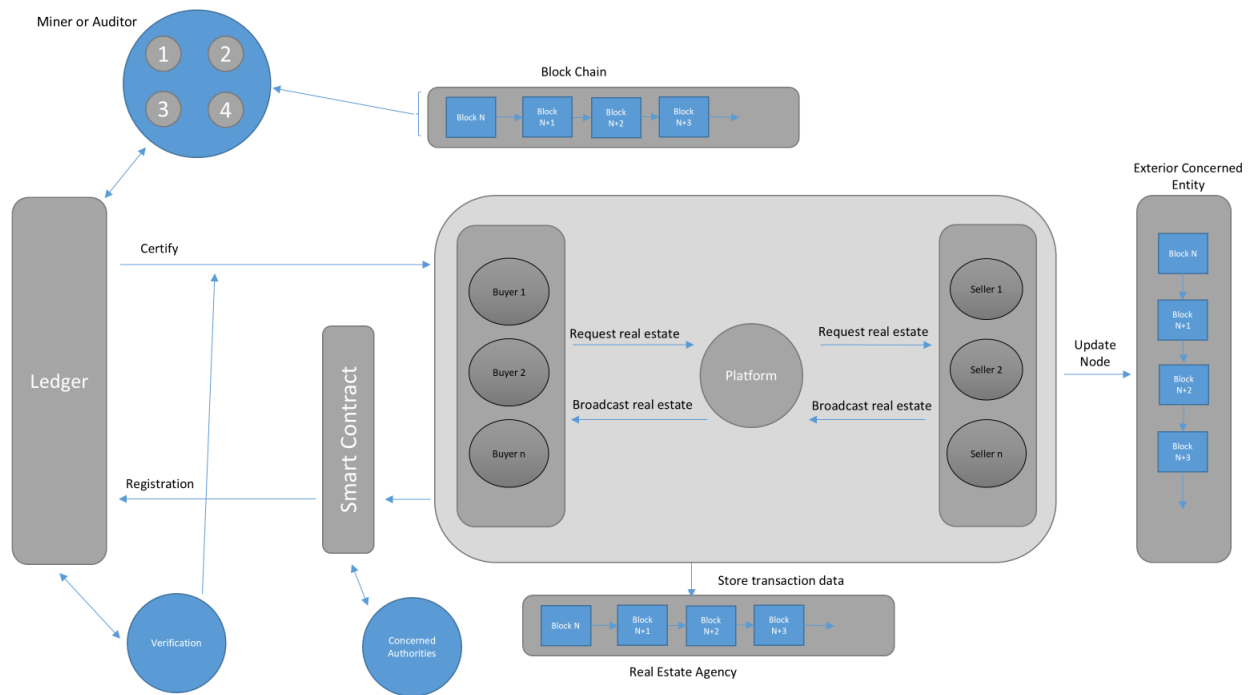


Figure 6: Mechanism of blockchain for transferring property ownership for Bahraini citizens

Figure 6 demonstrates the blockchain mechanism for transferring real estate to Bahraini citizens. The first step of real estate ownership is finding a suitable property; the buyer can do this directly by finding the property and negotiating the terms with the sellers. Or by using a real estate broker whose job is to satisfy both parties by finding suitable properties for the buyers; in this case, the broker would find properties that are suitable for the ownership of Bahrainis and find suitable buyers for the sellers. The broker will help close the deal by assisting both parties in agreeing on the contract terms.

A smart contract would be used as a final sales agreement; it is an accurate and immutable contract that can only execute the agreement as it was coded. The smart contract ensures that all the necessary information is in the contract and that both parties' legal consent is obtained. An extra feature of the smart contract is the ability to be used as an authenticator to release the property's payment; once the contract is executed, the payment is directly transferred to the seller. A traditional contract can be used in exceptional cases, but it would need a bridging process to be compatible with the platform.

After the contract is finalized, the registration process can start when the property ownership is transferred from the seller to the buyer. Legally, this is done after the finalization of the sales agreement; however, legal ownership does not grant the owner control of the property; only after registration does the owner have full control over the property. Transferring property ownership requires changing the ledger, which requires the approval of at least 51% of the nodes in the system; the nodes use miners to authenticate the transaction, as they mine information to authenticate the transaction.

