

Department of Business and Management

Chair of Real Estate

NEW TECHNOLOGIES APPLIED TO REAL ESTATE, HOW THESE WILL CHANGE IT

Prof. Gaetano Casertano

SPEAKER CANDIDATE

Enrico Mattarella Patr. 769841

Academic Year 2023/2024

Index

| CHAPTER 1 | 4 |
|--|----------|
| INTRODUCTION | 4 |
| CHAPTER 2 | 6 |
| WHAT IS THE REAL ESTATE MARKET, WHAT ARE ITS PROBLEMS NOW AND NEW TECHNOLOGIES APPLICABLE TO IT | 6 |
| | 6 |
| 2.2) How is it divided and what are the characteristics of this market | 7 |
| 2.3) REAL ESTATE MARKET PROBLEMS | 10 |
| 2.4) BLOCKCHAIN, CRYPTO, SMART CONTRACT AND TOKEN | 15 |
| 2.4.1) Cryptocurrency | 15 |
| 2.4.2) Blockchain | 17 |
| 2.4.3) IOKEN | 19 20 |
| 2.4.4) Smart Contract | 20 |
| CHAPTER 3 | 21 |
| ISSUES OF NEW TECHNOLOGIES AND THE EVOLUTION ON THE REGULATIONS GOVERNING THEM (SWITZERLAND, ITALY, LIECHTENSTEIN, USA) | 21 |
| 3.1) Issues related to these technologies | 21 |
| 3.1.1) Cryptocurrencies | 21 |
| 3.1.2) Blockchain | 22 |
| 3.1.3) Token | 23 |
| 3.1.4) SIMULE CONTRACTS | 24 24 |
| 3.2.1) Switzerland | 24 25 |
| 3.2.1.a) FIMNA | 25 |
| 3.2.2) Italy | 26 |
| 3.2.3) Liechtenstein | 27 |
| 3.2.3.a) The "Blockchain Act" | 28 |
| 3.2.4) USA | 29 |
| 3.2.4.a) Blockchain | 29 |
| 3.2.4.b) Token | 30 |
| 3.2.4.C) SMARL CONTRACTS | 31 21 |
| S.Z.4.U) Cryptocurrencies | 51 22 |
| CHAPTER 4 | 33 |
| POSSIBLE SOLUTIONS | 33 |
| 4.1) SMART CONTRACT AS AN INTERMEDIARY | 33 |
| 4.2) MANAGEMENT OF PROPERTY TITLES | 35 |
| 4.3) TRANSPARENCY AND SECURITY | 36 |
| 4.4) FINANCING AND LOANS | 38 20 |
| 4.4.1) Automation and Kisk Reduction | 30 39 |
| 4.4.3) Transparency and Compliance | 39 |
| 4.4.4) Reduction of Operating Costs | 40 |
| 4.5) PROPERTY VERIFICATION AND THE REGISTRATION OF THE PROPERTY UNDER ANALYSIS | 41 |
| 4.5.1) Global Implications | 44 |
| 4.6) TOKENIZATION OF THE HOUSING MARKET | 45 |
| 4.7) INTERNATIONAL TRANSACTIONS | 54 |
| CHAPTER 5 | 59 |
| CONCLUSIONS | 59 |
| REFERENCES | 62 |

Chapter 1

Introduction

When we talk about the Real Estate market, we are talking about one of the most important economic markets in the world, which can be understood from the 2007 crisis, which originated in the United States and has affected the whole world.



It can be seen from this table how this market has a huge impact on the global economy.

Every market is accessible to everyone, but one must ask how accessible this market actually is. Suffice it to say that when you make a small investment in this sector you are talking about six-figure numbers.

So you have to start asking the right questions....

"How can this market be made more accessible to small investors?" "How stable or volatile is this market?"

"How can this area be improved?"

These questions are the starting point for this analysis, which could find the answers in new technologies...cryptocurrencies, blockchain, tokens & smart contracts.

CHAPTER 2

What is the Real Estate market, what are its problems now and new technologies applicable to it.

2.1) Introduction

The Real Estate market, also known as the real estate market, concerns the buying, selling and leasing of real estate. This market includes different types of real estate, namely residential (houses, apartments, condominiums, villas); commercial, by which we mean all those properties with a commercial purpose, such as offices, stores, shopping malls and restaurants; industrial, meaning factories, warehouses and similar facilities intended for production or storage; and finally miscellaneous land, by which we mean areas of land useful for agricultural purposes. On the other hand, with regard to the actors, when buying or selling, in the industry we can see buyers, investors (who differ from the former in that they do not buy for personal use, but for a business purpose), real estate agents and sellers.

As in any market, when you are proceeding with a purchase and sale agreement, you have to start with an economic evaluation, but in this specific market, what influences the valuation of a property and its relative price?

Economy: The overall health of the economy affects demand and real estate prices.

Interest rates: Mortgage rates affect buyers' ability to finance the purchase of real estate.

Supply and demand: Availability of property and demand from buyers determine prices.

Government policies: Regulations, taxes and tax incentives can have a significant impact on the market.

Demographics: Changes in population, such as growth or decline, average age, and household size, affect the demand for residential real estate.

The Real Estate market is dynamic and complex divided into many subcategories, with multiple interconnected factors influencing buying, selling and investment decisions.

But what are these subcategories and what, specifically, are the characteristics that differentiate it from other types of markets?

2.2) How is it divided and what are the characteristics of this market

The real estate market can be divided into several main categories, each with its own characteristics, dynamics and different players:

Residential Market, with housing units as the type of property, active players in the market the homeowners, buyers, renters, real estate agents, and banks, the factors, however, that influence it are mortgage rates, economic market conditions, demographics, and the housing market business cycle

Commercial Market, characterized by properties with a commercial purpose, in which investors, developers, commercial tenants, and property managers operate with the goals of generating income through rents and economic activity to increase the value of the target asset and generate cash flow. this category is influenced by the local economy, occupancy rate, urban development, and industry trends.

Industrial Market, which includes all those properties that correspond to factories, warehouses, distribution centers, R&D structure. Easy to guess the main players are all manufacturers operating BtoB, logistics companies and industrial investors who aim to support production and distribution operations through long-term investments. In this specific slice of the market, the presence of infrastructure adjacent to the target land is of great importance.

Infrastructure Market, closely influential toward the industrial market, corresponds to that market that regulates roads, bridges, airports, ports, and rail

networks. As can be guessed, some of the major players correspond to government agencies, subsumed by infrastructure investors whose purpose is to support economic development and improve mobility. Obviously, one of the major influencing factors corresponds to public investments.

Territorial Market, i.e. agricultural land, building land or undeveloped land;

Leisure and Tourism Market; Health Sector Market.

These divisions of the Real Estate market help to better understand the specific dynamics of each sector, enabling investors, developers and other players to make informed decisions based on the characteristics and trends of each segment. Instead, by talking about the characteristics of the sector we mean all those elements necessary to understand the sector, understand its potential and stability, and will be useful to get an initial idea of all the issues in the sector itself, which will be analyzed in the next section.

These are: uniqueness, immobility, durability and longevity, heterogeneity, complex transactions, high transactional costs, economic and political factors, yield, indivisibility, and utility:

 Uniqueness of Location: Each real estate property is unique in terms of location. No two properties can occupy the same physical space.
 Importance of Location: The location of a property is a determining factor in its value and attractiveness.

-Inability to Move: Properties cannot be moved from one location to another. This means that changes in changes in local conditions (such as economic development or crime) can have a great impact on the value of the property.

- Duration and Longevity

Long Life: Real estate has a very long useful life compared to many other assets. This implies that investment are long-term and properties can last for decades. Maintenance and Renovation: They require maintenance and can be renewed or upgraded to maintain or increase their value.

- Heterogeneity

Variety of Properties: Each property is different in terms of size, design, quality of construction, and amenities.

Customization: Properties can be highly customized to meet specific needs of buyers or users.

- Complex Transactions

Return on Investment

Slow and Complex Processes: Real estate transactions tend to be slow and complex, often requiring the participation of many parties (real estate agents, lawyers, lenders).

- Regulation: Transactions are strictly regulated by local, national, and sometimes international.
- High Transaction Costs High Costs: The purchase or sale

High Costs: The purchase or sale of real estate involves costs significant, including taxes, real estate agents' fees, costs appraisal and legal costs.

Barriers to Entry: High transaction costs can pose a barrier to entry for new investors or buyers.

- Influence of Economic and Political Factors
 Sensitivity to the Economy: The housing market is closely linked to general economic conditions, such as interest rates interest, inflation, and economic growth.
- Government Policies: Tax policies, regulations zoning and other government decisions can have a significant on the housing market.
 - Cash Flow: Real estate can generate cash flow continuous through rents.

- Value Appreciation: Real estate can increase in value over time, offering potential capital gains.
- Indivisibility

Difficulty of Fractionation: Unlike many other assets, real estate real estate cannot be easily fractionated for sale or partial use. A property is often bought or sold in its its entirety.

- Mixed Utility

Versatile Use: Properties can be used for different purposes (residential, commercial, industrial), and sometimes a single property may have mixed uses.

These characteristics make the Real Estate market distinctive and complex, requiring a thorough understanding of local and global dynamics to operate effectively.

2.3) Real Estate market problems

The most important aspect of understanding the differences between this market and others is to understand what the problems are in this market, to which, subsequently, innovative solutions will be sought through what are the new technological breakthroughs.

For now, we begin by analyzing, precisely, the main problems that characterize the Real Estate market in general:

- Speculation

Rising Prices: Speculation can lead to rapid price increases, making housing less affordable. In addition, not all investors in this market recognize the appropriate time in which to invest or disinvest, buy or sell real estate, this is often taken advantage of by the more experienced (in most cases when straddling the maturity phase of the market and the beginning of its decline). Real Estate Bubbles: The risk of real estate bubbles increases with the speculation; this is also understandable from the volatility of the market itself, which is particularly affected by economic crises, as large amounts of capital are needed to invest in this sector and any economic crisis leads to a lowering considerable asset value. leading to cycles of booms and busts detrimental to the economy.

- Affordability

Impossibility of splitting the investment, which makes the market accessible only to large capitals, who can afford a large outlay of money and time just to evaluate a single property

High Prices: High property prices can make it difficult for many people, especially young people and families with low-income, to buy a home or invest in property for income.

