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**Future of Real Estate Investment Tokenization and Blockchain
Integration: A Systematic Review**

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**Future of Real Estate Investment Tokenization and Blockchain
Integration: A Systematic Review**

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Özet

Amaç – Bu araştırmanın iki temel amacı bulunmaktadır. Birincisi, blokzincir tabanlı tokenizasyonun likidite, yatırım getirisi (ROI) ve işlem maliyetleri üzerindeki etkisini teorik ve ampirik literatür kapsamında sistematik olarak incelemektir. İkincisi ise, tokenizasyonun benimsenmesinin önündeki genel yasal ve teknolojik engelleri belirleyerek, gelecekteki araştırma gündemleri için literatürdeki boşluklara dikkat çekmektir.

Yöntem / Tasarım - Bu araştırma, Sistematik Literatür Taraması (SLR) metodolojisini ve tematik analiz yaklaşımını benimsemiştir. Fikir boşluklarını ortaya koyarak ve teknolojik ile düzenleyici etkiler hakkında bilgi sunarak bu çalışma, mevcut literatürdeki eksiklikleri gidermeyi ve konuya dair bilgi birikimini artırmayı amaçlamaktadır.

Bulgular – Tokenizasyon ve blokzincir teknolojisi, piyasa performansını artıran yenilikçi yatırım modelleri olarak görülse de, bu çalışma düzenleyici belirsizliklerin, sınırlı ampirik verilerin mevcut olduğunu vurgulamakta ve evrensel, standartlaştırılmış token performans ölçüm sistemlerinin, uyumlu düzenleyici çerçevelerin ve birlikte çalışabilir platformların geliştirilmesi için gelecekteki araştırma ve politika önceliklerini ortaya koymaktadır.

Pratik Katkılar – Bu tez, tokenizasyonun yatırım getirisi (ROI), likidite üzerindeki etkisini analiz ederek ve benimsenmenin önündeki başlıca engelleri vurgulayarak yatırımcılar, politika yapıcılar ve sektör paydaşları için değerli bir rehber sunmaktadır. Özellikle MENA (Orta Doğu ve Kuzey Afrika) bölgesinde daha fazla araştırmaya ihtiyaç olduğunu vurgulamaktadır. Bu bilgi birikimi, gelişimi kolaylaştırmakta ve gelecekteki araştırmalar için sağlam bir temel oluşturmaktadır.

Özgünlük/Değer – Bu araştırma, tokenleştirilmiş gayrimenkul piyasasının finansal, hukuki ve teknolojik boyutlarını tematik analizle inceleyerek özgün bir katkı sunmaktadır. Mevcut boşlukları haritalandırmakta, stratejik çerçeveler önermekte ve karar vericiler ile araştırmacılar için gayrimenkul sektöründe gelecekteki inovasyonları destekleyecek bir yol haritası işlevi görmektedir.

Anahtar Kelimeler: Tokenizasyon, Gayrimenkul, Blokzincir, Likidite, Yatırım Getirisi (ROI), Maliyet Etkinliği, Sistematik Literatür Taraması (SLR), Düzenleyici Zorluklar, Piyasa Benimsenmesi

ABSTRACT

Purpose – This research has two fundamental purposes. First, it systematically reviews the theoretical and empirical literature on blockchain-based tokenization and its effect on liquidity, ROI, and transaction costs. Second, it identifies general barriers to tokenization adoption, both legal and technological, and highlights gaps in the literature.

Design/methodology/approach – The research applies a systematic literature review (SLR) methodology and thematic analysis. By informing about technological and regulatory effects, this study expands the knowledge and addresses a deficiency in the current literature.

Findings – highlights the lack of regulatory uncertainty, limited empirical data, and sets priorities for future research and policy needs to develop universal uniform token performance measurement, compliant frameworks, and interoperable platforms.

Practical implications – This thesis provides valuable guidance for investors, policymakers, and industry stakeholders by analyzing the effect of tokenization on ROI, liquidity, highlighting the key barriers to adoption, and emphasizing the need for a more solid foundation for future research.

Originality / value - This research provides original value through thematic analysis of the financial, legal, and technological dimensions of the tokenized real estate market. Mapping current gaps and proposing strategic frameworks and acting as a road map for decision makers and researchers to support future innovation in the real estate sector.

Keywords: Tokenization, Real estate, Blockchain, Liquidity, ROI, Cost-efficiency, SLR, Regulatory challenges, Market adoption.

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LIST OF ABBREVIATIONS

ACTUS: Algorithmic Contract Types Unified Standards
AML: Anti-Money Laundering
BFT: Byzantine Fault Tolerant
DAO: Decentralized Autonomous Organization
DeFi: Decentralized Finance
DLT: Distributed Ledger Technology
DOI: Diffusion of Innovation Theory
DPoS: Delegated Proof of Stake
ERC-1238: Ethereum Request for Comments 1238 (nontransferable token standard)
ERC-20: Ethereum Request for Comments 20 (fungible token standard)
ERC-721: Ethereum Request for Comments 721 (non-fungible token standard)
ESG: Environmental and Social Governance
ICO: Initial Coin Offering
KYC: Know Your Customer
PICOC: Population, Intervention, Comparison, Outcome, and Context Criteria
PoS: Proof of Stake
PoW: Proof of Work
REIFs: Real Estate Investment Funds
REITs: Real Estate Investment Trusts
ROI: Return on investment
SEM: Structural Equation Modeling
SLR: Systematic Literature Review
STOs: Security Token Offerings
TAM: Technology Acceptance Model
TCE: Transaction Cost Economics
TPI: Token Performance Index
UTAUT: Unified Theory of Acceptance and Use of Technology

CHAPTER ONE

1. INTRODUCTION

1.1 Evolution of Real Estate Investment

‘Real estate investment is the process of purchasing, managing, and selling real property to earn a financial return’ The types of property are residential, industrial, commercial, retail, agricultural, and fix-and-flip properties, renovated and resold for profit (Brueggeman & Fisher, 2005).

One of the primary influential sectors in the global economy is real estate. The market size in 2023 was approximately \$380 trillion. The early start of real estate investment was in the 19th and early 20th centuries. After World War II, real estate prices continued to rise, creating the need for a change in the investment model (Baltais et al., 2024).

Accordingly, REITS were established in the United States (1960) and evolved as a key vector to empower investors to access the market and create opportunities. On the other hand, REITS have limitations, such as interest rate sensitivity and market volatility (Cotter & Stevenson, 2007).

After the successful win of REITs, new instruments were developed, such as real estate crowdfunding platforms and real estate investment funds (REIFs), which provide an enhanced experience characterized by ease of entry into the market (Brueggeman & Fisher, 2005).

The 2008 global economic crisis was a turning point in the real estate market, which exposed the real estate sector's reliance on mortgage-backed instruments. The crisis caused severe liquidity problems, with banks terminating lending and demand reduction. Although REITs were previously perceived as a stable instrument, they faced a sensitivity to market economic meltdown, revealing many issues such as limited transparency, delayed property valuation adjustments, and expressing the need for transparent and reliable solutions.

The evolution of the real estate investment process alongside technological advancements has significantly reshaped the investor's mindset about property values and

market trends. That will define an innovative approach to transactions with this asset class through blockchain technology and tokenization.

1.2 Blockchain and Tokenization in Real Estate

The most current emerging trend in real estate investment is real estate tokenization and a blockchain-based approach that arises from weaknesses within its traditional investment model, primarily the illiquidity associated with high transaction costs. Tokenization converts ownership rights in a real estate property into smaller, tradable digital tokens that can be recorded on a blockchain; it involves digitizing a piece of real estate property into digital units or tokens.

The real estate assessment process is complicated, since it depends on many factors, including location, market demand, supply, and property management (Eichholtz & Geltner, 2002).

Property rules and legal rights are imperative to protect ownership and preventing disputes. Conventionally, this involves formal registration of title and comprehensive legal due diligence. The innovation of blockchain technology and the promising elements in this technology focus on these conventional systems to improve the transparency, efficiency, and security of property records. Even as legal due diligence remains essential to reveal liens, encumbrances, and claims, especially when dealing with tokenized property, compliance, and trust become the most significant issues (Konashevych, 2020a).

Mortgage-backed products in conventional property finance make the sector highly sensitive to interest rates. Tokenization is seen as an opportunity to disrupt traditional funding sources, potentially with a lower reliance on debt, but not eliminating the leverage and interest rate risk factor (Baum, 2020).

Taxation is one of the most important aspects of real estate investment decision making. Investors must consider the depreciation rates, capital gains taxes, and other taxes to obtain the maximum return. Tokenization, as it brings about some revolutionary changes, also brings forth scales of complexity based on jurisdictional variations and new asset classes. This impacts the appeal of investments and the degree to which they fit into regulations (Joshi, S., & Choudhury, A, 2022).

The real estate market experiences boom and bust cycles, influenced by interest rates, policy, and general economic growth. Cycles cause property prices to fluctuate, affecting investors' risk tolerance. Regardless of the ease with which transactions are facilitated by tokenization and blockchain, they cannot completely shield the sector from such wider market variations (Baum, 2021).