The miners will work in sequence, verifying the sales agreement, whether it is a smart contract or a traditional contract, and if the contract is valid and all information is accurate. The next step can be taken. The next step is checking the security approval, the certificate's authenticity and the buyer's eligibility; if all information is in line, then it goes to the next step. The following steps are universal for all property transfers in Bahrain, the case number and year are used to verify if the title deed is the latest, as with every transaction on the property, the case number is changed, and any previous case number and deed are considered null and void.

If the case number and deed are valid, then the title deed number will verify if the title deed is clear of any mortgage or hold; its status must be free; if it is not, the transaction is invalid. The property type is used as an extra layer of authentication to ensure the transaction is done on the agreed property. The parcel number is used to do the same thing with an additional feature, where the parcel number is used to verify with other authorities to check if the property is clear with them, as sometimes the property is under the process of repossessing or rezoning, this will ensure that the buyer receives the property as intended. The contract price will be checked against similar transactions to ensure the price is not inflated or deflated. The contract price will be used later to determine the property registration fees. The final auditing will be done on the property owner; the owner must be the same in the notarized sales agreement and the title deed. When all the steps are authenticated and cleared, the platform will open the payment gateway for the buyer to pay the transfer fees. Once the payment is clear, the ledger is changed and a new block with the new information is added to the blockchain.

5.4 Process of transferring real estate ownership for non-Bahraini citizens

A question arises about why the process of transferring ownership of real estate is different for non-Bahraini citizens. To address this question, on April 20th, 2023, the Prime Minister issued a decision (38) of 2023 regarding modifying item one of decision (43) of 2003 regarding non-Bahrainis owning built real estate and lands in the Kingdom of Bahrain. The decision specified the areas where non-Bahrainis can own properties

in Bahrain; it listed 18 areas and projects where non-Bahrainis can either own built real estate i.e., villas, apartments, townhouses, etc... or empty land with specific zoning in the listed areas and projects. The list is updated regularly to what the Cabinet of Bahrain sees fit to benefit the kingdom's economic development.

Gulf Cooperation Council (GCC) citizens are treated as Bahraini citizens by law, and the same law applies to property ownership; GCC citizens can own properties the same as Bahraini citizens, although they must issue security approval certificates in order to own the property. The security approval is issued for a natural person or legal person on a case-by-case basis, the security approval is issued for the person for a specific property, so a person can be denied the certificate even if they have obtained the approval for previous properties. To get the security approval, GCC citizens must apply for it in SLRB if the property is in the freehold areas specified in the decision (38) of 2023 or from the four governorates of Bahrain, as they can own properties anywhere in Bahrain.

Non-Bahraini and non-GCC citizens are limited to owning properties in the projects and areas listed in the decision (38) of 2023; they must apply for security approval, preferably before the notarization of the sales agreement, although logically it is impossible to notarize the agreement without the security approval as the notary will require the security approval before proceeding with the notarization process. In the rare cases in which a non-Bahraini, non-GCC citizen got the sales agreement notarized without security approval, the registration process will not be completed as it is a mandatory document to the process.

The first part of the platform can be considered universal because it consists of the same components. Buyers and sellers meet and negotiate the terms of the agreement either directly or through a broker. Working with natural persons, legal persons, or a mix of them, as the law permits non-Bahraini legal persons to own property in the same way it permits natural non-Bahraini persons.

Other concerned parties and stakeholders related to the deal can use blockchain technologies in their industries, such as banks and credit unions, that could automate the process of vetting and providing financial services and facilities in addition to the real estate companies and regulators. As the concerned persons are non-Bahrainis, the platform can be linked to concerned entities in Bahrain such as the Ministry of Justice and the Ministry of Interior. Moreover, it could be related to overseas entities concerned with specific persons such as the government of the concerned person, or even a specific entity in that country, such as taxing authorities in that country.