Inequality: Inequality in the ability to acquire property can contribute to economic inequality.

- Financing and Debt

Indebtedness: The purchase of property often involves a high level of debt, which can be risky in the event of changes in interest rates or loss of income, so it is preferable for a prospective investor to know the market potential and macroeconomic trends in order to understand whether it is worthwhile to get financed with a fixed- or variable-rate loan.

- Financial Crises: Unstable housing markets can contribute to and in some cases be the foundation of financial crises, as seen in the financial crisis of 2008.
- Regulation and Bureaucracy
 Slow Processes: Bureaucratic procedures can slow down the real estate transactions and the development of new projects; this is also due to the number of players involved in a single transaction. Along

with the problem of market transparency is the most important problem, as it makes the Real Estate market slow and inconvenient for small investments, as they are long-term, expensive and, as is often the case, at high risk of fraud.

- Stringent Regulations: the stringent regulations typical of this market can limit the construction of new housing and increase development costs by making the market more volatile.
- Transparency and Information
 Information asymmetry: Buyers and sellers may have unequal information, leading to suboptimal decisions.

Scams and Fraud: Lack of transparency can increase the risk of scams and fraud in the housing market. This aspect makes the market much slower, as an investor, in order to protect himself, must involve a large number of actors who can verify that all the characteristics of a property, it often happens that the information is partial and does not guarantee the safety of the transaction (example: it is not always verifiable the fitness of a property or whether all the work done previously has been done in accordance with the law or condoned; or it cannot be verified that there are or are not legal pending on that specific property or whether the sale is fake aimed at scamming a buyer who pays a deposit for the transaction, in fact when buying a house, t he buyer pays a small fee corresponding to about 5 percent to prove intentionality in buying the property)

- Market Volatility

Price Fluctuations: Real estate prices can be volatile, influenced by economic, political and social factors. More specifically, prices are influenced by both endogenous factors (controllable by operators) and exogenous factors (macroeconomic trends; bureaucratization; degree of openness of the financial markets; regulatory-regulatory framework

- Market knowledge: The difficulty of interpreting the trend and the future of the market can make it difficult to predict the trend and makes investment planning complicated.

These are the generic issues of the market itself, but, as seen before, this is divided into a multitude of subcategories, each of which presents distinct and prominent issues, going in the same order we can see that:

For the residential market, affordability presents the biggest problem, as house prices are often too high for many people, this leads to having to take on debt by creating mortgages that often bind the applicant for several years (10-20 years). Since banks are unlikely to cover more than 60 percent of an investment the buyer faces a large initial financial outlay. These two factors (i.e., debt and initial outlay) lead the person not to diversify his or her income for a long period of time. On the other hand, as far as real estate developers operating in the residential market are concerned, one of the main issues corresponds to stringent regulations that often limit the ability to develop new housing; in addition, there are many constraints that limit the ability to renovate properties in order to put them on the market at a higher price (landscape constraints; elevation constraints, etc...)

As for the commercial market, on the other hand, one can start by considering all those consumer habits, the growth of digital markets, in fact, as one can easily see by going around the cities, many stores are being replaced by all those businesses that cannot operate solely and exclusively digitally, in fact, the restaurant sector (especially in Italy) is booming. In addition, the growth of shopping malls, of aggregations of stores also leads small merchants scattered around the city toward bankruptcy. Finally, another problem characteristic of this subcategory is location, in fact this choice is crucial as a mistake leads to significant losses. As for the industrial market, location is also an issue here; in fact, proximity to infrastructure is crucial to operate, along with regulations that limit the development of new industrial facilities.

Infrastructure projects require large capital investments and can be difficult to finance and implement (example, the bridge over the Strait of Messina). One must also consider the difficulty in obtaining premises, which slows down project development. Finally, infrastructure maintenance is time-consuming and often expensive, considering also that there is often no record of the latest maintenance, which leads to hazards (example: Morandi bridge, Genoa).

The leisure and tourism market is characterized by seasonality and dependence on tourism

Finally, the health care market has high costs in both construction and operation of facilities, which are also often due to health regulations and very high and often very strict standards. regulations often change and make it extremely expensive to adapt

These problems require careful management and innovative solutions to ensure that the real estate market can function efficiently and sustainably, meeting the needs of all stakeholders.

Having seen the characteristics of the Real Estate market, having seen how it is divided and what are the problems, specific or not, of the market itself and its subcategories, it can be inferred that most of these problems, in summary, stem from the difficulty of finding information, the difficulty in investing in the market itself, the high costs, the number of intermediaries present in a single transaction, and the bureaucratic timelines, also considering the attached costs, for a single transaction.

Trying to read this summary as a map, one could say:



Basically, looking at the problems in this way, it can be said that the lack of transparency in the Real Estate market makes it extremely expensive and volatile. How can this problem be solved?

You could say that by now, when faced with a problem, you have to go and examine new technologies and whether they are actually applicable.

An excellent solution could be Blockchain and related technologies, namely smart contracts, Cryptocurrencies and digital tokens.

But what are these?

2.4) Blockchain, Crypto, Smart Contract and Token

The analysis starts with the key element of economic exchanges, namely Cryptocurrency.

2.4.1) Cryptocurrency

Starting with the term itself, it can be seen that it itself is composed of two words, namely *Crypto* and *Currency*. From these two words it can be guessed that it is a currency like the most common ones (euro, dollar, etc.), but with two major differences:

the first can be identified in the initial word that makes up the term, Crypto, in fact from here it is clear that it is indeed a currency, but a virtual one. This

completely changes the way in which it can be exchanged, the way in which it is created and what it takes to own it. It is also important to keep in mind that it cannot exist in physical form.

The second difference, which is completely revolutionary, is that, unlike of other currencies, cryptocurrency is not under the control and supervision of any central bank, thus making it a completely private.

The inherent purpose of cryptocurrency is both its use as a medium of exchange, as well as possession for investment purposes.

From this analysis of the word, a precise definition of Cryptocurrency, or "digital representation of value."

Each Cryptocurrency has very specific and peculiar characteristics that distinguish it from other Cryptocurrencies (this is because all Cryptocurrencies are different from each other, with different codes and with different possibilities for use and conversion):

a protocol, which is a set of rules that correspond to a specific computer code that describes the way in which transactions can be carried out transactions;

a blockchain, which is a "ledger" that stores in an unchangeable the entire history of a transaction, making it impossible to forgeries;

a decentralized network of entities that store, consult and update the blockchain, according to the rules of the protocol.

But what is blockchain?

Again if we break down the word Blockchain we identify the words *Block* & *chain*, viz:

block corresponds to a plurality of data that cannot be changed;

chain corresponds to the concatenated union of the above blocks.

By blockchain therefore we mean a set of data, immutable and up-to-date, concatenated together, which performs the function of collecting the information processed through this technology and as a public ledger of transactions made through cryptocurrencies that rely on a given blockchain (for example, bitcoin's Blockchain is different from Ethereum's).

This topic will be explored more precisely in section 2.4.2.

How to crowdfund with cryptocurrencies?

Cryptocurrency crowdfunding is a collective funding mode that leverages the technologies described earlier, namely blockchain and cryptocurrencies to raise funds. This method offers the possibility of reaching a global audience without traditional intermediaries and allows even small investments and in a quick and immediate manner. Here is a guide on how it works and what are the main aspects to consider:

The most popular types of crowdfunding are: ICO (Initial Coin Offering); the STO (Security Token Offering); IEO (Initial Exchange Offering); Traditional Crowdfunding with Cryptocurrencies on dedicated platforms.

But what are the steps to proceed with cryptocurrency crowdfunding? There are 7 basic steps and they correspond to: defining the project; choosing the platform, such as kickstarter, coinbase commerce, Binance Launchpad...(or whether to proceed with an ICO, STO, or IEO); creating a whitepaper; developing a smart contract and promoting the project with a marketing strategy (this corresponds to the major cost); launching the campaign and, finally, managing the funds

2.4.2) Blockchain

After taking a general look at Cryptocurrencies, let's look at where the exchanges are registered and why this process is actually relevant and innovative.

For such needs, the new technology called Blockchain was developed.

Blockchain consists of a public, but more importantly immutable ledger which is intended to facilitate that process of recording assets and facilitate asset tracking. Exchangable assets on a blockchain are all assets (tangible or intangible entity susceptible to economic valuation) whether tangible (a property, money, land, etc...) or intangible (patents, copyrights, intellectual property, trademarks, etc...).

It can be said that on a blockchain network it is possible to buy or sell anything that has value, that is traceable and exchangeable.

Exchanging these assets on a blockchain network is useful since this process leads to reduced costs and risks for all stakeholders.

Regarding the operation of a blockchain, as mentioned earlier, it involves exchanges of data in the form of "blocks" connected with those that precede them and those that follow them, therefore irreversibly concatenated.¹⁰

This mechanism increases the trust of the data subject, enhances the security of the data itself, and improves the efficiency of exchanges.

It should always be kept in mind that when people talk about blockchain, they are not talking about cryptocurrency; this is a frequent mistake that, in fact, can create confusion.

The blockchain is the engine that allows cryptocurrencies to be traded.

But are blockchains the same with each other?

Absolutely not, in fact there are several categories:

Private blockchain networks, decentralized peer-to-peer networks where a single organization governs access to them, protected primarily by firewalls and access permissions. All transactions within the blocks are validated and agreed upon by a consensus mechanism, ensuring that each transaction is verified and correct;

Consortium networks, in which multiple organizations are involved in the responsibility for the operation of the network with the same functions as the private networks;

Public blockchain networks, such as Ethereum's, similar to private in as a peerto-peer network, but which anyone can access, thus reducing thus greatly increasing privacy and increasing costs as it requires a great deal of computing power, making them little used for enterprise;

Permission-based blockchain networks, in which you need different permissions based on the action to be performed.

There is also another consideration to be made when discussing the differences between blockchains, namely the environmental factor.

Normally an ordinary person would come to think that because it is entirely digitally developed, there is no environmental impact. Nothing could be further from the truth.

In fact, being data to be saved and impossible to erase there is a need for continuous growth of the server farms used producing materials that have a high environmental impact. but the real problem lies in the energy required to keep the servers running.

A common example in terms of impact based on the amount of energy used to maintain them is the difference in consumption between the blockchain of Ethereum (geared toward a 0 impact principle) and Bitcoin.