Another long-standing problem in blockchain technology, generated by greater access to information, is fraud; however, a distributed ledger can help improve transparency and make property information tamperproof and easily readable. This added transparency can lead to better functioning markets, better prices, and higher stakeholders' trust (Garcia-Teruel, 2020; Konashevych, 2020a).

The tokenization model contains technical and legal structures while using smart contracts. Some models imply tokens as full ownership, fractional ownership, or joint ownership using mechanisms like multisignature contracts (e.g., Ethereum, Bitcoin). These blockchain protocols ensure secure transfers (Konashevych, 2020b).

The types of tokens are utility, security, and asset-backed. Utility tokens are not considered as an investment instrument that serves as a facilitator of access to services on a blockchain system. The second type is a security token that is similar to traditional securities. The third is that asset-backed tokens are mainly used for tangible or intangible assets. Hybrid tokens integrate aspects from multiple categories. Blockchain protocols like Ethereum support token standards such as ERC-20 (fungible), ERC-721 (nonfungible) and ERC-1238 (non-transferable), which define token functionalities and interoperability (Casino et al., 2019).

Smart contracts are automated contracts encrypted on the blockchain network that transfer ownership rights to improve transparency and grant immutability, despite addressing legal and technical challenges (Clack et al., 2016).

The legal and regulatory frameworks are used to prevent scams and protect investors. Regulatory associations like the SEC (USA) and EU agencies are developing specific guidelines for Security Token Offerings (STOs) (Garcia-Teruel & Simón-Moreno, 2021).

Transparency and data immutability are the main factors in decreasing fraud and strengthening trust. Can be enhanced by creating operational tasks in a smart contract system.

Cybersecurity risks are a significant problem, even with blockchain security demanding solutions, such as Know Your Customer (KYC) and Anti-Money Laundering (AML) frameworks, which protect from token theft (Pilkington, 2016).

1.3 Context of the Study

This thesis, titled "The Future of Real Estate Investment: Tokenization and Blockchain Integration," explores the consequences of tokenization on market performance through blockchain technology. One of the rising practices of blockchain in this sector is real estate tokenization.

The motivation behind this research stems from the recognition that real estate investment characteristics, such as illiquid asset class, high transaction costs, numerous intermediaries, and restricted accessibility, especially for small-scale investors. With its decentralized ledger and smart contract capabilities, blockchain technology offers a foundation to digitize and fractionalize real estate assets, democratizing access, and potentially enhancing liquidity and cost-efficiency. Early empirical studies demonstrate that tokenized properties can exhibit ownership diversification and price dynamics linked to underlying housing markets, suggesting tangible economic exposure and benefits (Baum, 2020; Gupta et al., 2020).

Despite these encouraging trends, the literature reports several recurring issues and areas of concern. Regulatory uncertainty is one of the key problems known and, to date, diminishes the scalability and credibility of tokenized real estate markets due to heterogeneous legal frameworks in jurisdictions. The other source of difficulties is technological issues, such as scalability issues regarding blockchain, security vulnerability issues, and tokenization integration or compatibility with traditional land registries at the adoption stage (Avci & Erzurumlu, 2023; Garcia-Teruel & Simón-Moreno, 2021).

This study employs an SLR methodology to investigate and synthesize current scholarly understanding of blockchain-based real estate tokenization. The SLR approach embraces transparency, enables replicability, and addresses shortcomings in the existing

literature. Offers a deep understanding of the impact of tokenization on real estate activities and investment processes, pointing out advantages such as liquidity, transparency, and accessibility that are given concrete consideration in existing literature. Methodological choice also enables degenerative criticism of the theory types employed in constructing academic knowledge about the implications of tokenization and financialization theories based on models of technology adoption (Baum, 2020; Garcia-Teruel & Simón-Moreno, 2021; Gupta et al., 2020).

Further, the research identifies technological regulation and market barriers to mass adoption due to legal uncertainty, non-standard regulation, and a lack of centralized secondary markets limiting market expansion. With market access as a unifying theme in ongoing empirical and theoretical research (Baum, 2020; Mottaghi et al., 2024).

This research follows existing knowledge and emphasizes key gaps that should be addressed. These include empirical facts regarding the impact of tokenization on ROI and liquidity, dispersed ownership governance structures, and coordination of law between jurisdictions, combining legal technology and financial expertise.

1.4 Motivation for the Study

High entrance hurdles, lack of transparency, poor liquidity, and high transaction expenses have historically defined ineffective real estate deals. Such hurdles can significantly limit overall market performance and investment possibilities. Blockchain-based tokenization could cause a new and fascinating technical revolution that could change the face of real estate investment. Tokenization has great promise by enabling fractional ownership, improving liquidity, lowering costs, and simplifying investor participation.

There is great interest and excitement about creating tokenization platforms, but scholarly studies in the area are sparse, mostly concentrating on theoretical approaches with little empirical understanding of the practical consequences and difficulties connected with this growing trend. The demand for a systematic literature review (SLR) is increasing to let researchers more precisely depict present knowledge gaps in relevant research themes.

This study centers on the reality that in real estate applications, blockchain technology, at the core of tokenization, offers specific complexity and opportunities.

Because blockchain removes mediators such as brokers and notaries, automation through smart contracts, and the production of clear and secure property titles, it can simplify real estate transactions. Recent research shows that advantages come with major regulatory, technological, and market obstacles, including ambiguous legal status for tokenized property, scalability issues, security concerns, and the lack of established secondary markets. Understanding the technological, economic, and legal elements of tokenization of real estate.

The main motivator for this initiative is awareness of knowledge gaps in current research. Although many studies have been conducted on many aspects of tokenization, including financial results, technological stacks, and legal frameworks, there is a scarcity of thorough summaries that could adequately capture the subject matter under discussion. Furthermore, there is little factual basis for the impacts of tokenization on cost reductions, investment returns, and liquidity, which could discourage educated judgments from legislators, practitioners, or investors.

This research investigates the academic literature to address actual challenges. Consolidating information on these problems will guide regulatory bodies and industry participants on the major enablers/bottlenecks in the sector, hence enabling them to respond more consistently with policy measures.

This study aims to systematically collect and integrate the scattered academic knowledge of tokenizing real estate using blockchain to identify the primary themes, analyze the benefits and drawbacks of liquidity, transparency and clarity, and reveal technological limitations and regulatory obstacles to more general application.

1.5 Research Questions

This study seeks to provide answers to the following research questions.

1.5.1 Main Research Question

RQ1 How does real estate tokenization impact liquidity, return on investment (ROI) and cost-efficiency in academic literature from 2018 to 2025?

1.5.2 Sub-Questions

RQ1.1 What legal and technological barriers prevent the adoption of tokenization adoption in real estate, as identified in existing research?

RQ1.2 How deeply does the current literature demonstrate empirical results measuring market performance metrics related to real estate tokenization?

RQ1.3 What are the current research gaps, and the proposed future directions in tokenization-based blockchain real estate investment?

1.6 Significance and Scope

1.6.1 Scope of the Study

The scope of the study is to investigate academic literature, particularly peer-reviewed publications and conference papers, adopting the SLR methodology and using PRISMA analysis sourced primarily from established and reputable academic databases. Filtering gray literature, industry reports, white papers, and nonpeer-reviewed sources to maintain academic integrity and credibility.

The thesis explores recent studies and concentrates on thematic areas, including theoretical frameworks employed in Blockchain-Based Tokenization in Real Estate. In addition, the study covers the trends and dominant themes.

The study lacks a specific geographic focus and concentrates on broader comparative themes and international trends. By defining these parameters, this academic work provides relevant insights to the research topic, acknowledging several stakeholders, investors, regulators, and researchers.

1.7 Problem Statement

Part of innovation is real estate tokenization, where a physical asset is tokenized into digital tokens on a blockchain. It not only makes fractional ownership available, but also simplifies transactions and could expand market access. However, despite its potential, this is an intriguing topic that is fragmented and lacking in larger economic, legal, and property issues. Furthermore, any research conducted is theoretical or is based on limited groups of case studies, without presenting a balanced picture of the industry. Consequently, there is minimal empirical research and theoretical work to support the widespread deployment of tokenized property in different market settings.

The insufficient academic treatment of real estate tokenization has significant implications for research and practice. Players, including investors, policymakers, and developers, lack clarity when assessing this innovation, primarily because they do not

understand the administrative, legal, and operational concerns. This topic is particularly relevant in countries with uncertain or unstable legal frameworks for digital assets. Furthermore, limited understanding of the influence of tokenization on real-world investment factors such as liquidity, transparency, cost effectiveness, and accessibility dilutes the ability to create effective market strategies or quantify risks. Limited, poorly stratified knowledge can lead to missed opportunities or adverse effects as interest in blockchain-based real estate solutions grows. Therefore, policy making, decision support, and ethical innovation are drastically dependent on systematic academic research of the research landscape.