The main addition here is the issuance of security approval, the platform can feed information to the involved entities to issue the approval, the platform can check the eligibility of the person initially and then send the necessary information to each concerned party and return with the approval or denial, before proceeding with the notarization and registration process.

After completing the agreement on the deal terms and obtaining the security approval, the notarized sales agreement can be completed by using smart contract which helps by inputting all the necessary data in the contract and obtaining the legal consent of all parties. The smart contract's accurate and immutable properties would benefit both parties by speeding

up the notarization process and protecting them in the future, as the contract can only execute the agreement as it was coded. Also, the registration process would be more efficient as the information in the contract is accurate.

The second main part is the real estate registration process; the real estate ownership is saved in the ledger of the issuing entity, and the issuing party will check the ledger before issuing any new title deed. In the platform, the distributed ledger and the miners do the same job. The miners will authenticate the transfer of ownership and edit the ledger so a new block can be added to the blockchain. A second verifier is beneficial in the case of non-Bahrainis as the information comes from sources outside the realm of the Bahraini authorities. Further authentication helps find inconsistencies and fraud.

Issuing security approval for non-Bahraini and non-GCC citizens is a simple process of applying to a committee in SLRB, where they issue the approval or denial in coordination with other governmental entities.

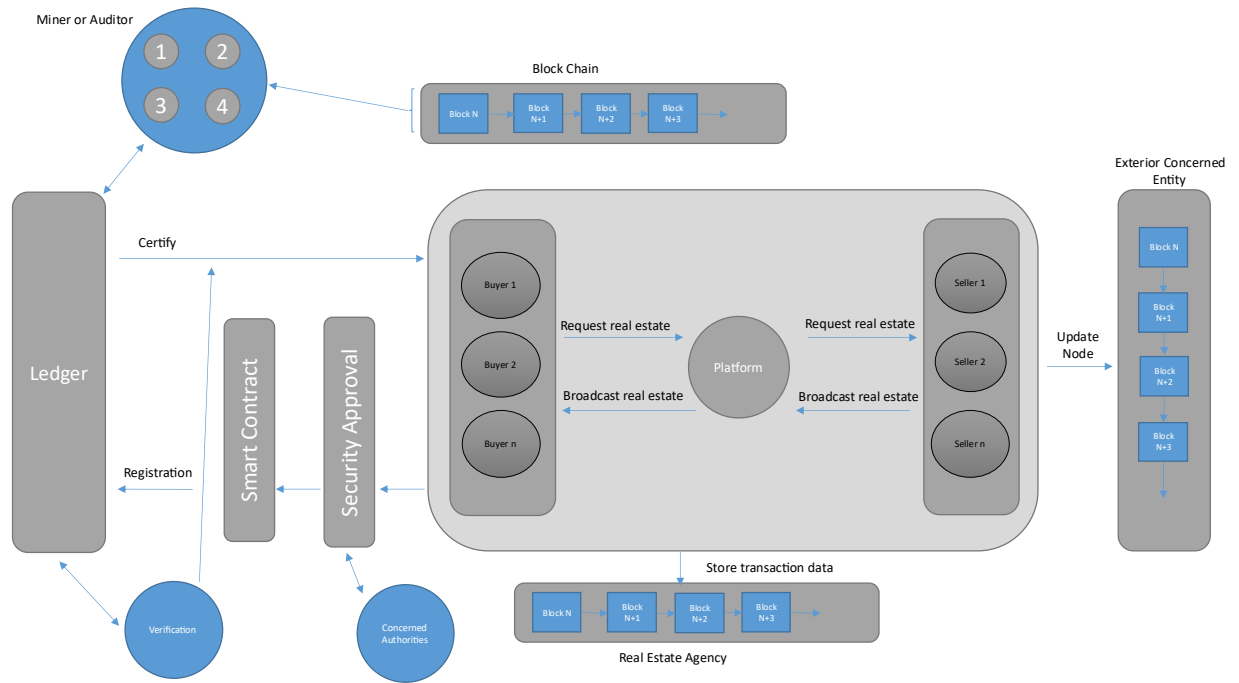


Figure 7: Mechanism of blockchain for transferring real estate ownership for non-Bahraini citizens