2.4.3) Token

The term "token" in technology and finance can have several meanings, but generally refers to a digital representation of an asset or right on a blockchain. There are various categories, among which we find cryptocurrency tokens, security tokens, access tokens, and programming tokens. In this analysis, the interpretation that is of interest is the idea of a token as a portion of something, such as, for example, a property. it can be defined almost as a share, with the difference that accessing this market is easier and transactions are faster and more efficient, in addition, the risk of fraud is reduced because, both the history of the token and the asset to which it refers is tracked and unchangeable, transparent and intuitable, but above all in the public domain.

2.4.4) Smart Contract

Smart contracts are programs with the terms of the agreement between buyer and seller written directly into the code. They operate on a blockchain, which provides security, transparency and immutability of transactions. The main characteristics specific to smart contracts are that they are self-executing, meaning that they automatically execute the instructions in the code, eliminating intermediaries; they are "transparent" and immutable, thus reducing the rate of fraud; and they are secure in that they run on a blockchain that typically, within its own characteristics, resists attacks due to its decentralized nature. One of the main advantages is the fact that by eliminating intermediaries, costs are reduced and speed is increased at the transaction stage. In summary, smart contracts automate and secure all contracting processes.

Chapter 3

Issues of new technologies and the evolution on the regulations

governing them (Switzerland, Italy, Liechtenstein, USA)

When we talk about cryptocurrencies, blockchain, smart contracts and tokens, we are talking about new technologies, new tools that are beginning to become part of economic reality and will be essential elements for operating in any industry.

But, one must balance the economic "utopian" aspect of these with the regulatory aspect.

As can be guessed, the regulatory aspect is still not well defined, which creates short-term functionality issues, but many countries are opening up and developing laws to facilitate the use of new technologies, especially by ensuring their safety.

3.1) Issues related to these technologies

As previously mentioned there are various issues related to these technologies, which differ depending on the subject of the analysis.

3.1.1) Cryptocurrencies

For example, when it comes to cryptocurrencies one of the main problems is the volatility of the market and the possibility of falling into fraud related to the existence of sheetcoin, which happens when the investor does not have a knowledge about how cryptocurrencies work. This aspect needs to be analyzed very specifically.

The main limitations are:

Cryptocurrency volatility linked to foreign exchange risk Limited infrastructure, by which is meant: Technological infrastructure limitation, in fact blockchains such as Ethereum do not yet have adequate infrastructure to handle large numbers of transactions, risking slow exchange processes due to data traffic.

Compatibility with software currently used within the industry

Accessibility and improvement of the user interface so that it is intuitive and easy to use

Improved security with regard to the digital wallet, in fact, currently, losing the password corresponds to irreversible prediction of funds

Infrastructure must be effective for handling legal disputes, which are more complicated as they involve a decentralized environment

Fiscal treatment of transactions, in fact, this method, must not be a way to circumvent all that are taxes, such as VAT or registration taxes. In addition, transactions must comply with AML regulations and KYC customer knowledge regulations.

3.1.2) Blockchain

When it comes to blockchain, problems can take on a completely different nature as well, such as that of privacy.

More specifically, when it comes to privacy, one must comply with regulations, such as the General Data Protection Regulation (GDPR-05/25/2018), which is the European legislation governing the protection of personal data, how it should be collected and handled, and data deletion clauses.

In fact, this problem is difficult to solve, precisely because of the natural characteristics of the blockchain, this is because one of its key features is the immutability of data.

A good place to start would be to make any details you want to delete inaccessible and obscured, thus limiting disclosure, or to create a detached digital identity. This possible solution, however, conflicts with Know Your Customer (KYC) and Anti-Money Laundering (AML) regulations. As a final problem you have "too much transparency."

As mentioned earlier to improve the real estate sector we need to improve its transparency, but we should never fall into excess. This would in fact lead to distrust in new technologies and, therefore, also in that "improved" market. Taking transactions as an example, one can guess that if the blockchain is available and open to all, all transactions would be public and searchable by all. One possible solution would be to allow access to all, but using layers of access.

In fact, allowing only certain parties (e.g., notaries) to have access to certain data would improve the industry by making searches faster, but without affecting the privacy issue too much.

3.1.3) Token

As far as tokens are concerned, some thought must be given to the nature of the same. Indeed, one of the complications that characterize this element is the consideration of the same, this is because, as will be seen in the next chapter, these should be valued, in many cases, as securities. But what does this entail? Logically, this results in tokens being subject to registration and compliance requirements with securities laws.

This is because tokens can represent property or interests in real estate assets. Under these laws, if a token is considered a security, it must therefore adhere to a specific set of regulations to protect investors and ensure market transparency.

Like securities, these must be registered with regulators such as the Italian Consob or the U.S. SEC; they must display a prospectus describing the risks of the investment, the business plan, and other details relevant to any equity investment-this is also necessary to make the market more transparent, giving confidence to investors; and appropriate international regulations must be developed to offer legal protection to investors, especially in case of fraud. Another issue to be analyzed is the fiscal aspect.

When there are gains from a property, tokens being to indicate the percentage of ownership of the same and therefore considered securities, one must declare the gains derived from the asset being considered. Therefore, one must ensure transparent financial reporting, thus complying with tax regulations.

3.1.4) Smart Contracts

When it comes to smart contracts, the problems that characterize them are in a sense in common with other technologies, in fact the main problem that characterizes them is the non-existence of a common regulation governing them, this also due to the inherent characteristic of them, namely their self-executability.

Thus, currently, where they are applied to protect the parties one has to interpret the current regulations. However, this, as you can easily guess, induces errors in assessments and inexperienced people can fall into fraud much more easily, also they do not allow arbitrations.

There are various solutions for improving the integration of smart contracts within the real estate sector.

In fact, notaries, therefore people who already have a clear normative knowledge of generic contracts, could be required to take training courses.

Or another solution might be to introduce clauses allowing arbitration within smart contracts.

These two solutions are a great cue, but they can only take their true value after the creation of appropriate laws.

3.2) The evolution of the regulatory aspect.

Having seen the problems presented by these new technologies, we move on to looking at how the world is approaching them, this through the regulatory aspect. It must be considered that many countries, such as those in Europe, espouse the idea of adapting to this change, while other countries do not, in fact, speaking of cryptocurrencies, many countries have prevented their disclosure, such as Brazil and China.

3.2.1) Switzerland

Switzerland was one of the first countries to open up to the world of cryptocurrencies, blockchain, tokens and smart contracts, despite being essentially unregulated.

Despite its lack of regulation, Switzerland has established itself as a cryptocurrency hub by introducing Ethereum, one of the most important and robust cryptocurrencies in history.

In anticipation of more clarity and knowledge about this world, the state has issued guidelines through FINMA, the Swiss financial market regulator.

3.2.1.a) FIMNA

The first regulation of virtual currencies in Switzerland began in 2014, when the term virtual currency was used in the Federal Council report for virtual currencies

This combined virtual currency with the definition of a digital representation of value, and thus considered virtual currency a commodity of exchange and means of payment

The above directive is not a regulatory law, but rather describes how FIMNA itself decides on the acceptance of ICO applications in Switzerland

In addition, FIMNA classifies cryptocurrencies into categories based on their purpose:

1) Utility Tokens: These provide access to specific services and thus correspond to the right to receive specific services from the issuer of the cryptocurrency itself

The qualification of tokens in this category entails obligations to the to the originator of the prospectus project under the law Swiss debt

2) Payment Token: As the word suggests, these are tokens that serve as a means of payment for the purchase of goods and services.

Unlike utility tokens, these do not confer any rights beyond ownership to the holder of the token itself.

FIMNA emphasizes in its guidelines that virtual currencies also qualify as alternative payment systems and are therefore subject to Article 81 of the Swiss law 81 "Payment system" means an institution that carries out the clearing and settlement of payment obligations on the basis of uniform rules and procedures 3) Security Token; Conceptually it is very similar to a stock in the sense that it actually functions as an action of a corporation and also gives you the right to share profits and social benefits

From 2018 onward, some existing Swiss laws, such as the Anti-Money Laundering Act (AMLA), and the minimum information elements necessary for an ICO to be accepted. Security tokens are considered securities by FINMA.

3.2.2) Italy

Although the situation in Italy is still evolving, progress has been made and Congress has passed legislation to regulate this new world.

One of the first laws to support the introduction of cryptocurrencies in the country was passed on Jan. 13, 2022, and covers the protection of recipients of government services and owners of virtual wallets

This standard, in fact, establishes the minimum identifying elements of the operating company (identification, purpose, and other general information)

Other provisions of the Regulations also regulate the register of transactions and financial intermediaries, the timing of publication of transactions, and the subject matter of transactions: "Service providers related to the use of virtual currency. and digital wallet service providers transmit to the OAM electronically, data on transactions carried out on the territory of the Italian Republic. Specifically:

- (a) customer identification data, as reported
 In Annex 1 to this decree, which constitutes part of it
 integral;
- (b) summary data on the overall operation of Each service provider related to the use of currencies
 Virtual and digital wallet service provider per individual customer, as listed in Annex 1 of this decree."

It can be said that this norm serves to prevent one of the elements already mentioned above that make this world dangerous and suspicious, namely, money laundering. This can be understood from the very opening of the standard:

"In this decree:

(a) anti-money laundering decree: means the legislative decree 21 November 2007, No. 231, as amended..."

3.2.3) Liechtenstein

In Europe, the small state of Liechtenstein is one of the leading examples of a country that is fully opening up to the world of cryptocurrencies and blockchain.

Here, just on May 7, 2019, Parliament passed the "Law on VT tokens and service providers," which is the national regulation on cryptocurrencies and their use (which will not come into effect until January 2020).

It aims to increase investor safety, prevent questionable uses (e.g., money laundering) and ensure regulatory clarity.

This law has special characteristics and is, in fact, one of the first forward-looking laws.

This is because this law does not specifically affect blockchain or cryptocurrencies, but all commercial systems based on trust technologies, i.e., not controlled by a central bank (decentralization)

3.2.3.a) The "Blockchain Act"

This law (the "Token and VT service Providers Act," referred to as the "Blockchain act") corresponds to an initial attempt to flexibly and impartially regulate the transaction and issuance of tokens and all that underlies them, all to increase the legal safeguards of those in the industry.