The intention is to integrate existing research evidence, identify core themes, and critically assess research gaps and methods. Specifically, the study will provide insight into how academic writing has handled the effect of tokenized property on the legal, regulatory, financial, and technological dimensions of tokenized property, as well as its implications for market conduct and investment gains. By mapping the current scholarship landscape, this book will present an integrative framework that sharpens theoretical knowledge. The findings are intended to inform future academic research and offer helpful recommendations to policymakers, investors, and real estate professionals considering the use of blockchain in property markets.

1.8 Research Aim

1.8.1 Purpose of the Study

The main purpose of this study is to analyze theoretical knowledge on blockchain-based tokenization in real estate investment by raising research questions and the systematic literature review (SLR) methodology.

Moreover, this research intends to tackle the existing literature by applying the SLR methodology to:

- **Outlining Important Research Subjects and Trends** Through a rigorous reading of peer-reviewed academic papers, the book acknowledges changing priority topics within the real estate tokenization field. This thesis explores how different real estate activities and investment strategies intersect with blockchain and tokenization and maps research findings over time.

- The study discusses the advantages most frequently associated with tokenization, including increased liquidity, increased openness, increased access, and lower costs. It also reveals the major concerns presented in the literature: unclear legislation, technical issues, and access barriers to market acceptability.
- The study examines the theoretical frameworks used in the industry to get a clear picture of the impact of blockchain tokenization on real estate investment. The Encompassing Legal-Economic Theories that explain market performance and Regulatory Interaction.
- The study examines the technological, legislative and market-based obstacles that limit the more common use of tokenization in property.

Aligning with the motivation and problem statement, the study intends to bridge this knowledge gap by aggregating and critically evaluating existing knowledge, synthesizing main research questions and concerns, and developing a future research and policy-making approach.

The main research question (RQ1) seeks to understand the broader academic landscape and identify trends in blockchain-based tokenization of real estate.

In addition, the sub-questions (RQ1.1, RQ1.2, RQ1.3) probe particular dimensions and the most frequently cited benefits and problems, theoretical foundations employed, adoption barriers, and potential areas of future research. This study will offer a systematic overview of the available academic literature on blockchain-based real estate tokenization. Among the objectives are:

- Clarify and organize the available knowledge to measure the tokenization revolution in real estate investment.
- Illuminating the practical effects and constraints experienced by stakeholders, powerful investors, tech innovators, and policymakers on the current state,
- Providing an exhaustive roadmap for future empirical and interdisciplinary investigations will best realize the potential of tokenization in democratizing and improving real estate markets.

1.8.2 Specific Aims and Objectives

The main objectives are to investigate and evaluate the academic environment connected to blockchain-based tokenization in real estate investment. This emphasis follows

the growing need for practical insights from researchers and business experts. The first aim is to provide an overview of real estate tokenization on the blockchain by evaluating the quantity, dispersion, and trends of research publications. Next, the study will draw attention to the main advantages and drawbacks of real estate tokenization stated in the literature. This covers benefits such as better liquidity, partial ownership, and more openness, as well as obstacles such as regulatory uncertainties, scalability problems, and market readiness.

The third goal includes an analysis of the theoretical frameworks employed in the present studies and an examination of the legal-economic viewpoints, financial models, and technology adoption hypotheses.

Emphasizing the need for more empirical verification, governance mechanisms for fractional ownership, and regulatory alignment among several areas, the fourth aim is to find research gaps and recommend directions for future investigations, by collecting data on how tokenization impacts investor accessibility, cost efficiency, and liquidity by comparing tokenized real estate to conventional investment vehicles, to determine whether tokenization is living up to its promise to democratize access.

These fifth goals work together to provide a methodical, evidence-based, and forward-looking investigation of blockchain-enabled real estate tokenization.

1.8.3 Practical Outcomes

The study aims to generate practical impacts relevant to academics, regulators, and industry stakeholders. Produces a comprehensive knowledge base through an exhaustive collection of available academic insights on real estate tokenization. This knowledge base will help researchers, practitioners, and policymakers who want to study the phenomenon of blockchain in real estate.

Additionally, the study generates information for small-scale investors about the effect of tokenization on liquidity, risk, and access, focusing on fractional ownership and market dynamics. Furthermore, it will provide concrete steps in technology and business models that will benefit tech providers and real estate firms.

Finally, this research will improve financial inclusion and market efficiency through tokenization by highlighting barriers in the real estate investment model. The

outcomes will inform academic theory and practical application as they transform trust in blockchain to a high level.

1.8.4 Significance of Research

The significance of research is to find critical gaps in existing knowledge; however, many studies focus on technological, financial, or legal aspects. This research applies a systematic approach to present findings in a cohesive framework and offers valuable insights for academics, practitioners, and policymakers.

The uniqueness of this study lies in the fact that it reveals the effects of tokenization on market performance as identified in the literature. In summary, the importance of this study is to uncover critical gaps and provide a roadmap for research and practice. Exploring the future of blockchain tokenization in estate investment, revealing inefficiencies, and examining market performance.

1.8.5 Conclusion

The chapter outlines the main components of the thesis, including precise objectives, general goals, applicability value, scope, delimitations, and significance. Additionally, it bridges knowledge gaps between distributed research and presents a unified overview of blockchain-based real estate tokenization.

The objectives correspond closely to the research questions to guide the review of thematic trends, strengths and weaknesses, theoretical frameworks, adoption obstacles, and literature gaps. In parallel, the general objectives highlight the study's strategic goal of gathering multiple perspectives and improving theory and practice.

The study correctly restricts the scope and field of investigation to peer-reviewed scholarly papers and investment uses of blockchain tokenization while still preserving methodological precision and integrity.

By connecting idea gaps, promoting empirical research, and informing technological and regulatory growth, this study seeks to raise knowledge and thus address a deficiency in the current literature. Definitions help to achieve a consistent understanding in studies using terminology.

Ultimately, this chapter prepares the ground for a reproducible, open, and systematic literature review that will show how blockchain-based tokenization is changing real estate investment towards more inclusive, effective, and transparent market systems.

Although there are a lot of published studies in this research area, the existing studies draw attention to the technical approach the absence of systematic approach in this field leaving a knowledge gap, indicates the urgency to conduct a systematic literature review (SLR) through evaluating the existing studies to perceive future trends for tokenization of real estate and blockchain technology by providing directions and recommendation for research and practice in this rapidly evolving field.

1.9 Thesis Outline

Chapter 1: The Tokenization of Real Estate: A Brief Introduction

The chapter outlines the main components of the study, including objectives, general goals, delimitations, significance, and important terminology. It elaborates on real estate investing, setting the stage for the research's importance and scope.

Chapter 2: Theoretical Background

This chapter reviews the literature on blockchain and real estate tokenization. It gives a historical background and indicates gaps in the literature. This chapter intends to set the framework for research based on academic industry literature.

Chapter 3: Related Work

This chapter reviews the literature on blockchain and real estate tokenization. It provides a historical background, summarizes important works, and indicates gaps in the literature.

Chapter 4: Research Design

This chapter presents the research methodology. It illuminates the relevance and scope of the research and sets the objectives. Data collection methods and study procedure, ethical issues, and study limitations.

Chapter 5: Analysis

The chapter offers empirical evidence through an in-depth analysis of real estate tokenization and its performance.

Chapter 6: Results & Discussion

The chapter discusses the implications and findings for real estate enterprises and key results from the existing literature to provide insight into the tokenization model.

Chapter 7: Conclusions

The final chapter summarizes the findings, introducing the most important contributions to knowledge, practical and theoretical implications, findings, and directions for future research into real estate tokenization.



CHAPTER TWO

2. THEORETICAL BACKGROUND

This chapter presents the theoretical background applicable to tokenization of real property and the implementation of blockchain technology. It illustrates how these technological innovations are reshaping the conventional paradigm of real property investment by combining knowledge from finance, legal theory, and technology. The aim is to develop a comprehensive overview of the principles and theories underlying the research, consistent with the aims set out in Chapter One.

The evolution of blockchain has been a critical factor in the advance of real estate tokenization. Introduced prominently by Nakamoto (2008), titled "Bitcoin: A Peer-to-Peer Electronic Cash System", Digital cash system that authorized electronic payments with a rare blend of decentralization, immutability, and scalability, even though the concept was introduced before (Bayer et al., 1993; Chaum, 1983; Haber & Stornetta, 1991).

Blockchain is a decentralized distributed ledger; the data is stored in nodes called blocks and transactions are recorded on the system, with every variation subsequently recorded on each block to ensure integrity (Nakamoto, 2008; Zheng et al., 2017).

Blockchain uses different mechanisms like (PoW), which is utilized in Bitcoin, to solve transaction validation but faces an energy consumption issue. Another alternative is (PoS), (DPoS), and Byzantine Fault Tolerant (BFT), which are considered effective protocols in private networks (Bano et al., 2017).