Figure 7 explains the mechanism of blockchain technology for transferring real estate ownership to non-Bahraini citizens. The first step of real estate ownership is finding a suitable property; the buyer can do this directly by finding the property and negotiating the terms with the sellers. Or using a real estate broker whose job is to satisfy both parties by finding suitable properties for the buyers; in this case, the broker would find properties ideal for non-Bahrainis ownership and suitable buyers for the sellers. The broker will help close the deal by assisting both parties in agreeing on the contract terms. The buyer would also use the platform to issue the security approval; the platform would link the buyer with all the concerned entities to issue the security approvals. All the buyer information would be available to these entities and they can be assured that all the information is accurate

and immutable; this is a crucial role of the platform, as all the buyer's information are consistent throughout the whole process.

A smart contract would be used as a final sales agreement, the smart contract is an accurate and immutable contract that can only execute the agreement as it was coded. The smart contract is used to make sure that all the necessary information is in the contract and that the legal consent of both parties is taken. An extra feature of the smart contract is the ability to be used as an authenticator to release the property's payment; once the contract is executed, the payment is directly transferred to the seller. A traditional contract can be used in special cases, but it would need a bridging process to be compatible with the platform.

After the contract is finalized, the registration process can start when the property ownership is transferred from the seller to the buyer. Legally this is done after the finalization of the sales agreement; however, legal ownership does not grant the owner control of the property; only after registration does the owner have full control over the property.

Transferring property ownership requires changing the ledger, which requires the approval of at least 51% of the nodes on the system; the nodes use miners to authenticate the transaction, as they mine information to authenticate the transaction.

The miners will work in a sequence, verifying the sales agreement whether it is a smart contract or a traditional contract, if the contract is valid and all information is accurate, the next step can be taken. The next step is checking the security approval by checking the authenticity of the certificate and checking the eligibility of the buyer, if all information is in line, then it goes to the next step.

The following steps are universal for all property transfers in Bahrain, the case number and year are used to verify if the title deed is the latest, as with every transaction on the property, the case number is changed, and any previous case number and deed are considered null and void.

If the case number and deed are valid, then the title deed number will verify if the title deed is clear of any mortgage or hold; its status must be free; if it is not, the transaction is invalid. The property type is used as an extra layer of authentication to ensure the transaction is done on the agreed property. The parcel number is used to do the same thing with an additional feature, where the parcel number is used to verify with other authorities to check if the property is clear with them, as sometimes the property is under the process of repossessing or rezoning, this will ensure that the buyer receives the property as intended.

The contract price will be checked against similar transactions to ensure the price is not inflated or deflated. The contract price will be used later to determine the property registration fees. The final auditing will be done on the owner of the property, the owner must be the same in the notarized sales agreement and the title deed.

When all the steps are authenticated and cleared, the platform will open the payment gateway for the buyer to pay the transfer fees. Once the payment is clear, the ledger is changed and a new block with the latest information is added to the blockchain.

5.5 Smart contracts

Smart contracts are self-executing contracts; the terms of the agreement are written directly into lines of code. They also use distributed ledger technology to conduct trusted transactions (Ethereum.org, 2023) Using smart contracts would help in the process, as it would digitize the notarization process. The smart contract will have the consent of both parties, and all the necessary information will be available to authenticate (Jiang and Chiang, 2022).

It is essential to note that some systems or procedures look like automated systems but are human controlled processes, such as the system used in some countries, where a third-party application is used to hold the funds and authenticate the transaction and then the asset and funds would be released to their respective owners.

5.6 Implementation of Blockchain in real estate

Implementing the technology would require building the platform and digitizing all the data, which would cost time and money. So it would face a lot of scrutiny due to the lack of legal recognition, although the proposed framework is based on the current system of transferring ownership, there are some laws that must be changed to include the digital aspect of the proposed framework. Real estate industries and government property registries are heavily reliant on legacy systems, including paper records and centralized databases. These systems are not natively compatible with blockchain. Transferring ownership data from existing databases to blockchain networks presents a logistical challenge, particularly ensuring the integrity and accuracy of historical records.