The peculiarity, mentioned above, of this law is precisely its adaptability to a plurality of future cases, this precisely from Article 1 paragraph 1 which states that this legislation applies to all transactional systems that are based on reliable technologies.

A special feature written within the standard itself, in the first part, that is, in the descriptive and defining section, lies in the definition of "payment token," in that it gives a definition of it and compares it with currencies in current use seeing cryptos however not as a replacement, but as an equally viable alternative.

The second part, on the other hand, contains the specifics of the law itself, namely the territorial scope of the law, activities and monitoring, deregistration and registration of token-related service operators, the rules aimed at the protection of third parties, validity of transactions.

Specifically, the aspect of territorial application of the law should be examined; in fact, this law is directly applicable even to companies that are not based in the state itself. In this way, companies that decide to invoke it in their contracts will also benefit from it. Specifically, all this is stated in Article 4 of the law, which deems that all companies claiming the standard will be located in Liechtenstein. This occurs only if there is no legal procedure related to the reference token prior to the claim of the law itself (excluding cases of good faith).

Another aspect that needs to be analyzed in depth is the obligation of service providers to register on tokens, this obligation, in fact, is extended to all those who perform services directly related to the token, regardless of the nature of the token itself, except those who perform token issuances in a non-professional way, but within certain limits of value and growth.

Regarding the main problem with tokens, the protection of third parties, it is stipulated in Article 25 of the rule that tokens that are deposited in the interest of the customer cannot be subject to actions related to bankruptcy or insolvency proceedings of the manager himself.

The only case of exemption from this detail is if the operation does not involve more than 150 users and does not exceed a value of CHF 5 million in 12 months.

3.2.4) USA

Going overseas, however, we find one of the best situations for the adoption of new technologies; in fact, there are laws governing their operation.

3.2.4.a) Blockchain

Regarding blockchain, one can analyze ad ok laws implemented in Vermont and Illinois.

Vermont (Act 157, 2016) was one of the first states to recognize blockchain records as legal evidence. This recognition means that data recorded on blockchain can be used as evidence in court, giving them the same validity as traditional authenticated documents. This law aims to promote trust in digital records and facilitate the adoption of blockchain technology in business and legal transactions. The law can be said to support technological innovation by

encouraging the use of blockchain to improve the transparency and security of transactions regardless of the target market.

In Illinois, on the other hand, is the "Blockchain technology act" (01.01.2020), which establishes the regulatory framework for the use of blockchain and smart contracts within the state. The law legally recognizes smart contracts and digital signatures within blockchains, giving them the legal value of traditional "paper" contracts. It defines smart contracts themselves as programs that automatically execute the terms of a contract when the conditions are met and deem the information stored on the blockchain to be authentic.

The law establishes that data on the blockchain remains the property of its creator, ensures that such data cannot be altered without consent, and facilitates the application of blockchain technology by businesses and public institutions, thereby promoting innovation and development. It includes consumer protection and benefits both the public and private sectors by improving efficiency and transparency. However, intergovernmental regulation can create complexity for domestic businesses, requiring a balance between innovation and consumer protection, as well as possible future regulatory updates to address new technological challenges.

3.2.4.b) Token

Instead concerning tokens the Securities and exchange commission (SEC) comes into play. Its intervention is necessitated by the boom in ICOs (initial coin offerings) during 2014-2017.

The SEC regulates digital tokens, treating them as securities if they meet the Howey test, which assesses whether there is an investment of money in a joint venture with the expectation of profits from the efforts of a third party. Tokens that are considered securities must be registered with the SEC or exempted from registration. Companies that issue tokens must provide transparent information to investors. The SEC has taken legal action against several ICOs for failure to register and fraud, aiming to protect investors from deceptive practices.

3.2.4.c) Smart Contracts

Arizona and Tennessee laws have laid the groundwork for the legal recognition of smart contracts, fostering technological innovation and security in digital transactions. Arizona House Bill 2417, passed in 2017, states that electronic signatures and blockchain-based records cannot be denied legal validity just because they are in electronic format. In addition, data recorded via blockchain are considered immutable, making them trustworthy for legal uses. This law promotes trust in digital records and facilitates the adoption of blockchain in various sectors.

Similarly, Tennessee enacted House Bill 1507 in 2018, which recognises smart contracts and transactions on blockchain as valid legal contracts. The law specifies that data recorded on the blockchain is verifiable and immutable, providing a solid legal foundation for the use of blockchain technology in business and legal settings. These regulations are crucial for promoting transparency and security in digital transactions, reducing the risk of fraud and encouraging the adoption of innovative technologies. They also create a favourable environment for companies that want to use blockchain to improve transparency and efficiency in their operations.

3.2.4.d) Cryptocurrencies

Finally, with regard to cryptocurrencies, mention must be made of New York State and BitLicense.

The BitLicense, introduced in 2015 by the New York State Department of Financial Services (NYDFS), is a regulation specifically for cryptocurrencyrelated activities in New York State. This regulation requires companies engaged in cryptocurrency-related services to obtain a dedicated license, ensuring compliance with stringent anti-money laundering (AML) and knowyour-customer (KYC) standards. It also includes measures to protect consumers and imposes a requirement to report suspicious activity, increasing confidence and security in the cryptocurrency market. These provisions, however, make the market less fast and accessible, as they have created significant barriers to entry for new firms in the sector.

Chapter 4

Possible solutions

This analysis begins with understanding the characteristics of the Real Estate sector, understanding the problems in the sector, identifying elements that can be found useful, and understanding the pros and cons.

Having reached this point, one can begin to see how these elements can integrate to the real estate sector.

4.1) Smart Contract as an intermediary

Smart contracts in real estate represent a remarkable technological innovation that promises to revolutionize the way real estate transactions are handled. These digital contracts, which are self-executing thanks to blockchain technology, can simplify, automate and make real estate transactions more efficient by eliminating the need for traditional intermediaries such as notaries, lawyers and real estate agents.

Reducing these intermediaries can not only mean lower transaction costs, but also a decrease in the time it takes to complete transactions, which are often long and complicated.

In addition, the immutable and decentralized feature of the blockchain ensures a high level of security and transparency. Every transaction is permanently and unambiguously recorded on the blockchain, making information available to all participants and drastically reducing the possibility of fraud. For example, in the case of rentals, a smart contract can automate the flow of rent payments, management of security deposits and even termination of lease terms, all without the need for manual intervention. Similarly, for real estate sales, smart contracts can facilitate the immediate verification of payments and the subsequent transfer of title to the buyer, speeding up processes that would otherwise take weeks, if not months. For example, imagine a real estate transaction where seller and buyer use a smart contract to simplify and secure the entire process of selling an apartment. Starting with the initial agreement, the sale price of the apartment is set at \$1,000,000, and all conditions of the sale, including terms and timelines, are encoded in the smart contract on the blockchain platform. This smart contract automatically verifies, through access to a database on the blockchain, that the seller is the rightful owner and that the property has no encumbrances. Next, the buyer deposits \$100,000 in cryptocurrency into a trust account managed by the smart contract, which confirms receipt and proceeds with the inspection of the apartment.

Once the inspection confirms that the apartment meets the stipulated conditions, and the buyer approves, the final payment of \$900,000 is transferred. The smart contract then registers the buyer as the new owner in the blockchain registry, transfers the funds to the seller, and notifies both parties of the completion of the sale. This process not only reduces execution time but also increases security by preventing fraud and reducing legal and brokerage costs due to its automated and transparent nature. In this way, the use of smart contracts in real estate transactions represents a significant advance toward faster, safer, and more cost-effective transactions.

Despite the obvious advantages, the implementation of smart contracts in real estate presents some challenges. The main one concerns the integration of existing regulations into the smart contracts code explained in the last chapter and the need to ensure that these are legally binding and comply with local laws. In addition, managing disputes that may arise during real estate transactions remains a critical issue, which may require new approaches and solutions to ensure that disputes can also be resolved effectively.

In conclusion, while there are hurdles to overcome, smart contracts have enormous potential to transform the real estate industry. As trust in digital technologies grows and blockchain infrastructure matures, we are likely to see increased adoption of these innovative solutions, which promise to make property transactions more accessible, cheaper and significantly faster.

4.2) Management of property titles

The management of property titles using blockchain technology in the real estate sector is a promising area that could lead to significant transformations, optimising the security, efficiency and transparency of transactions. Traditionally, the process of registering and transferring property titles is lengthy, costly and requires the involvement of numerous legal and bureaucratic intermediaries. Blockchain, through the use of smart contracts, offers a revolutionary solution that automates these processes. These digital contracts automatically execute, verify and record transactions in a secure and transparent manner, reducing waiting times and lowering operational costs.

The immutability of blockchain ensures that records cannot be altered once created, providing an almost insurmountable barrier against property fraud, which is often complex and difficult to eradicate with traditional systems. Every transaction is recorded on a public ledger, which not only increases security but also trust between parties, as the information is verifiable by anyone in real time. This feature significantly reduces the risk of litigation and simplifies the due diligence procedures that are essential in real estate negotiations.

Examples of the implementation of this technology include trials in Sweden and Georgia, where title records have been transferred to blockchain platforms. These projects have demonstrated that the technology is not only feasible, but also brings tangible improvements in operational efficiency and cost reduction. However, despite the obvious potential, large-scale adoption of blockchain in real estate faces a number of challenges.

Imagine a scenario where Mary, interested in buying a house, meets with Luca, the seller, through a real estate platform that leverages blockchain technology to simplify and secure transactions. After visiting and deciding to buy Luca's house, a sales contract is created in the form of a smart contract on the blockchain, which encodes the terms of the agreement, including price and key dates.

Using a decentralised public registry, the blockchain platform automatically verifies the title of the home to ensure it is free of mortgages or other encumbrances. This normally time-consuming and labour-intensive process is completed quickly and accurately, dramatically reducing the time required for legal due diligence.

Once the terms are met, including payment and home inspection, Maria transfers the funds into an escrow account managed by the smart contract. If all requirements are met, the smart contract proceeds with the release of funds to Luke and records the transfer of title in Mary's name directly on the blockchain. This title update is immediate, transparent and immutable, ensuring a clear and verifiable trail that can be consulted in the future. Mary thus becomes the new registered owner, with all parties receiving confirmation of the completion of the transaction and the legal documents digitally archived for future reference. This approach not only speeds up the entire process of buying a property, reducing the time from weeks to days, but is also more secure due to the immutable nature of the blockchain, minimising the risk of fraud. In addition, the elimination of many traditional intermediaries and the digitalisation of verification significantly reduces transaction costs, while improved transparency increases trust between the parties involved. Through this example, we can see how blockchain can revolutionise the real estate industry, making transactions not only more efficient, but also more secure and cheaper.