Based on the access to the blockchain, there are two main categories, as shown in Table 1. Public blockchains like Bitcoin and Ethereum are open to all investors, and the second type, private blockchain with limited access controlled by a single organization, offer enhanced privacy. The third type is the consortium blockchain, a hybrid prototype controlled by trusted organizations, combining public and private data (Allessie & Sobolewski, 2021; Kannengiesser et al., 2021; Xu et al., 2017).

Table 1 - Classification of Block chain Technology Categories

Write Permissions	Read Permissions	
	Public Anyone can access and join the transacting network	Only selected nodes can access and participate in the transaction.
Permissionless Anyone can validate transactions through the consensus mechanism	e.g., Bitcoin, Ethereum	e.g., LTO Network
Permissioned Only selected nodes can validate transactions through the consensus mechanism	e.g., Ripple, Ethereum	e.g., Hyperledger

Source: (Allessie et al., 2019; Kannengießer et al., 2021).

This part of the study reviews several important theoretical frameworks in the real estate market to support understanding of tokenization.

Market equilibrium in real estate refers to where supply and demand meet on the graph and presents the market value and quantity of transactions. The concept of market equilibrium is critical for understanding value distribution in total surplus. The market equilibrium price reflects the anticipated future benefits to the buyer and the expected costs to the seller, but solely at the point of sale (Marcato & Nanda, 2022).

A study by Trinh (2022), places the market equilibrium within the real estate market in the context of value creation by supply and demand, where price is the means to allocate value between stakeholders. It discovers that market equilibrium occurs when production and consumption are equal and real estate has a stable value allocation and economic surplus. The paper, in turn, elucidates the role of investors and credit institutions, whether credit expands or restricts demand, the mechanisms that create bubbles, and the pathways for their corrections. Finally, the article tries to connect market mechanisms to value allocation and shows that financial factors and participants' behaviors impact the price and stability of real estate markets.

Behavioral economics studies the impact of psychological aspects and cognitive biases on investor choices, which regularly diverge from traditional economic rationality

models. In the behavioral context of real estate markets, these biases imply systematic anomalies that can distort property prices, investment timing, and market efficiency.

Some significant biases influencing real estate markets include overconfidence, herding behaviors, loss aversion, and anchoring (Barberis & Thaler, 2003).

Overconfidence can also lead investors to believe they have superior knowledge or predictive insight, which results in speculative buying in rising markets. That impacts the buyers and the process of assessing property prices based on irrelevant reference points, such as the listing price (Genesove & Mayer, 2001).

In conclusion, behavioral anomalies challenge the efficient market hypothesis (EMH) in real estate models. It also suggests that price movements were often not completely rational or simply information-based. Recognizing rational personal and group biases is important in developing reasonable predictive models and government intervention related to real estate investment or regulation.

Douglas North describes the "rules of the game" in society and includes both formal rules (laws, contracts, regulations) and informal constraints (norms, traditions, codes of conduct). He explains that institutions are critical to shaping human behavior because they reduce the uncertainty involved in exchange and provide a basis for greater predictability of economic processes.

There is significant emphasis on the idea that institutions develop historically, which influences the evolution of economic performance. A long-term understanding of markets in which capital, risk, and regulation are closely linked, such as real estate, is appropriate.

In short, institutional theory is an important starting point for understanding the broad interconnections of the numerous legal, political, and cultural systems within a real estate context. North stated that real estate markets are institutionally embedded processes and more than just economic systems. Market performance depends on the quality and adaptability of governance structures within the real estate market. The work is useful for policymakers, investors, and urban planners who want to understand or change real estate systems (North, 1990).

Table 2 - North Theories in Real Estate

Related Theory	Application in Real Estate	Support from North (1990)
Transaction Cost Theory	Institutional structures such as REITs (real estate investment trusts) reduce transaction frictions, agency costs, and information asymmetries.	North (1990) discusses institutions as mechanisms to reduce uncertainty in exchange. Lower transaction costs promote more efficient markets.
Public Choice Theory	Helps explain how government actions and regulations affect land use, zoning, and real estate development.	North recognizes the influence of political institutions and their incentives, aligning with Public Choice perspectives on regulatory frameworks.
Path Dependency (Institutional Theory)	Historical legal frameworks, land tenure systems, and urban plans shape today's real estate investment decisions and market behaviors.	North highlights how institutional change is incremental and constrained by past arrangements, leading to persistent patterns in property systems.

Source: (North, 1990).

Urban economic theories provide a structure for explaining the spatial variation in land use and values, especially the bid-rent theory. This theory predicts increases in land value within central business districts, which influences residential and commercial settlement. Moreover, the theory of social space production asserts that cities and urban spaces are not determined only by physical design or economic considerations but extend to social relationships, cultural meanings, and political power. And how people use and engage in space shapes cities' growth, and properties shift in value. This idea is important when analyzing real estate development patterns and property values (Alonso, 2013; Lefebvre, 2010).

Theoretical frameworks are useful in real estate management, including property attributes, investors' goals, market conditions, and regulatory needs. Portfolio management models, valuation techniques, and the legal parameters are included here. Institutional theories, however, emphasize governance, sustainability, and long-term asset performance as drivers of a real estate investment strategy. ESG factors in investment decision-making represent an advancement in sustainable real estate management.

TCT theory, as advanced by Coase (1937), explains how firms minimize economic transaction costs such as search and information, bargaining, police, and enforcement costs. Thus, blockchain technology could significantly reduce costs by executing transparent and decentralized transactions.

The acceptance of blockchain by real estate buyers and sellers shows that blockchain acceptance decreases transaction fees and makes property transactions smoother. In studying blockchain, the immutable ledger and smart contracts ease processes and increase trust between parties (Zheng et al., 2018).

Tokenomics, the science of token design and behavior in a blockchain environment in real estate, means issuing digital tokens that represent ownership interests proportionate to a property; thus, people can invest in real estate without full ownership.

A qualitative study into the relationship between tokenomics and real estate crowdfunding. The main objective was to show that well-structured tokenomics can create aligned incentives among stakeholders, maintain the value of tokenized assets, and keep liquidity (De Filippi & Wright, 2018).

Contracts that you can write the provisions of automatically, in code. Automatic transactions and contract enforcement without intermediaries (participation). Smart contracts in the real estate trade enhance efficiency, minimize fraud, and reduce transaction costs. Also, research issues included legal enforceability and the need for a standardized contract template (Sowmya et al., 2024).

Research introduced tokenization models for property, which involved legal, technical, and managerial approaches. Describes a Title Token as a digital proof of title kept on the blockchain (Baum, 2015).

It analyzes laws related to the development and adoption of blockchain. It covers the rules for the legal use of digital assets, compliance with the main laws on property, and the enforceability of agreements made on the blockchain.

ACTUS expresses financial contracts using a single algorithm, enabling smart contracts to process transparency and irrefutably easily, following regulations due to the uniformity of interoperability achieved by ACTUS real estate tokenization. However, research on the application of ACTUS in real estate remains limited (Brammertz & Mendelowitz, 2018).

Legal theories of property rights discuss property ownership and distribution in terms of the rules for managing ownership with digital tokens, and the effects of ownership transferability methods on traditional concepts of property ownership (Modigliani & Miller, 1958).

Paper by Bell & Parchomovsky (2005), suggests a unified theory that goes beyond ad hoc perspectives such as instrumentalism, conceptualism, or the bundle-of-rights metaphor, concerned with how property law exists to facilitate the preservation of the value of stable possession. This theory specifies the rights secured by property law by explaining how rights-enforcement mechanisms work, giving a uniform foundation to legal analysis of real estate tokenization and fractional ownership schemes.

Finally, the real estate sector has a reliable theoretical foundation that combines classical economic principles, behavioral science, spatial analysis, and institutional management theories to facilitate insightful understanding and improve analysis tools for forecasting market trends (Silvia, 2024).

DoI theory depends on five factors: relative advantage, compatibility, complexity, trialability, and observability. Its relative advantage has improved liquidity, fractional ownership, and reduced transaction costs. Explain that legal complexity and blockchain-based infrastructure are considered barriers to adoption (Rogers, 2003).

Empirical studies of blockchain adoption in finance confirm that complexity and regulatory risk are powerful drivers of investor adoption (Gupta et al., 2020). Consequently, DoI theory provides a framework for assessing adoption barriers and market readiness for tokenized property, especially in resolving research questions on investors' behavior and technology diffusion.

Agency theory, created by Jensen and Meckling (1976), developed solutions for the issue of conflict of interest between principals (shareholders) and agents (managers). In tokenized asset classes, the theory is related to the governance structure in fractional ownership. When microinvestors acquire digital tokens, the associated decision-making rights often remain with platform developers or asset managers, which raises the issue of separation between control and ownership.

DiMaggio and Powell (1983), affirmed that organizational behavior emerges from legislative, normative, and cognitive. The regulatory and legal environment is the main

driver of institutional legitimacy and uptake. Also, via the lens of institutional theory, blockchain adoption is hard in different jurisdictions, and what developers do is to tag their platforms to the regulatory norm in a bid for acceptance (Dimaggio & Powell, 2004).