Scalability issue might be raised from stakeholders, however it would not be an issue when taking into account the size of the Kingdom, currently around 70 transactions are being processed every day which is far less than the 7 transactions Bitcoin can do in one second, which is more than half a million transactions in one day. Logically this amount would never happen in real estate in Bahrain considering its size.

Transitioning to a blockchain system would immediately lower transaction cost because of the reduction of the need for intermediaries (e.g., notaries, real estate agents), which could lower fees associated with property transactions.

Chapter Six

Conclusion and Recommendations

6.1 Introduction

This chapter summarizes the research and presents the conclusions drawn from the study. It recaps the study background, problem statement, research objectives, methodology, and critical findings. Additionally, it highlights the study's limitations and offers recommendations for future research on real estate ownership transfer.

6.2 Summary of research findings

Based on the research gaps presented earlier in the introductory chapter of this thesis, this exploratory research was conducted to create an improved framework for real estate ownership transfer. The new framework should bring all the benefits of the current ownership transfer system and add new features that were unavailable due to various limitations.

The traditional property transfer method is usually complex and lengthy, as it involves multiple legal and procedural steps, which can be time consuming and complicated. This adds to the transaction cost that the property buyer carries out. The traditional method is also prone to errors; the manual nature of the process increases the risk of errors and discrepancies. This leads to delays in transactions and legal complications, which add to the cost to the buyer.

Any improvements to the current ownership transfer process must improve efficiency, reducing the time and effort required to complete the transaction. It would also enhance the transparency and security of the process, reducing and hopefully eliminating the risk of fraud and disputes. Lowering the transaction cost is an important task to be considered in any new streamlined process, as it is one of the most important factors when deciding whether to implement new processes and procedures.

The study analyzed the current real estate ownership transfer process, identifying two main pathways for ownership transfer: one for Bahraini citizens and another for non-Bahrainis using platform economics. This illustrates that the distinct processes are established under the legislations and rules outlined in the Kingdom of Bahrain. Any new structure for ownership transfer must adhere to these established pathways to ensure legal compliance and applicability. Failure to do so would render the new transfer structure legally invalid. Therefore, any proposed changes or innovations in the property ownership transfer process must align with existing legal frameworks to ensure their enforceability and legitimacy.

The research proposes a platform that would connect all the relevant stakeholders. Buyers and sellers would be the first stakeholders involved in the process; blockchain technology would be used throughout the process, confirming every step. Nodes on the network are working to validate each step; as discussed previously, it is virtually impossible to compromise the blockchain. From the initial agreement it is confirming that the property is clear and available to be transferred without any issues. After the final agreement is done, a conventional or smart contract could be used to finalize the transaction. A smart contract is more beneficial because it is more secure and can only be executed if all its conditions are

met. After finishing the final sales agreement, the registration process starts with the buyer's application for registration. The process begins with the valuation of the property and then a technical inspection. The application will only require the fee payment to complete the process if all is good.

The benefit of the platform is that it provides a reliable and smooth process that is secure and virtually impossible to hack or compromise, reducing the transaction cost and providing a sense of security to all stakeholders. This will increase the willingness of the public to invest in real estate, especially foreign investors, as their biggest fear is the loss of their investment due to hacking or poor record keeping; the blockchain process will ensure that the records of their assets are kept untampered. The platform would also add to the scalability of the process, where an additional type of transaction could be done on the platform, such as exchanging assets, which is currently being done as separate transactions. The platform could treat it as one transaction, which expedites the process.

Tokenization of real estate is a feature in Proptech, where digital tokens represent real estate assets. Each token can be divided into smaller units, allowing investors to buy and sell fractions of the real estate assets. This would increase the ability of the public to invest in real estate because they could invest in a portion of the real estate asset instead of the whole thing. However, for tokenization to be successful, a fast, affordable, and reliable method of transferring ownership must be implemented, as it is not feasible to invest in small portions of real estate if the process is slow and expensive. Blockchain technology would benefit the tokenization and transferring process, as it would be the best solution to create tokenized assets and then transfer ownership quickly, creating a secured and transparent market where the barrier to entry is low.