4.3) Transparency and security

The transparency and security offered by blockchain technology is revolutionising the real estate industry, bringing a number of significant improvements in the reliability and efficiency of transactions. Due to the immutable and decentralised nature of blockchain, every transaction is permanently and transparently recorded, giving all parties access to verified and always up-to-date information. This is particularly valuable in a sector where clarity and accuracy of information is critical.

The use of blockchain in real estate dramatically reduces disputes because all property-related information is clearly documented and easily accessible. For example, details such as transaction history, property titles and any encumbrances are verifiable in real time, eliminating ambiguities that often lead to legal disputes. This transparency not only simplifies the verification process but also reduces the legal and administrative costs associated with real estate transactions.

In addition, blockchain improves property valuations. Investors and lenders can leverage a detailed transaction log to make more accurate valuations based on reliable historical data. This is a major advantage over traditional methods, which can depend on subjective and variable estimates.

The adoption of blockchain technology in real estate is transforming the way property valuations are conducted, leading to dramatic improvements in accuracy, transparency and reliability. Blockchain provides a permanent and immutable record of all transactions relating to a property, including details such as sales, purchases, title changes and mortgage funding. This direct access to comprehensive and reliable historical data allows valuers to gain a detailed and accurate view of property transitions and historical prices, resulting in more accurate and justified market valuations.

In addition, the transparency provided by the blockchain ensures that all information is easily accessible and verifiable, allowing appraisers to analyse important details such as renovations, data on previous owners and other factors that may affect the value of the property. This reduces the risk of erroneous appraisals based on incomplete or inaccurate data, and also minimises the potential for fraud and manipulation, as it is extremely difficult to change or alter data recorded on the blockchain.

Concrete examples of blockchain implementation in real estate include property listing platforms that integrate this technology to provide users with access to comprehensive and up-to-date property records. This integration can significantly increase user confidence and satisfaction by facilitating faster and more transparent transactions.

Another example is the use of blockchain to manage collateral deposits through smart contracts, which ensure that funds are released only when specific conditions are met. This system minimizes the risks of fraud and delay, ensuring that transactions are completed fairly and efficiently.

4.4) Financing and loans

Blockchain technology, with its ability to provide security, transparency and automation, is emerging as a revolutionary solution in the real estate finance and mortgage industry. This technology promises to transform traditional banking operations by reducing processing time, minimising fraud risks and lowering operational costs.

4.4.1) Automation and Risk Reduction.

One of the most transformative aspects of blockchain in the mortgage industry is the use of smart contracts. These digital contracts are self-executing programs that live on the blockchain and operate according to predetermined parameters without human intervention. In a real estate mortgage context, a smart contract can be configured to automatically perform actions such as verifying the borrower's creditworthiness, analyzing his or her financial and credit data, and releasing funds once certain conditions are met.

This automation significantly reduces the risk of human error and document fraud. Data entered into the blockchain is protected by encryption, making it

nearly impossible for it to be altered or tampered with. This is crucial, considering that the mortgage industry has traditionally suffered from exposures to fraud risks, such as manipulating documentation or obtaining financing on false information.

4.4.2) Efficiency and Speed

Speed of processing is another key benefit of blockchain. Traditionally, the process of obtaining a mortgage can be long and tedious, taking weeks, if not months, to complete. This delay is often due to the need to manually collect, verify and approve a wide range of documents and data. With blockchain, many of these processes can be automated and data verification can take place in near real-time. For example, instead of waiting for a credit bureau to provide a credit report, a bank can directly access a decentralised, immutable ledger to verify a borrower's financial history. This not only speeds up the process, but also ensures that lending decisions are based on accurate and up-to-date data.

4.4.3) Transparency and Compliance

Regulatory compliance is another area where blockchain has significant potential. Transactions recorded on the blockchain can be easily audited, making it easier to comply with financial and banking regulations. Every transaction on the blockchain is independently tracked and recorded, providing a complete history that can be verified by regulators and other stakeholders without the risk of forgery.

This transparency also benefits borrowers, who can access the same information as banks, such as their transaction details, mortgage balances and payment history. This level of openness not only increases trust between borrower and lender, but also enables greater financial awareness among consumers.

4.4.4) Reduction of Operating Costs

Using blockchain to automate and digitise mortgage processes can significantly reduce operational costs. Banks and other financial institutions often face high costs associated with managing staff, verifying documents and maintaining data security. With smart contracts, many of these activities can be automated, reducing the need for manual intervention and the associated costs.

A notable example of the application of blockchain in the mortgage industry is Figure Technologies, which offers home equity lines of credit (HELOCs) through the use of blockchain. This allows them to process applications in days rather than weeks, with greater security and at a lower cost than traditional methods. Another example is Homelend, a peer-to-peer lending platform that uses blockchain to connect borrowers and lenders directly, eliminating the need for intermediaries and further reducing costs.

One can imagine a scenario where blockchain technology is used to revolutionise the process of granting a property loan, improving efficiency, security and transparency for all parties involved.

Anna, a prospective buyer, is interested in purchasing a house from Marco. Anna begins the process by filling out an online pre-qualification form on the blockchain platform, entering her financial information. This data is immediately made available to the bank, which uses it to analyze her credit history and ability to repay through automated algorithms.

Once pre-qualified, Anna makes an offer for the house, which Marco accepts. The details of the offer and acceptance are recorded on blockchain, ensuring their immutability and transparency. Next, the bank orders a property valuation and inspection, the results of which are also recorded directly on the blockchain. This step confirms that the value of the house matches the purchase price and ensures that the property has no significant problems.

With all the necessary documents, such as appraisal and inspection reports, stored and managed on the blockchain, a smart contract takes care of the

mortgage approval process. This smart contract verifies that all conditions are met before proceeding, automating much of the bureaucratic process that traditionally slows mortgage approval.

Once the mortgage is approved, the smart contract prepares the closing documents and coordinates the transfer of funds from the bank's account to Marco's. In addition, the change of home ownership is recorded on the blockchain, ensuring a solid and transparent legal record that confirms Anna as the new owner.

Finally, Anna begins making monthly mortgage payments through the blockchain platform. Each payment is automatically recorded and verified, simplifying mortgage administration and reducing the risk of payment errors.

This scenario demonstrates the significant benefits of using blockchain in the real estate lending process, significantly improving overall efficiency. Automation reduces waiting times, speeding up the closing process and making it less labour intensive. Security is greatly enhanced through encryption and the immutable nature of the blockchain, which protects against fraud and data manipulation, providing a much higher level of security than traditional systems. In addition, real-time access to data recorded on the blockchain increases transparency, improving trust between all parties involved and facilitating clearer and more open transactions. Finally, the reduction in paperwork and manual labour leads to lower costs for banks, potentially translating into better rates for borrowers.

4.5) Property verification and the registration of the property under analysis

The introduction of blockchain technology into the real estate industry, particularly for property registration and verification, represents a radical change with the potential to revolutionise traditional processes that have been in place for decades. While these processes have worked for a long time, they are not without their shortcomings. They are often slow, expensive and prone

to human error, fraud and bureaucratic inefficiency. Blockchain offers an innovative solution that not only addresses these problems, but also creates new opportunities for a system that is more secure, transparent, and accessible to all. One of the biggest benefits of using blockchain for property records is the increase in data integrity. Traditionally, property records have been stored in paper documents or, more recently, in centralised digital systems, both of which are susceptible to manipulation, error and even accidental destruction. Blockchain, on the other hand, provides an immutable ledger in which every piece of data related to a property is encrypted and permanently recorded. This means that once information is entered into the blockchain, it cannot be altered or deleted without the consent of the majority of the network, dramatically reducing the risk of document fraud such as title forgery or record manipulation.

This feature is particularly important in contexts where there is little trust in institutions that manage property records, such as in some developing countries. In these contexts, traditional property registration systems can be easily compromised, leading to costly and protracted legal disputes. Blockchain eliminates this risk by ensuring that property titles accurately reflect the legal and physical reality of the property in question. This not only protects property owners, but also increases trust in the system as a whole, encouraging more investment and activity in the property market.

In addition to improving data integrity, blockchain has the potential to dramatically simplify the property transfer process. In traditional systems, property transfers require a significant amount of manual documentation and verification. The parties involved must coordinate their efforts through a series of bureaucratic steps, often involving intermediaries such as notaries, lawyers and estate agents, which contribute to slowing down the process and increasing its cost. The blockchain can automate much of this process through the use of smart contracts. Smart contracts are self-executing programs that reside on the blockchain and operate according to predefined rules. In the context of property transfer, a smart contract could be programmed to automatically execute the transfer of title once all legal and contractual conditions have been met. For example, when the buyer has made full payment and the conditions of sale have been verified, the smart contract could automatically transfer ownership from the seller to the buyer and record this transaction on the blockchain.

This type of automation not only reduces the time it takes to complete a transaction, but also eliminates many of the manual steps that are prone to errors or delays. In addition, because blockchain is a decentralized system, there is no need for a central authority to approve or verify transactions. This reduces the need for intermediaries, further lowering costs and making the property transfer process more streamlined and efficient.

Cost reduction is another significant benefit of adopting blockchain for property registration and verification. In traditional systems, the costs associated with transferring ownership can be high, mainly due to legal and administrative fees. These costs are often the result of the need to manually verify documents, coordinate between different parties and ensure that all legal procedures are followed correctly.

With blockchain, many of these costs can be reduced or eliminated. Because the verification and registration of properties can be automated, the need for human intervention is minimized. This not only lowers operational costs, but also makes the process more accessible to a wider range of people. For example, in contexts where high transaction costs have traditionally excluded certain segments of the population from the real estate market, blockchain can open up new opportunities by democratizing market access.

Moreover, cost reduction is not limited to individual transactions. At a system level, the adoption of blockchain can lead to significant savings for governments and institutions that manage property records. Fewer resources will be needed to maintain and update records, and the resources saved can be reinvested in other critical areas.