Report that in the case of economies in Germany and the US, regulatory warnings, which in turn push out pilot tokenized property projects. Also, from an Institutional Theory perspective, the setting of legal precedents to legitimize tokenized models in the traditional real estate space (Garcia-Teruel & Simón-Moreno, 2021).

Investors who invest in tokenized assets base their decisions on risk assessments, ease of use, and trust. TAM and its extension, UTAUT. Behavioral theories play a crucial role in terms of perceived ease of use. These models perform perfectly for retail and institutional investors (Davis, 1989; Venkatesh et al., 2003).

A study by Gupta (2020), Evaluating trust in the blockchain platform, the legitimacy of token issuers, and digital wallet awareness are key factors in adoption. Proves that TAM and UTAUT improve investors' knowledge of market preparation by explaining technology illiteracy, fraud phobia, and behavioral inertia.

Tokenized property complexity requires a multi-sectoral theoretical approach, as mentioned in Diffusion of Innovation Theory, Transaction Cost Economics, and Agency Theory emphasize concerns related to efficiency and governance.

Institutional Theory contributes insights into regulatory structures, and Technology Acceptance Models introduce a different perspective, which presents a richer picture of the issues and options for real estate tokenization. These theoretical points are the basis of the SLR conceptual framework.

Despite the potential of the legal and regulatory framework, tokenization of real estate confronts limitations due to the fragmented and sometimes ambiguous legal situation as stated by the authors, the absence of universal classifications for securities, the fact that regulation varies by each jurisdiction, and the uncertainty of whether smart contracts are legally binding as the main hurdles to overcome (Garcia-Teruel & Simón-Moreno, 2021).

Broader access and Inclusion for Investors. Tokenization substantially decreases entry costs for financial investment, and thus opens real estate markets to a larger group of investors, mainly retail investors. The ability to democratize investment this way is

considered one of the biggest disruptive potentials of blockchain in real estate (Baum, 2020; Mottaghi et al., 2024).

Developing platform models and Business Strategies. The existing literature discusses several tokenization platform models, from the more regulated Security Token Offering (STO) to more decentralized concepts such as DAOs (Avci & Erzurumlu, 2023).

This master's thesis evaluates key indicators such as liquidity, price discovery, transaction speed, cost-efficiency, and return on investment (ROI). This section critically examines the depth and coverage of each indicator within the academic literature.

- Liquidity: The indicator most described in the literature studies indicate that tokenization enhances liquidity by reducing entry barriers.
- Transaction speed: there is a shortcoming in the literature for this metric; the studies revealed that tokenization accelerates the speed of transactions, but there is no deep understanding in academia, such as case studies or comparative studies.
- Cost efficiency: previous studies introduce tokenization as a promising innovation for cost reduction by removing overhead costs from banks and agents; in contrast, there is a gap in research for a detailed analysis of cost matters.
- Return on Investment (ROI): a significant unexplored metric in academia, it is usually connected with liquidity, which is considered an important research arena, especially for investors looking for performance affirmation.

Economic tokenization is creating a new paradigm of the existing real estate economy. Tokenization allows for fractional ownership and, thus, permits small investors to engage in large real estate projects that were previously unattainable for them because of high entry costs. The field of real estate economics addresses the impact of such changes on portfolio diversification, capital flow, asset valuation, and risk management (Mottaghi et al., 2024).

Financial intermediary theory looks at how financial intermediaries' function. According to an article from the University of Florida's Warrington School of Business (2022), technology such as blockchain and smart contracts allows real estate tokenization to accelerate, reduce costs and boost the efficiency of property ownership. Liquidity Preference Theory Saving money Having property shares tokenized increases liquidity by

making it possible to break up ownership and resell shares. As a result, property investment attracts the interest of more investors. The authors found, as presented in their article, that on average properties on the blockchain are owned by about 254 people (Swinckels, 2023).

Blockchain technology enables real estate tokenization by allowing secure, decentralized and tamper-proof record-keeping, which is fundamental to proving ownership and recording transactions (Avci & Erzurumlu, 2023).

However, there are major technical limitations, mostly around scalability, interoperability between blockchains, and energy consumption. These concerns are especially relevant to the real estate sector, where a high level of accuracy is legally mandated and closely integrated with other property management systems. Researchers have suggested the need for enhanced and scalable blockchain infrastructures with real estate data standards rather than standardization (Allessie & Sobolewski, 2021).

Legal and regulatory considerations are important, but immature, aspects of real estate tokenization. One of the many issues related to tokenization is whether tokens are securities or commodities. Furthermore, property laws vary from one jurisdiction to jurisdiction, making real estate tokenization becomes especially difficult to apply cross-border (Gomber et al., 2017).

The existing literature deals with market performance indicators as one-dimensional and does not integrate them into a unified model that combines them all. As a disruptive innovation in this industry, this practice misses the potential of real estate tokenization. Several authors have argued in favor of constructing a more integrative, consolidated academic, and practical approach as a holistic and pragmatic framework for research and practice (Baum, 2020; Mottaghi et al., 2024).

This framework integrates the technological capabilities with economic models and legal requirements, and integrates human behaviour in technology adoption and usage. For instance, advocate for regulatory sandboxes for test deployments, economic incentives for early adopters, and standard protocols for interoperability. The separation of the disciplinary silos can help researchers and practitioners see how the process of tokenization has systemic effects and understand ways to make tokenization processes scalable and sustainable.

In summary, the tokenization of real estate is a crossroads of various fields of study. Its proper application requires a multidisciplinary team approach, injecting economics, technology, law, and behavioral science inputs into the process. An integrative approach is necessary to overcome existing limitations and exploit the full potential of this innovation as the field advances.



CHAPTER THREE

3. RELATED WORK

This chapter presents related works on blockchain technology and tokenization in real estate to conduct this research and highlight the literature gap that motivates this thesis.

Liquidity is one of the most significant constraints in real estate investment, as the blockchain and the tokenization of assets allow for the fractionalization of an asset in secondary markets Catalini & Gans (2020), Provide foundational knowledge related to removing friction in the transaction of assets related to blockchain. In particular, blockchain reduces the need for intermediaries (think notaries, escrow agents, etc.) and lowers the operational costs associated with the transaction. This leads to more democratic access to assets without the restrictions of economic or geographical barriers, and assets can easily be fractionally owned or traded back and forth on an exchange.

Recent research has focused on the influence of tokenization through the application of blockchain on real estate market liquidity. Avci and Erzurumlu (2023) established an SPV-based model to enhance liquidity, ultimately concluding that tokenization reduces the time required for transactions and improves transparency, thereby facilitating the trading of real estate-related assets.

Henker et al. (2023) conducted research in Germany that analyzed the regulatory and technical effects of tokenizing real estate. They suggested that tokenization enables a higher rate of participation, but liquidity would be established through clarity in regulations and a secondary market.

Sharma et al. (2024) also supported the concept of a nonfungible token (NFT) registry on the basis that, where ownership transactions are made automatic using blockchain technology, the time for the transaction is reduced, and fraud is minimized. This aspect, though not their primary objective, offered additional liquidity as it generated greater confidence in secondary markets.

Finally, Oza et al. (2024), implemented a model based on an Ethereum smart contract and a three-tier approval system based on buyers, lenders, and inspectors, which showed that the tokenization process eliminates administrative bottlenecks and thus enhances liquidity. The general finding of this research is that blockchain technology has the potential to significantly improve liquidity in real estate assets, but this enhancement is contingent upon the prevailing regulatory frameworks and market infrastructure (Avci & Erzurumlu, 2023; Henker et al., 2023; Sharma et al., 2024; Oza et al., 2024).

Although significant empirical data on ROI are limited, multiple studies suggest that tokenization potentially improves returns by reducing operational and intermediary costs.

In the return on investment (ROI) of tokenized real estate and its effects, there has been significant study on aspects of the phenomena including Mottaghi et al. (2024), who provided an overview of tokenized real estate projects, among them the St. Regis Aspen Resort, and outlined how fractional ownership allows smaller investors to invest in high-value real estate assets and, by extension, enhances ROI for such an investor with diversification of their portfolio.

Similarly, Joshi and Choudhury (2022) consider a blockchain architecture framework for real estate tokenization and present empirical facts to support their argument that tokenization can reduce barriers to entry and intermediary expenses in effective governance structures, leading to higher ROI potential in investments in real estate portfolios for small investors.

Tanveer et al. (2023), in a more general tokenization context (not specifically real estate), compared serial tokens based on gaming and carbon credit assets with real estate tokens and posited that real estate could offer realistic, stable returns that would be commensurate with property values, yet effectiveness still relied on good governance practices to optimize ROI.

Lastly, Konashevych (2020) could publish a theoretical example to complement from examples and discuss what could be a democratization of investing through tokenization, but was cautious to add that they could be "pie-in-the-sky" promises in terms of ROI, as long as blockchain was not legitimized through legal evolution as accepted property titles.

The potential cost reduction with tokenization is undisputed within the scholarly literature. A report by PwC estimates that transactions that adopt blockchain technology that use real estate will reduce real estate costs by 30%, focused on disintermediation. Furthermore, smart contracts decrease administrative expenses and improve operational efficiency.