The expedited nature of the platform will improve the liquidity of the real estate assets, which are traditionally illiquid, not just because of their higher price tag but also because of the slow nature of the current ownership transfer. The quicker the asset can be sold, the more it will be bought, increasing the movement of the real estate market and leading to more general and economic growth.

By conducting transactions on a platform, users automatically generate more data and information than traditional methods would allow. This data provides invaluable insights into user behaviors and preferences, enabling the platform to identify and analyze emerging market trends. Stakeholders can leverage this information to create curated products and services that best serve the market's needs and demands. Furthermore, this data can be utilized for research purposes, facilitating a deeper understanding of the market dynamics and allowing for continuous improvements and enhancements to better cater to user needs.

In the light of above, this study proposes the following policy implications:

- a) Blockchain technology will help monitor the buying and selling activities of real estate property and make this sector smoother for trading. This technology will boost the confidence of buyers and sellers, allowing them to track the position of real estate property and eliminating the manipulations associated with this industry.
- b) Through this mechanism, a limit on transactions and financial amounts may be set (e.g., two transactions and BD100,000 once a month), providing an opportunity for real estate investors.

c) Based on the simplicity of this technology, transactions up to a certain amount should be disclosed to the concerned authorities to provide fair competition for all market players.

6.3 Transition strategies

The transition from the current system to any new structure or technology would require a phased approach, focusing on building stakeholder trust, regulatory alignment, and technological infrastructure.

Some strategies may include pilot programs where we begin with small-scale pilot program in collaboration with SLRB, real estate professionals, and RERA. To ensure that the pilot adheres to existing legal frameworks while exploring necessary adjustments to accommodate blockchain technology. Stakeholder engagement and training is an essential part to ensure a successful transition, stakeholders such as real estate agents, notaries, buyers, sellers, legal professionals, and financial institutions should be educated about blockchain's benefits, such as transparency, security, and efficiency.

A phased implementation is essential to ensure seamless transition, it could start with non-critical, lower-risk transactions such as rental agreements or title verification before expanding to full property transfers. This gradual adoption will allow the system to be tested and refined.

Providing financial incentives for early adopters is a great way to incentivize stakeholder to use the new technology, which will increase the stakeholder enthusiasm to use the technology.

6.4 Limitations of the study

The main limitation of this research is that it focuses exclusively on the real estate market in Bahrain. While this approach allows for a detailed examination of ownership transfer practices within the country, it may limit the generalizability of the findings to other contexts. Real estate ownership transfer processes vary significantly between countries due to differences in legal frameworks, regulatory systems, and market dynamics. As a result, it's possible that the results of this study won't immediately apply to real estate markets elsewhere. A broader perspective would be obtained by broadening the research's scope to include more nations; nonetheless, because ownership transfer processes differ from country to country, compiling data from those nations could lead to overly generalized findings. Cultural factors in Bahrain may also affect the acceptance of a blockchain based system. In a region where personal relationships and traditional methods are often favored, a digital and decentralized system may face skepticism. The trust that blockchain offers through technology may not immediately resonate with stakeholders who prefer trusted intermediaries or familiar processes.

6.5 Recommendations for future research

Based on the limitations highlighted in the previous section, the following recommendations may be considered for future research on transferring real estate property ownership in Bahrain

6.4.1 A survey may be conducted from the stakeholders to get insights for applying blockchain technology in the real estate sector.

6.4.2 A comparison between Bahrain and any other Gulf countries regarding real estate property may be made in terms of the applicability of Blockchain technology, which will help in understanding different market dynamics.