Another key benefit of using blockchain for property registration is increased transparency. The blockchain provides a public ledger, accessible to all, in which all transactions are recorded in a transparent and immutable manner. This means that anyone can check the history of a property, including previous owners, previous transactions, and any encumbrances or liens that exist on the property.

This transparency is particularly useful in property markets where trust is low or information is difficult to obtain. In many developing countries, for example, a lack of transparency in property records can lead to legal disputes, fraud and corruption. Blockchain can address these concerns by providing a system where information is easily accessible and verifiable by anyone. This not only protects buyers and sellers, but also creates a more stable and reliable market environment.

With increased transparency comes increased trust. In a blockchain system, all parties involved in a transaction have access to the same information, reducing information asymmetries that often lead to conflicts or misunderstandings. In addition, because blockchain eliminates many of the opacities associated with traditional processes, parties can have greater confidence that the transaction will be conducted fairly and in accordance with the law.

4.5.1) Global Implications

The global implications of adopting blockchain for property registration are particularly significant. In emerging markets and developing countries, where property registration systems are often ineffective, outdated or prone to corruption, blockchain offers a robust and reliable solution. In these contexts, the creation of a blockchain-based property registry could help stabilise the real estate market, boost investor confidence and support economic development. In many African countries, for example, property records are often incomplete or unreliable, making it difficult for property owners to prove ownership or obtain loans secured against their property. Implementing a blockchain-based registration system could solve these problems by providing a registry that is both accessible and secure. This could have a significant impact on these countries' ability to attract foreign investment, develop their property market and improve access to credit for property owners.

Several countries have already begun experimenting with the use of blockchain for property registration, with promising results. For example, in Georgia, the government has partnered with the blockchain company Bitfury to transfer property records onto a blockchain. This project demonstrated that blockchain can make the registration process more secure, faster, and transparent, while reducing the associated costs.

Similarly, the UAE has launched initiatives to use blockchain in property registration, aiming to become a global leader in the adoption of this technology. In both cases, the adoption of blockchain has led to increased trust in the property registration system, reduced the risk of fraud, and improved the efficiency of property transactions.

4.6) Tokenization of the housing market

Real estate tokenisation, powered by blockchain technology, is emerging as one of the most promising innovations in real estate, with the potential to radically change the way real estate is bought, sold and managed. The process involves breaking down the value of a property into digital fractions, known as tokens, which can be bought, sold or traded in a similar way to shares on a financial market. This practice opens up new investment opportunities, making the property market more accessible, liquid and secure. However, the scope of tokenisation goes far beyond these fundamentals, touching multiple areas of the real estate market and promising to revolutionise the industry in ways that were unthinkable just a few years ago.

One of the most revolutionary benefits of tokenisation is the democratisation of property investment. Historically, the property market has been dominated by large institutional investors or individuals with significant capital. Buying property requires a significant financial commitment, effectively excluding most retail investors. This has created a barrier to entry that has made property an exclusive investment opportunity for a privileged few.

Tokenization completely changes this dynamic. By dividing a property into thousands, or even millions, of tokens, it is possible to allow investors with more modest capital to participate in the real estate market. For example, a property worth 10 million could be divided into 10 million tokens, each worth 1\$. This allows anyone to buy a fraction of a property, making real estate investment accessible to a much wider range of people. In this way, tokenization not only democratizes access to the real estate market, but also opens up new opportunities for small investors to diversify their portfolios and participate in a market that has traditionally been reserved for larger investors. Tokenization also offers a solution to one of the real estate market's historical problems: liquidity. Traditionally, the real estate market has been known to be one of the least liquid, with transactions that can take months to complete. The process of selling a property is often long and complicated, requiring the participation of multiple parties and a significant amount of documentation and verification. This makes it difficult for investors to enter and exit the market quickly, limiting their ability to react flexibly to market changes or to quickly monetize their investments.

Tokenization solves this problem by allowing investors to buy and sell digital tokens representing fractions of real estate quickly and easily. These tokens can be traded on digital platforms, similar to how shares are traded on a stock exchange. This not only makes the real estate market more liquid, but also allows investors to access their capital more quickly and efficiently. In addition, this increased liquidity can attract more investors, increasing the volume of transactions and, consequently, the fluidity of the real estate market.

In addition to improving liquidity, the tokenisation of real estate has the potential to significantly reduce the transaction costs associated with buying and selling property. In the traditional model, property transactions require the involvement of numerous intermediaries, including notaries, lawyers, estate agents and lenders. Each intermediary adds a cost to the process, which can add up to a significant percentage of the total value of the property. These costs can be a significant barrier for many investors, making the market less accessible.

Blockchain, with its ability to automate many processes through smart contracts, reduces the need for intermediaries and consequently reduces transaction costs. Smart contracts, which are self-executing digital contracts recorded on a blockchain, can automatically handle many of the transactions traditionally performed by intermediaries. For example, a smart contract could automate the transfer of ownership once all conditions of sale have been met, without the need for human intervention. This not only makes the process more efficient, but also significantly reduces the costs involved, making buying and selling tokenised property cheaper and more accessible to a wider audience.

Transparency and security are two of the key pillars on which blockchain technology is based, and property tokenisation takes full advantage of these benefits. One of the biggest challenges in the traditional property market is the lack of transparency. Often, information about a property - such as transaction history, ownership and any legal disputes - is not easily accessible or may be incomplete. This can create uncertainty and risk for investors.

The blockchain solves this problem by providing an immutable and transparent record of all transactions. Every token transaction is recorded on a public blockchain, where it can be viewed and verified by anyone. This means that investors can easily access accurate and up-to-date information about a property before making a purchase. In addition, the immutable nature of the blockchain means that once data has been recorded, it cannot be changed or deleted without the network's consent, dramatically reducing the risk of fraud and increasing investor confidence in the system.

The security offered by blockchain is another crucial factor. In the traditional real estate market, transactions can be vulnerable to fraud, such as document forgery or double transfer of ownership. The blockchain, thanks to cryptography and decentralization, makes these frauds virtually impossible. Each token representing a fraction of ownership is uniquely linked to a cryptographic key that only the rightful owner can use. This ensures that only the owner of the token can transfer or sell it, making transactions extremely secure.

Another major advantage offered by tokenization is the ability for investors to easily diversify their portfolio. In the traditional model, investors often have to commit a significant amount of capital to a single property, which can be a high risk if the market in that specific area experiences a downturn. With tokenization, investors can split their capital by purchasing tokens of different properties, even those located in different geographic locations. This diversification reduces the risk associated with a single investment and allows investors to take advantage of market opportunities in different areas.

For example, an investor might decide to buy tokens in different cities, benefiting from different market trends in each area. He or she might also decide to invest in different types of real estate, such as residential, commercial, or industrial, to further reduce risk. This ability to diversify not only reduces overall risk, but also provides the opportunity to optimize returns by balancing the portfolio according to market trends and growth opportunities.

Despite its many benefits, the tokenisation of real estate is not without its challenges. One of the most significant is regulatory. Real estate tokens, as

representations of ownership interests, may be considered securities under the laws of many jurisdictions. This means they have to comply with a complex and diverse set of regulations around the world. Securities regulations are strict and vary from country to country, which can complicate the distribution and management of tokens on an international scale.

Legal and tax issues must be carefully managed to ensure that tokenisation complies with local regulations. For example, regulators may require property tokens to be registered as securities, subject to certain restrictions on sale and distribution. In addition, the tax implications of holding real estate tokens can vary widely from jurisdiction to jurisdiction, creating additional complexity for international investors.

Another challenge is managing the private keys required to access the tokens. While blockchain is extremely secure, it requires users to manage their cryptographic keys very carefully. The loss of a private key can mean the permanent loss of access to the tokens, and therefore the investment. This is a significant risk, especially for less experienced or less tech-savvy investors.

In spite of these challenges, real estate tokenisation is one of the most promising innovations in the real estate industry. As blockchain technology continues to develop and regulations evolve, tokenisation is likely to become an increasingly central component of the global real estate market. The benefits of accessibility, liquidity, transparency, security and diversification are too significant to ignore, and as more investors and institutions recognise these benefits, tokenisation could completely redefine the way real estate is bought, sold and managed.

As blockchain technology becomes more widespread and regulations adapt, we will likely see an expansion of tokenization into other real estate sectors, such as agriculture or industrial real estate. In addition, the integration of tokenization with other emerging technologies, such as artificial intelligence

49

and the Internet of Things, could lead to new opportunities and innovative business models.

The theory of tokenization finds confirmation in several practical examples that demonstrate how this technology is already transforming the real estate industry. One of the best known platforms is RealT, which allows investors to purchase tokens representing shares of residential real estate in the United States. Each token not only represents a fraction of the property, but also entitles the investor to a share of the profits from renting out the property. This creates a passive income stream for investors, who can earn from their investments without having to manage the property directly.

Another example is the St. Regis Aspen Resort, a tokenization project of a luxury resort in Aspen, Colorado. In this case, investors can purchase tokens that represent ownership shares in the resort, allowing them to share in the profits generated by the business. This project demonstrated that tokenization can be successfully applied to even high-value properties, opening up new investment opportunities in market sectors previously inaccessible to most investors.

The commercial real estate sector is also seeing the benefits of tokenization. Brickblock is a platform that enables tokenization of commercial properties, allowing investors to own fractions of commercial buildings such as offices, stores or warehouses. This type of investment not only offers portfolio diversification, but can also generate steady income streams through commercial rents, which tend to be more stable than residential rents.

These are some existing examples, but here are some examples to understand how actually tokens might fit in a hypothetical situation:

50

Example 1

A group of developers built a luxury resort on a tropical island valued at 100 million euros. Instead of seeking a single buyer or a small group of, the group decided to tokenize the property to make the investment accessible to a wider audience.

The value of the resort is divided into 100 million digital tokens, each worth 1 euro. Each token represents a fraction of the resort property and entitles the holders to receive a portion of the profits generated by the resort's business, such as room reservations, restaurants, and tourist activities offered to guests.

These tokens are offered on a blockchain platform, allowing investors from around the world to buy a stake in the resort. Some investors are attracted by the opportunity to diversify their portfolio with a real estate investment in a growing tourism market, while others are interested in the potential returns from the resort's profitable business.

Tokens can be traded quickly and securely on digital platforms, giving investors the ability to sell their shares when they wish. This increased liquidity is particularly attractive to investors who may not be interested in holding a real estate investment for a long time.