The tokenization of real estate enables cost efficiency by minimizing intermediary agents, automating transaction processes using smart contract programming language, and eliminating or reducing legal and administrative costs. Research suggests various cost efficiency measures realized for the tokenization of real estate, which suggests that it provides greater speed to the transaction and transparency, flexibility with ownership, reduced barriers to entry, fractional ownership, and greater potential for real-time auditing. These benefits require careful evaluation as regulatory uncertainty is an immediate challenge in achieving a broader real estate cost. Similarly, there may not yet be viable branding options to decentralize routine decision-making (Hashemi Farahmand & Rahimiaghdas, 2024; Tian, 2022).

Beyond direct benefits of reduced transaction costs and administrative fees on real estate transactions, direct tax efficiencies from tokenization of real estate by its capabilities to increase capital formation in the real estate marketplace while allowing for fractional ownership. Furthermore, token securities introduce liquidity into the market.

Tian (2022), states that this liquidity also decreases operational friction costs associated with the transaction, such as compliance costs through the investor's choice to codify agreements and terms with smart contracts. Blockchain also enables many foreign investment avenues, reducing transaction fees due to digital efficiencies and time-based fees for cross-border trading, which makes investment decisions quicker for global or foreign investors, similar to the operationalization of the different costs related to transaction and ownership for real estate tax obligations, there are some short-, mid- and long-term anticipated barriers that need to be realized the cost efficiencies to such scale such as regulatory standardization, investor safety mechanisms and technological readiness (Comert, 2018).

While the impact of tokenization on asset volatility and price discovery is still in the preliminary study stage. A study by Chow & Tan (2022), examined the Singapore property market, discussed the issues of volatility and liquidity in real estate tokenization

stemming from having no centralized secondary market. Tokens are only available for trading on certain exchanges, limiting market depth and creating price discrepancies. This nonsystematic structure consists of increased transaction costs and uncertainty in tracking price and volatility, leading to lower efficiency. Additionally, they do not have a single blockchain network or a cryptocurrency-based payment mechanism to take advantage of related cost savings. Overall, these factors contribute to increased volatility and limit the effectiveness of tokens of the real estate market as a stable investment.

An empirical study by Swinkels (2021), represents the first empirical examination of real estate tokenization with a dataset of 58 residential properties in the U.S., mostly in Detroit. This research indicates that tokenization allows for significant fragmentation in ownership, leading to considerable potential for risk sharing. Investors with more than \$5,000 generally have diversified portfolios. In this way, the turnover of ownership of the asset occurs once per year.

Tokenized prices correspond to long-term housing prices, providing some exposure to long-term trends in real property. Token prices sometimes detach from intrinsic property values; this detachment is sometimes more visible in token prices or platform-based popularity, rather than in valuation fundamentals. The study shows that tokenized real estate acts as conventional real estate investments on a smaller scale. Despite many limitations, including a small sample size and dependence on unreliable price proxies, tokenization demonstrates promising signs of delivering many of the anticipated benefits of real estate tokenization. Moreover, future research into the implications of the regulation of tokenized real property, transaction costs, governance issues, and the methodology for generating prices.

The role of tokenization in asset and price discovery is still unapproved and under investigation. For example, a study describes how certain transaction fee mechanisms might change waiting times and agreement security, possibly influencing volatility in tokenized assets that new Fintech firms have the potential to serve as substitutes to traditional financial services, it remains to be seen whether digital asset management is disruptive to the traditional asset management industry (Li et al., 2017).

With the growing interest in real estate tokenization, the following studies explore difficulties in measuring tokenization effects, such as A systematic review in Land Use Policy by Saari & Vimpari (2022), an analysis of 262 academic publications established

that while blockchain technology is being adopted, with blockchain assets and tokenization in particular, there are still no defined Key Performance Indicators (KPIs) as well as evidence for performing empirical validation of these methods, or reliable performance comparisons between tokenized and traditional forms of real estate. This is mainly due to the issues surrounding financial disclosures, the lack of historical data, and the issue of data from only one platform. Liu & Chen (2025), stated that one challenge with tokenized platforms is the absence of a unified reporting requirement to comply with, unlike real estate investment trusts (REITs), which makes impact and investor comparisons impossible. The regulatory and legal environment makes it difficult to track performance.

In addition, the absence of integration between tokens and national land registries makes it difficult to form clear regulatory standards. At the same time, critics note that asset tokenization has key issues and there are still concerns such as low liquidity and highly concentrated investors that impair market efficiency and make marking down performances that much more difficult (Joshi & Choudhury, 2022).

Together, these works indicate a significant gap in the literature for empirical testing and standardization of ROI metrics for blockchain-based real estate models. In response, this thesis seeks to highlight this gap by investigating to what degree tokenization currently provides a measurable return on investment (ROI) by offering a performance measurement framework. This research is relevant because it adds to the current discussion through practical knowledge and improves the comparison and evaluation of tokenized property.

Tokenization increases transparency and accessibility because blockchain provides an immutable transaction history and allows for verification of who conducts transactions and when, which decreases any information asymmetries between parties to the transaction. Furthermore, fractionalization democratizes access to investment capital, allowing investors to invest with little capital. tokenized platforms can support microinvestment, thus expanding market participation in developing economies (Alateef et al., 2025; Allessie & Sobolewski, 2021).

Tokenized real estate faces serious technical, legal, and security-related challenges. Cite smart contract vulnerabilities and custody risks, such as hacks and lost keys, as potential security-related issues (Atzei et al., 2017).

There is regulatory uncertainty, which is presented by De Filippi & Wright (2018), argue that in most jurisdictions, blockchain-based property titles do not constitute legal property titles, making enforcement complex. Jurisdiction fragmentation exacerbates transfer border token challenges (Clack et al., 2016).

On the technical side, which refers to the research sub-question, blockchain scalability challenges are highlighted in the research with emphasis on the blockchain problems and interactions with outdated land registry systems. And common technical standards prevent platform interoperability (Beck et al., 2018; Croman et al., 2016; Kouhizadeh & Sarkis, 2018).

The most recent systematic literature reviews provide strong academic evidence for this thesis by identifying key gaps, affirming emerging trends, and proposing avenues that directly relate to the purpose of this study: to assess the market exposure, barriers to adoption, and regulatory and technology challenges to tokenizing real estate using blockchain.

Recent systematic reviews of the literature (SLRs) have increasingly examined blockchain applications in real estate and identified important knowledge gaps, adoption barriers, and performance assessment opportunities, which align closely with the aims of this thesis.

Seamlessly following on from adoption challenges, Yeoh (2024), address the adoption of blockchain in the real estate sector through the extended Unified Theory of Acceptance and Use of Technology (UTAUT) model. Through an extensive review of the literature, the authors presented the challenges that hinder the tokenization of assets and addressed the democratization of investment in the real estate sector and its influence on the extended investor base.

A review of the literature that highlights the restricted research on performance metrics, legal enforcement, and investor conduct within the field. Their recommendation of the problem of fragmentation explains the need for a systematic narrative review, which has the potential to pull together and illuminate the findings of several studies at once (Saari et al., 2022).

This article addresses the main challenges in the industry: there is a shortcoming in the set of performance indicators, the interrelationship of the legal system, and the organ-

izational terminus, which are the determining factors. Thus, the study answers these challenges directly by focusing on the investment issues of the real estate sector through tokenization and using both theoretical and empirical analysis.

While the theoretical attention to real estate tokenization has increased during the last decade, many studies lack empirical validation. A limited number of studies have focused on projects and investment results in the real estate market of blockchain technology. However, there are still areas where performance evaluation, longitudinal data, and comparative case analysis are missing.

Although the scholarly interest in real estate tokenization has expanded, research on empirical performance and adoption in some areas needs development. Studies in the literature for now, while offered as good examples, show that pilot projects and early market introduction are the positive aspects but at the same time, the literature suggests that there are gaps especially for standardized performance evaluation, investor behavior, and regulatory interoperability, issues that my thesis proposes to address through its research questions and structured synthesis.

Ante and Meyer (2021), did not specifically focus on real estate but did present valuable empirical research that can contribute to studies on real estate tokenization. The authors performed an event study of 250 cross-listing events involving blockchain-based tokens issued through initial coin offerings (ICOs) on 22 different cryptocurrency exchanges. They found statistically significant abnormal returns, 6.51 on the listing day and 9.97% on seven days, which shows that measurable market action occurs in response to token events. This study also employed risk-adjusted performance analysis and liquidity-based regression models to evaluate the effects of trading volume and market cap on outcomes against traditional real estate investment products. Moreover, it is important to note that the listing outcome varies significantly across exchanges, which shows that the trust in platform structure is important to the outcome, where in the real estate space, clarity of regulation, and confidence from investors are vital. While this study focused on general ICO tokens, the empirical design and the focus on market behavior, liquidity, and performance make it a compelling reference model for employing rigorous, data-based research on real estate tokenization.