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الملخص

الخلفية: لقد كانت التكنولوجيا جزءًا لا يتجزأ من حياتنا لعقود عديدة، وتزداد أهميتها باستمرار. تستفيد العديد من القطاعات من التكنولوجيا لتعزيز منتجاتها وخدماتها. ولا يُعدّ قطاع العقارات استثناءً؛ إذ تعمل الحكومة البحرينية وأصحاب المصلحة في القطاع باستمرار على تطبيق أحدث وأبرز التقنيات لخدمة المواطنين البحرينيين على أفضل وجه. ومع ذلك، هناك بعض المجالات التي لا تستفيد من التكنولوجيا بشكل كامل، ومن الضروري الاستفادة من التكنولوجيا المتاحة مبكرًا لتحقيق أقصى استفادة منها قبل أن تصبح قديمة.

أهداف البحث: يقترح هذا البحث إطارًا لنقل ملكية العقارات في البحرين. ويقوم بدراسة النظام الحالي لنقل الملكية وتحليل تقنية البلوك تشين كبديل لتسهيل الأعمال العقارية.

المنهجية: هذا البحث استكشافي ويقترح هيكلياً لتطبيق تقنية البلوك تشين في عملية نقل الملكية في قطاع العقارات. تهدف هذه الآلية المقترحة إلى جمع المشترين والبائعين معًا لتقليل التكاليف العامة، وتحقيق الشفافية، وتسهيل العملية باستخدام اقتصاديات المنصات. وقبل ذلك، يتم إجراء تحليل شامل للوضع الحالي لنقل ملكية العقارات في البحرين للبحث عن وسيلة لتحسين هذه العملية من خلال نظام البلوك تشين.

النتائج: تستخدم هذه الدراسة اقتصاديات المنصات لتوضيح كيفية استخدام تقنية البلوك تشين لنقل ملكية العقارات. ولتوسيع الفهم، تم تقسيم آلية نقل الملكية بين المواطنين البحرينيين وغير البحرينيين. تقترح الدراسة أن تتبع هياكل نقل الملكية الجديدة هذه المسارات القائمة لضمان الامتثال القانوني والقابلية للتطبيق. قد يؤدي الفشل في ذلك إلى اعتبار هيكل النقل الجديد غير قانوني. لذلك، يجب أن تتوافق أي تغييرات أو ابتكارات مقترحة في عملية نقل الملكية العقارية مع الأطر القانونية القائمة لضمان قابليتها للتنفيذ وشرعيتها. فائدة المنصة تكمن في أنها توفر عملية موثوقة وسلسة وأمنة بشكل كبير بحيث يكون من المستحيل تقريبًا اختراقها أو التلاعب بها، مما يقلل من تكاليف المعاملات ويوفر إحساسًا بالأمان لجميع أصحاب المصلحة. سيؤدي ذلك إلى زيادة استعداد الجمهور للاستثمار في العقارات، خاصةً المستثمرين الأجانب، حيث أن أكبر مخاوفهم هي فقدان استثماراتهم بسبب القرصنة أو ضعف حفظ السجلات؛ وسيؤكد نظام البلوك تشين من أن سجلات أصولهم محمية وغير قابلة للتلاعب. ستضيف المنصة أيضًا إلى قابلية توسيع العملية، حيث يمكن إجراء نوع إضافي من المعاملات على المنصة، مثل تبادل الأصول، والذي يتم حاليًا كمعاملات منفصلة. يمكن للمنصة معالجتها كمعاملة واحدة، مما يسرع العملية.

الخاتمة: يمكن لصناع القرار والجهات المعنية أن يأخذوا في اعتبارهم تقنية البلوك تشين لنقل ملكية العقارات، مما سيساعد في مراقبة أنشطة البيع والشراء في قطاع العقارات وجعل هذا القطاع أكثر سلاسة في التداول. ستعزز هذه التقنية ثقة المشترين والبائعين، مما يسمح لهم بمتابعة حالة الملكية العقارية.

جامعة البحرين

قسم الاقتصاد والتمويل



كلية إدارة الأعمال

البلوك تشين وعملية نقل ملكية العقارات: دراسة حالة على مملكة البحرين

أطروحة مقدمة كجزء من متطلبات الحصول على درجة الماجستير
في التطوير العقاري وإدارة الممتلكات

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