For the developer group, tokenization allows it to raise capital more quickly and efficiently, reducing dependence on a few large investors. At the same time, the resort benefits from a global investor base, which can also help promote the property through their networks, increasing the visibility and success of the project.

Example 2

A real estate investment company owns a commercial skyscraper in downtown New York valued at \$100 million. Traditionally, the company would have sold the property to a single buyer or a small group of institutional investors. However, the company decides to adopt tokenization to broaden its investor base and improve the liquidity of its portfolio.

The company uses a blockchain platform to divide the value of the skyscraper into 100 million tokens, each worth \$1. These tokens represent a fraction of the property and entitle the owners to a proportionate share of the profits from renting office and retail space within the skyscraper.

Investors from around the world can now purchase these tokens, allowing them to participate in the New York real estate market without having to invest large sums of money. Some investors buy thousands of tokens, while others buy only a small amount, diversifying their portfolio with a stake in prestigious commercial real estate. Tokens can be traded on a digital platform, providing investors with the ability to quickly liquidate their investment if necessary.

Through tokenization, the real estate company is able to raise capital more efficiently, increasing the liquidity of the property and engaging a global community of investors. Investors, for their part, benefit from direct access to the high-end real estate market and greater flexibility in managing their investments.

Is this the first time the real estate market has been opened to small investments? Actually no, there is a practice of buying and selling real estate called *"balance and* sale."

Settlement consists of a practice used to resolve debt situations. When a debtor is unable to meet his or her mortgage payments, instead of going through a lengthy and costly foreclosure process, he or she can negotiate with the creditor (usually a bank) to pay a reduced amount from the total amount of the debt. In return, the creditor agrees to treat the debt as discharged and to cancel the mortgage on the property. This solution allows the debtor to avoid foreclosure and the resulting legal and credit complications, while the creditor recovers a portion of the debt without incurring additional costs and risks.

In this case, the market opens up to small investors for several reasons. In fact, the buyer buys a property below cost as the lender (which often corresponds to the bank) seeks to recover as much as possible from a property that does not profit them, without resorting to the risk of a bankruptcy auction.

In addition, there are platforms that allow people to invest in such negotiations. In other words, a person can contribute a percentage of the portfolio needed in exchange for a percentage of the sale.

But what is the difference between settlement and tokenization?

The difference lies in the fact that with settlement is limited to foreclosed properties while tokenization allows trading toward any property. In addition, the platforms mentioned earlier, in order to allow investing in this market, retain a percentage as commission, decreasing the profit margin and increasing the risk. With tokenization, on the other hand, intermediaries and exorbitant commissions can be avoided.

In conclusion, real estate tokenisation represents an exciting and rapidly evolving frontier in the real estate industry. With the potential to make real estate investments more accessible, liquid and secure, this technology has the potential to fundamentally change the market and create new opportunities for investors at all levels. Despite its challenges, tokenisation promises to democratise access to the real estate market, making it more inclusive and open to a wider range of participants. As technology and regulation continue to evolve, tokenisation could become a key pillar of the real estate market of the future, redefining the way people invest in and manage property around the world.

4.7) International Transactions

International property transactions are among the most complex and sensitive in the global investment landscape. While the international property market offers significant opportunities, buying and selling property across borders often presents a number of challenges that can significantly complicate the process. These challenges range from regulatory differences between countries to language and cultural barriers, from the complexity of document verification and due diligence to the high costs associated with brokerage and transaction management. However, with the advent of blockchain technology, these barriers are rapidly becoming surmountable, paving the way for a more secure, transparent and efficient international property transaction system.

One of the main difficulties in international property transactions is the regulatory differences between countries. Each nation has its own legal and regulatory system for dealing with real estate, which can vary widely from one jurisdiction to another. These regulatory differences are often a major obstacle for international investors. Laws governing foreign ownership, taxation, property registration and owners' rights can be complex and difficult to understand for those unfamiliar with the legal system of the country in which they are considering investing. These differences increase the risk of costly mistakes or legal penalties, making the whole process more complicated and burdensome. These difficulties are compounded by language and cultural barriers, which can be significant obstacles in international transactions. The lack of a common language can lead to misunderstandings and misinterpretations between parties, while cultural differences can affect business expectations and practices.

For example, in some countries price negotiation is a normal part of the buying process, while in others it may be considered inappropriate. These differences can lead to misunderstandings that slow down the transaction process or, in the worst case, cause negotiations to fail.

Another key challenge is document verification and due diligence, which is particularly complex internationally. Investors need to ensure that property titles, building permits and legal certifications are authentic and valid. However, when dealing with a foreign country, verifying these documents can be difficult and often requires the assistance of local intermediaries, which in turn increases costs and the risk of fraud. In addition, limited access to public records or a lack of confidence in available information can further complicate the process and increase investor uncertainty. International property transactions are often associated with high costs. These costs include currency conversion fees, taxes, legal fees and brokerage fees. The need to involve multiple intermediaries, such as lawyers, notaries and estate agents in both jurisdictions, adds to the overall cost and makes transactions less accessible and attractive to investors. These costs can be a significant barrier, particularly for smaller investors, who may be deterred from entering the international property market by the high costs and legal complexities involved.

In this context, blockchain technology is emerging as a powerful and innovative solution to the challenges of international property transactions. Blockchain, a distributed and immutable digital ledger, provides a common global platform that eliminates many of the traditional barriers, making international property transactions more secure, transparent and efficient. One of the major innovations introduced by blockchain is the creation of a common global platform, which eliminates the need for separate legal and financial systems for each country. This single platform allows all information related to a transaction to be recorded and verified in a single ledger that is accessible to all parties involved, regardless of their geographical location. This not only

simplifies the transaction process, but also facilitates regulatory compliance, as laws and regulations can be incorporated into the smart contracts that process the transaction.

The transparency offered by the blockchain is another key advantage for international transactions. Every transaction recorded on the blockchain is visible to all authorised parties, and cannot be altered once it has been entered. This transparency is particularly valuable in international transactions, where trust between parties can be limited. Investors can verify property titles, transaction history and other relevant documents directly on the blockchain, eliminating the need for local intermediaries for verification and reducing the risk of fraud. In addition, blockchain ensures information security through advanced encryption, protecting sensitive data from unauthorised access and manipulation. Another important benefit of blockchain is reduced transaction costs. Smart contracts, which are self-executing digital contracts, can automate many processes that would traditionally require intermediaries. For example, a smart contract can automatically handle the transfer of property once all predefined conditions have been met, eliminating the need for notaries or lawyers to verify and complete the transaction. In addition, blockchain can facilitate currency conversion and funds transfer more efficiently, reducing fees and processing time. This not only reduces costs, but also speeds up the transaction process, allowing investors to seize market opportunities in a more timely manner.

Standardisation of procedures is another benefit that blockchain can offer. Currently, each country has its own legal and bureaucratic practices for handling property transactions, which can lead to confusion and inefficiency. With blockchain, a single set of rules and procedures can be applied to all transactions, regardless of jurisdiction. This not only simplifies the process for investors, but also reduces the risk of misunderstandings and disputes arising from differences in national legal systems. Due diligence, a crucial step in any property transaction, becomes simpler and more secure with blockchain. The technology provides a complete and immutable record of all transactions and documents related to a property, which is directly accessible to investors. This reduces the need to rely on local intermediaries and minimises the risk of error or fraud, simplifying the verification process and increasing investor confidence.

One of the most prominent examples of the application of blockchain to international property transactions is the Propy platform. Propy allows users to buy and sell real estate around the world using smart contracts, managing the entire transaction process from contract signing to title transfer and recording all the information on the blockchain. This significantly reduces the time and costs associated with traditional property transactions, and offers investors the security of a transparent and immutable system. Propy has already demonstrated its potential with several successful transactions, such as the sale of an apartment in Kiev, Ukraine, which was completed entirely via blockchain. This example shows how blockchain can overcome traditional barriers to international property transactions, providing a secure, transparent and efficient solution. The Propy platform not only facilitates document and transaction management, but also provides fraud protection by immutably recording all transactions on the blockchain.

Looking ahead, blockchain technology is set to play an increasingly central role in international real estate. As the adoption of this technology expands, we are likely to see a significant increase in the transparency, security and efficiency of international property transactions. This could lead to a democratisation of access to the global real estate market, allowing a wider range of investors to participate in international opportunities. With blockchain, international property transactions will not only become simpler and more secure, but also more accessible. The ability to reduce transaction costs and speed up execution times will make the international real estate market more attractive to investors, including those with limited financial resources. This could lead to greater liquidity in the global real estate market, further stimulating economic growth and innovation in the sector.

In addition, blockchain could facilitate the development of new business models and investment opportunities in real estate. For example, the tokenization of properties, made possible by blockchain, makes it possible to divide a property into digital fractions, called tokens, that can be bought and sold in a manner similar to stocks on a financial market. This opens the door to a more fractionalized and liquid real estate market, where even small investors can participate. Standardizing procedures and creating a global registry of real estate transactions could also help reduce the risk of real estate bubbles and financial crises. The increased transparency offered by blockchain would allow investors and regulators to better monitor the market, identifying potential risks before they become problematic. In addition, the ability to easily verify property titles and transaction history could reduce the risk of excessive speculation and fraud, helping to stabilize the market.

Chapter 5

Conclusions

The analysis conducted in this thesis has highlighted the profound changes that new technologies are bringing to the real estate sector. Blockchain, smart contracts, tokenisation and cryptocurrencies are revolutionary tools that have the potential to reshape the traditional dynamics of the real estate market. In a sector that has historically been characterised by significant bureaucratic delays, high transaction costs and a lack of transparency, the introduction of these technologies could mark the beginning of a new era. One of the main strengths of blockchain is its ability to increase transparency and security in real estate transactions. The immutable nature of the data recorded on the blockchain ensures that every transaction is verifiable and tamper-proof, significantly reducing the risk of fraud. This characteristic has positive implications not only for investors, but also for financial institutions and governments, which can use the technology to make property registries more transparent and facilitate property management. In addition, the transparency offered by blockchain has the potential to increase investor confidence, thereby encouraging greater participation in the market, particularly at an international level.