Instances from industry, such as RealT (USA), Brickblock (Germany), and Prop-tech Power (UAE), reinforce the technical possibility of tokenized real estate by demonstrating that they are now offering capabilities like distributing rent via stablecoins daily, as well as asset-backed tokens that are registered under a licensed investment fund. It is important to highlight that these real use cases also expose certain continuing friction, such as a lack of legal recognition, disconnection from national property databases, and regulatory uncertainty, particularly concerning cross-border compliance issues that have recently arisen in connection with the MiFID II framework, as well as using U.S. SEC regulations. Thus, these industry examples illustrate the significance of this thesis, which seeks to understand the legal and institutional barriers to market-scale token adoption.

However, the literature clearly articulated some significant empirical limitations. For example, there is a conspicuous absence of longitudinal cross-jurisdictional studies that would allow for long-term evaluation of token performance or systematic evaluation of policy efficacy. Second, some performance metrics have suffered from blurred definitions (e.g., turnover ratio, Sharpe indices), making it impossible to meaningfully compare studies, which will be addressed in the Research Question of this thesis by proposing common indicators.

This thesis aims to review and analyze relevant literature to investigate the application of tokenization in the real estate market and to conduct an extensive examination of pilot blockchain projects in the literature.

In establishing and reviewing these empirical gaps, I have established case-based evidence from tokenized real estate projects, provided empirical evidence of standardizing performance measures, and created a cross-dimensional focus (i.e., legal, technical, financial, and behavioral). As a result, this thesis not only builds a specific understanding of the domain, but also presents some future areas of study: interoperable land registries, investor protection, and platform governance, which are all opportunities to take tokenization from theory to strong practice.

According to the main research question, as stated by Cong (2020), debate that smart contracts reduce manual mistakes and create permanent transaction records, which improve auditability and compliance monitoring. However, they highlight a critical challenge, like no standardized contract templates.

When attempting a large-scale implementation, this is a serious barrier to potential widespread adoption. This is relevant to the objectives and questions, as these seek to explore the institutional and technical readiness of platforms for wider adoption.

Integrating blockchain and tokenization technology into existing real estate infrastructure, including governance, is fraught with problems. The interoperability of smart contract platforms and existing land registry systems is a point of friction in many jurisdictions. Most property registries internationally still rely on old-fashioned paper or even antiquated digital technology, making any technical integration with blockchain platforms difficult. The realities of legacy, non-standardized technology, and governmental organization will not only hamper tokenization projects as they are executed, but are a major impediment to the future of real estate as a transaction process (Kouhizadeh & Sarkis, 2018).

According to Clack (2016), demonstrate that many aspects of ISDA contracts can be effectively incorporated into smart contracts and, therefore, can support and automate complicated financial instruments. However, a key takeaway is the need to marry legal semantics with their technical implementations. Clack defines some key ways to ensure that the implementation correctly complies with the obligations and rights of each Party.

An academic article by Jūrmalis (2025), presents a literature review and analysis of the regulation of asset tokenization and the specific regulatory landscape of this topic in the European Union, with a particular focus on Latvia. The authors reflect on the appropriateness of existing regulation and the adequacy of regulatory ambit and scope, emphasizing the requirements for absolute clarity and certainty of the aspects of both the asset and corresponding regulation to facilitate the development and uptake of tokenized asset products.

As mentioned in previous studies and research, directed according to the purposes and questions of the research, the studies proved that the impact of real estate tokenization led to improved liquidity and investment returns. After reading these studies, an initial understanding of the technological and legal challenges and influences on this sector is gained, thus directing the research method and narrowing the concepts that will be researched in the next chapter to evaluate deeper answers to the research questions to be discussed at the end of this thesis.



CHAPTER FOUR

4. RESEARCH METHOD

4.1 Overview of SLR

The SLR methodology originated in research in the early 1990s and gained attention in the medical and healthcare fields, to provide transparent and high-quality results. In the early 2000s, the application of SLR methodology expanded to other fields, including engineering, business, education, and the social sciences (Boell & Cecez-Kecmanovic, 2015; Higgins et al., 2019). According to Kitchenham (2007), the definition of SLR methodology is: “A means of identifying, evaluating, and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest” (p. 1).

4.2 Important Features in SLR

Systematic review of the literature provides reliability, minimize bias, and allows extensive analysis. On the contrary, the methodology is time-consuming and highly sensitive, which may cause insignificant biases. Table 3 indicates the important features of SLR.

Table 3 - SLR Features

Features Checklist	Feature in Thesis
Precise Research Questions	A primary research question (impact on liquidity, ROI, cost-efficiency) and five sub-questions, directed toward the contribution.
Transparent Protocol	A structured SLR process.
Comprehensive Search Strategy	The systematic literature search covers studies published between 2018 and 2025.
Quality Assessment	This dissertation draws solely on peer-reviewed journal articles and conference papers, deliberately excluding grey literature, to ensure academic credibility.
Thematic Mapping	The study context covers liquidity, cost-efficiency, transparency, regulatory barriers, and technological constraints.
Contribution to Theory and Practice	SLR contributes to theoretical models and practical frameworks for tokenization adoption in real estate.

Source: Author's elaboration.

4.3 Methodology Design

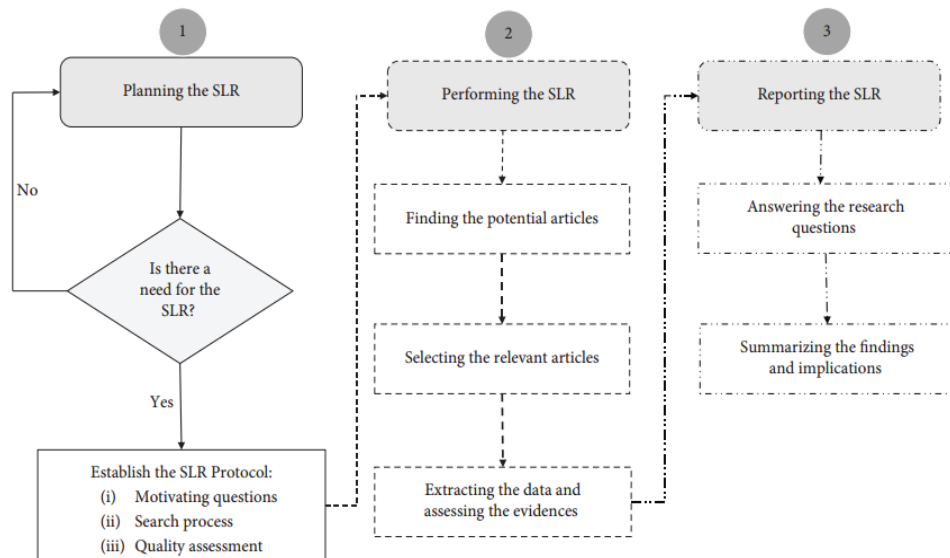
The main purpose of this master thesis is to reveal the available research in real estate tokenization and blockchain, and to examine the impact of tokenization on market performance metrics such as liquidity, return on investment (ROI), and cost efficiency in the existing database, thus the research adopts SLR methodology based on Kitchenham and Webster and Watson guidelines to ensure academic validity and is reliability and covered mainly in general three phases, as shown in Figure 1 Even if these phases appear to have linear iterations during the search strategy and protocol development, the research question is revised and updated throughout the process.

The three main phases of systematic literature review are as follows (Kitchenham, 2007).

- Plan the review.
- Implement the review.
- Report the review.

4.4 Phase 1: Planning the Review

Figure 1 - Kitchenham's General Phases of the SLR



Source: (Kitchenham et al., 2007).

4.4.1 Needs for the Systematic Review

The reason for applying SLR in this thesis is to scan the prior knowledge in blockchain tokenization in real estate investment by describing the current research gaps and the limitations of empirical work, and to establish a framework that gives directions to policymakers and stakeholders with verified academic insights.

Moreover, adopting SLR method in this thesis stems from the need to provide an objective description of existing research and summarize it to analyzes to which extent these studies are familiar with understanding the effects of this rapidly developing field, to classify the aspects that have not been covered, and to direct the concerned parties towards the important indicators in the real estate investment market in the era of the Internet of Things and technology.

Finally, the SLR methodology correlates with the study objectives by presenting the academic literature from 2018 to 2025. This approach conducts a rigorous protocol to ensure objectivity and reliability in the analysis process.

Planning is the first step of the SLR process, implementation is the second step, and Reporting is the third and final step. Research questions are determined during the review protocol step. Before preparing the review protocol, the preliminary planning step is described below:

- Theoretical background of the SLR (mentioned in Chapter 3).
- Identify the research question of the SLR.
- List of databases.
- Details of the inclusion and exclusion criteria.
- Quality assessment, Checklists.
- Techniques for data validation and extraction.

4.4.2 Review Protocol

After clarifying the need for SLR, the next step is to design a detailed plan that formulates the search strategy, procedures, and selection criteria for relevant research studies. Details of the review protocol are available in Appendix A.