The tokenisation of real estate, which is explored in depth in this thesis, is another key advancement. By dividing the value of a property into small digital shares (tokens), the market becomes more accessible to a wider range of investors. This process democratises property investment, making it accessible not only to large institutional investors but also to small savers. Tokenisation also improves the liquidity of a notoriously illiquid market like real estate, as tokens can be traded more easily and quickly than traditional property sales. Another key area of analysis is the use of smart contracts in the property sector. These self-executing digital contracts reduce the need for intermediaries and automate key processes such as property transfers, lease management and rent payments. Smart contracts can significantly reduce transaction costs and speed up processes, making property transactions more efficient and secure. However, one of the key challenges remains the integration of smart contracts with existing regulations. Although smart contracts are legally binding in different jurisdictions, regulatory efforts are needed to harmonise international laws and ensure that these contracts always comply with local laws.

Despite the many benefits described, there are still a number of obstacles to overcome before these technologies can be adopted on a large scale. One of the main problems is the lack of clear and consistent regulations at the international level. While some countries, such as Switzerland and the United States, have made significant progress in regulating blockchain and cryptocurrencies, others are still lagging behind. This regulatory disparity is a barrier for international investors, who may be reluctant to engage in blockchain real estate transactions in countries with less defined regulations. It is therefore essential that governments work together to create a global regulatory framework that can promote the safe and transparent adoption of these technologies.

Another critical issue is the environmental sustainability of blockchain technologies. While the adoption of blockchain can reduce costs and improve efficiency, the energy consumption associated with its maintenance is a significant challenge. Technologies such as the proof of work used by cryptocurrencies such as bitcoin require huge amounts of energy.

To mitigate this impact, it is necessary to promote the adoption of less energyintensive blockchains, such as those based on proof of stake, and to encourage the use of renewable energy in mining processes.

In conclusion, emerging technologies such as blockchain, smart contracts and tokenisation represent an extraordinary opportunity to revolutionise the real estate sector. These innovations have the potential to improve efficiency, reduce costs, increase transparency, and democratise access to real estate investment. However, to fully realise these opportunities, it is essential to address the regulatory, environmental and infrastructure challenges that still hinder their widespread adoption. With careful and sustainable regulatory approaches and the adoption of best technological practices, the future of the real estate sector looks bright, open to a wider range of investors and potentially more stable and transparent. The evolution of the property sector through technological innovation has only just begun, and the impact of these changes will be profound and lasting for many years to come.

References

- 1. Nakamoto, S. (2008). *Bitcoin: A Peer-to-Peer Electronic Cash System*. Retrieved from https://bitcoin.org/bitcoin.pdf
- 2. Mougayar, W. (2016). *The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology*. Wiley.
- 3. Tapscott, D., & Tapscott, A. (2016). Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World. Penguin.
- Buterin, V. (2013). Ethereum Whitepaper: A Next-Generation Smart Contract and Decentralized Application Platform. Retrieved from https://ethereum.org/en/whitepaper/
- 5. Swan, M. (2015). Blockchain: Blueprint for a New Economy. O'Reilly Media.
- 6. Finck, M. (2018). *Blockchain Regulation and Governance in Europe*. Cambridge University Press.
- Yermack, D. (2017). Corporate Governance and Blockchains. Review of Finance, 21(1), 7-31.
- Reyes, C. L. (2019). Distributed Ledger Technology and Corporate Governance: The Role of Smart Contracts. Fordham Law Review, 88(1), 261-297.
- Pilkington, M. (2016). Blockchain Technology: Principles and Applications. In Research Handbook on Digital Transformations (pp. 225-253). Edward Elgar Publishing.
- 10. European Union Blockchain Observatory & Forum. (2018). Blockchain and RealEstate:TheFutureofOwnership.Retrievedfrom https://www.eublockchainforum.eu/
- 11. Zohar, A. (2015). *Bitcoin: Under the Hood*. Communications of the ACM, 58(9), 104-113.
- Hileman, G., & Rauchs, M. (2017). *Global Cryptocurrency Benchmarking Study*. University of Cambridge, Judge Business School.
- 13. Securities and Exchange Commission (SEC). (2017). Investor Bulletin: Initial Coin Offerings. Retrieved from https://www.sec.gov/oiea/investor-alerts-andbulletins/ib_coinofferings
- 14. Swiss Financial Market Supervisory Authority (FINMA). (2018). *ICO Guidelines*.
 Retrieved from https://www.finma.ch/en/news/2018/02/20180216-mm-ico-wegleitung/

- 15. Propy Inc. (2017). *Propy: Decentralized Title Deed and Real Estate Transactions on Blockchain*. Retrieved from https://propy.com/
- 16. Monegro, J. (2016). *Fat Protocols*. Union Square Ventures. Retrieved from https://www.usv.com/writing/2016/08/fat-protocols/
- 17. Schatsky, D., & Muraskin, C. (2015). Beyond Bitcoin: Blockchain is Coming to Disrupt Your Industry. Deloitte University Press. Retrieved from https://www2.deloitte.com/content/dam/insights/us/articles/understandingblockchain/DUP_Understanding-Blockchain.pdf
- 18. Catalini, C., & Gans, J. S. (2016). Some Simple Economics of the Blockchain.
 National Bureau of Economic Research. Retrieved from https://www.nber.org/papers/w22952
- Chen, Y., & Bellavitis, C. (2019). Blockchain Disruption and Decentralized Finance: The Rise of Decentralized Business Models. Journal of Business Venturing Insights, 13, e00149.
- 20. PwC. (2018). *Blockchain: The Next Big Thing for Real Estate?* Retrieved from https://www.pwc.com/gx/en/industries/financial-services/publications/blockchain-real-estate.html
- 21. *Illinois General Assembly*: Available at official government websites, providing texts and discussions regarding the Blockchain Technology Act of Illinois.
- 22. *State of Wyoming Blockchain Legislation*: Found on Wyoming's official state government website for comparative insights into blockchain initiatives.
- 23. Swan, Melanie. "Blockchain: Blueprint for a New Economy". Offers foundational knowledge about blockchain technology.
- 24. Lewis, Antony. "The Basics of Bitcoins and Blockchains". Provides an introduction to the technical and financial aspects of blockchain technologies.
- 25. Casertano, G. (2011). "Finanza Real Estate: Il mercato, gli strumenti, i prodotti di investimento".
- 26. Borghi, A (2008). "Finanza immobiliare: Il mercato, la valutazione, gli strumenti e le tecniche di finanziamento".
- 27. https://www.ilsole24ore.com/art/cosa-sono-e-come-funzionano-criptovalute-AEXzrDCG
- 28. https://www.consob.it/web/investor-education/criptovalute
- 29. https://www.ibm.com/topics/blockchain-security

- 30. https://guce.techcrunch.com/copyConsent?sessionId=3_cc-session_166b130da3d7-4ff3-8c5d-b9470e024152&lang=en-US
- 31. https://flagtheory.com/successful-initial-coin-offering/
- 32. https://hbr.org/2017/03/what-initial-coin-offerings-are-and-why-vc-firms-care
- 33. https://www.borsaitaliana.it/borsa/glossario/blockchain.html
- 34. https://www.borsaitaliana.it/borsa/glossario/criptovaluta.html
- 35. https://bancaria.it/livello-2/archivio-sommari/gli-ultimi-sommari-dibancaria/bancaria-luglio-agosto-2020/le-monete-digitali-situazione-prospettive-esfide-il-caso-libra/
- https://forbes.it/2022/02/04/addio-diem-crypto-zuckerberg-meta-pagare-onlinemetaverso/
- 37.65 Ralph Atkins, Switzerland Sets Up Working Group on ICOs, Blockchain, FIN.TIMES (18 Gennaio 2018).
- 38. 64 Anti-Money Laundering Act (AML) Legge sul riciclaggio (LRD) (https://www.fedlex.admin.ch/eli/cc/1998/892_892_892/en)
- 39. https://tayros.bg/index.php/category/criptovalute/le-nuove-linee-guida-della-finmaper-le-startup-ico-in-svizzera/
- 40. https://www.fedlex.admin.ch/eli/cc/27/317_321_377/it
- 41. http://www.liechtensteinusa.org/article/liechtensteins-parliament-approvesblockchain-act-unanimously
- 42. http://www.ecri.eu/system/tdf/thomas_duenser_1.pdf?file=1=node=1%2055=0
- 43. https://www.financialounge.com/news/2022/02/03/criptovalute-arriva-in-italia-ildecreto-con-le-regole-per-gli-operatori/
- 44. https://www.osservatori.net/it/eventi/on-demand/webinar/crypto-asset-profilifiscali-antiriciclaggio-webinar
- 45. https://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario? atto.dataPubblicazioneGazzetta=2022-02-17&atto.codiceRedazionale=22A01127&elenco30giorni=true
- 46. https://www.bancaditalia.it/pubblicazioni/quaderni-giuridici/2019-0087/?dotcache=refresh
- 47. https://www.economyup.it/fintech/da-libra-a-diem-a-zuck-bucks-perche-facebookcontinua-a-provarci-con-le-criptovalute-e-non-riesce/
- 48. https://www.osservatori.net/it/eventi/on-demand/webinar/strumenti-finanziaritecnologie-distributed-ledger-stato-arte-prospettive-webinar

- 49. https://forbes.it/2021/11/04/un-panino-con-contorno-di-criptovalute-negli-usaburger-king-mette-in-palio-bitcoin-ether-e-dogecoin/
- 50. https://www.criptovaluta.it/30323/dogecoin-si-prepara-al-botto-mcdonalds-spacexo
- 51. https://blackmanta.capital/liechtensteins-blockchain-act/
- 52. https://www.econopoly.ilsole24ore.com/2019/11/06/liechtenstein-criptomoneteblockchain/
- 53. https://www.ilsole24ore.com/art/criptovalute-stretta-finale-cina-messe-bando-tuttetransazioni-AEDkaEl
- 54. http://documenti.camera.it/leg18/pdl/pdf/leg.18.pdl.camera.2572.18PDL0109490.p df
- 55. https://www.fiscoetasse.com/rassegna-stampa/32283-in-senato-la-nuohvanormativa-italiana-sulle-criptovalute.html
- 56. https://cre.mit.edu
- 57. https://www2.deloitte.com/us/en/pages/financial-services/articles/blockchain-incommercial-real-estate.html
- 58. National Association of Realtors (USA) Website: https://www.nar.realtor
- 59. Eurostat (European Union) Website: https://ec.europa.eu/eurostat Offers statistics and insights into the European real estate market.