4.4.3 Research Sub-Questions

Table 4 - Research Sub-Questions and Goals

Research Question	Question Goal
RQ1.1 What legal and technological barriers prevent the adoption of tokenization in real estate, as identified in existing research?	To examine the legal and technical obstacles that are potentially delaying or preventing the adoption of tokenization in real estate, including law, outdated property systems, and technical issues with blockchain (Analytical - <i>critically examines recurring adoption challenges</i>)
RQ1.2 How deeply does the current literature demonstrate empirical results measuring market performance metrics related to real estate tokenization?	Assess how much actual evidence and data are present in the literature on the performance of tokenized real estate in the market, including return on investment, liquidity, and transaction costs. (<i>Empirical assessment – evaluates depth and rigor of empirical findings</i>)
RQ1.3 What are the current research gaps and what are the proposed future directions in the study of tokenization-based blockchain real estate investment?	Identify any gaps in the current literature to dictate future studies. This may include gaps, such as insufficient case studies to conclude. (Forward-looking – guides contribution to knowledge and research priorities)

Source: Author's elaboration.

4.4.4 Validation of a Review Protocol

The review protocol continues to serve as a guide for the actual conduct of the study, making it the most vital and critical part of the systematic review. Transparency verification is necessary to maintain high study quality. Kitchenham has suggested conducting pilot searches to identify potential primary studies using the search strings and resources in the review protocol.

Ensuring the validity and transparency of the review protocol involves following these examples:

- **Clear Documentation:** Document every step of the methodology, including search terms, databases searched, decisions made in screening and inclusion, and exclusion criteria when searching and screening.

- **List Validated Tools:** Use standardized quality assessment tools when relevant and report how and when they were applied and the results for each study included in the SLR.

4.5 Phase 2: Conducting the Review

The implementation phase is the second phase, which starts after approving the review protocol and defining the search process and study selection criteria from the database.

4.5.1 Search Process

The search process is a critical stage in SLR, defined as a documented procedure to facilitate transparent and replicable analysis, carried out after the initial planning phase. This step supports transparent and replicable analysis through detailed documentation.

4.5.2 Study Selection

Study selection identifies the most relevant studies as an initial phase based on the selection criteria and associated with the scope and question. The first level includes scanning of titles and abstracts to remove insignificant studies. The second stage involved a full text review, applying precise requirements about language, publication type, authorship, research design, sampling method, and publication date. A third screening stage to achieve quality, verify accuracy, and minimize bias.

4.5.3 Search Strategy

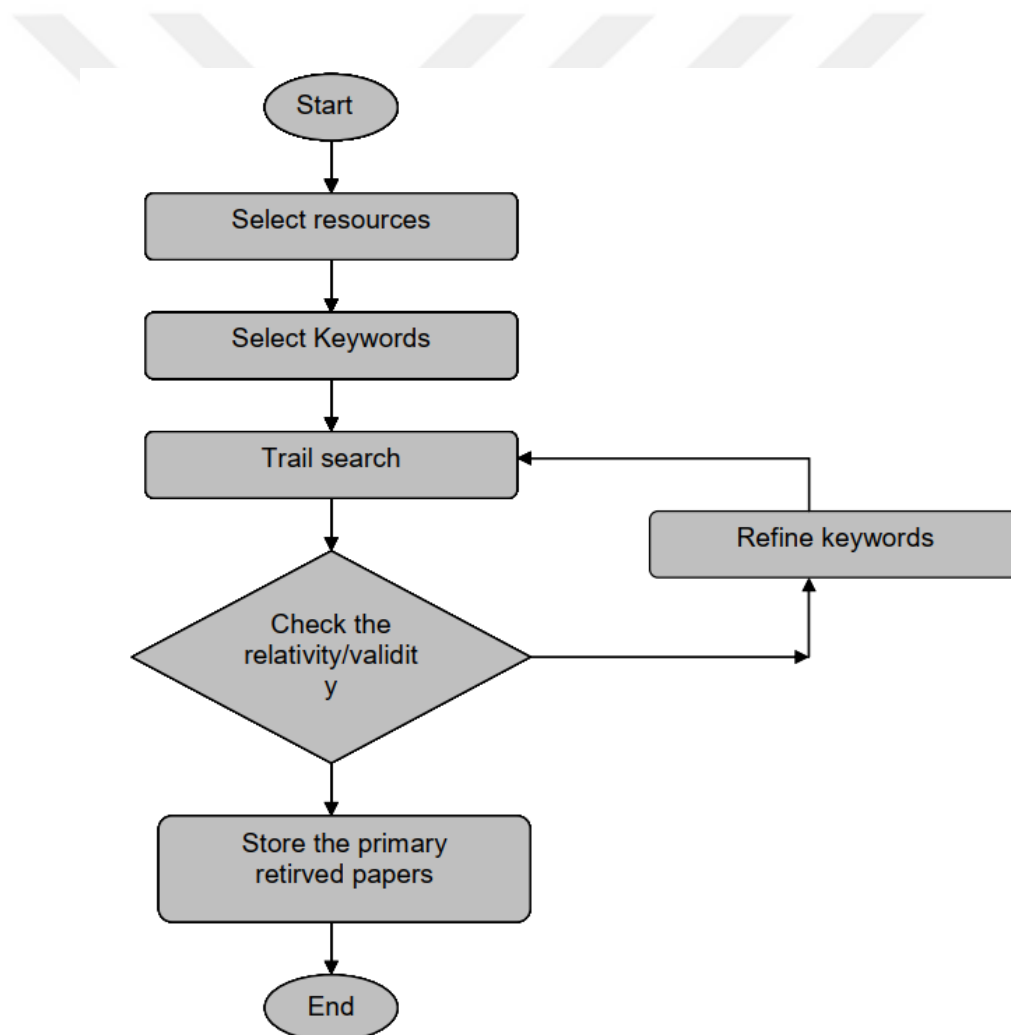
The objective during this phase is to find as many relevant primary studies that answer research questions about the technological, legal, and financial aspects of real estate tokenization through blockchain technology as possible. The initial step was to develop a well-defined search strategy designed to be used in several academic databases to provide a systematic coverage of the interdisciplinary literature that covers the research subject areas, including real estate investment, blockchain, smart contracts, regulation, and digital finance.

The search starts with exploratory searches on Google Scholar using the base phrase "real estate tokenization" to assess the general volume and dimensions of the literature. Next, the base phrase is updated into a string of keywords by creating Boolean operators

and quotation marks to restrict the number of results targeting specific intersections, such as "blockchain" AND "real estate" AND ("tokenization" OR "digital assets").

The revised and enhanced search queries were executed in the interest of the overall implementation of the SLR, using the following eight academic databases. The identification of studies was subsequently completed following the development of search strings modeled on each database, consistent with the core themes of the thesis, around investment performance, legal readiness, technical scalability, smart contract applications, and adoption trends. Figure 2, illustrates the research strategy based on Kitchenham's guidelines.

Figure 2 - Description of Search Strategy



Source: (Kitchenham et al., 2007).

4.5.4 Data Sources

4.5.4.1 Resources/Database

In defining the limits of the study, which focuses on tokenized real estate assets using blockchain as well as using systematic review methodologies applied in similar fields (see, e.g., Catalini & Gans, 2019), a series of high impact and multidisciplinary academic databases were selected for coverage. These databases, Scopus, Web of Science, ScienceDirect, SpringerLink, IEEE Xplore, ACM Digital Library, ABI/Inform, and EBSCOhost, were selected for their large citation indexing, multidisciplinary, and good basis for identifying research gaps. ScienceDirect (Elsevier) and SpringerLink provided high-quality peer-reviewed content on real estate finance, economics, and legal aspects of tokenized investment. The nature of the study required databases with technical depth in blockchain and tokenization; that is why IEEE Xplore and ACM Digital Library were selected because they would provide a central role in exploring the infrastructure of tokenized platforms. The goal of ABI/Inform and EBSCOhost was to expose investment behavior, market trends, and financial performance of real estate and digital asset professionals and academics. Therefore, the chosen databases represented a good combination to reflect the objectives of the study. Table 5 shows the most Suitable electronic Databases and Libraries.

Table 5 - Databases and Libraries

No.	Database / Library	Link
1	Scopus	https://www.scopus.com
2	Web of Science (Clarivate)	https://www.webofscience.com
3	ScienceDirect (Elsevier)	https://www.sciencedirect.com
4	SpringerLink	https://link.springer.com
5	IEEE Xplore	https://ieeexplore.ieee.org
6	ACM Digital Library	https://dl.acm.org
7	ABI/INFORM (ProQuest)	https://www.proquest.com/abiinformcollection
8	EBSCOhost	https://search.ebscohost.com

Source: Author's elaboration.

4.5.4.2 Search String

The general search string is clarified in the search strategy section, while the details for each database string will be explained profoundly later in the conducting phase.

4.5.4.3 Study Selection Criteria

To ensure the quality, relevance, and rigor of the systematic literature review, a clear set of inclusion and exclusion criteria is presented in Table 6 and Table 7. It was established based on the research objectives. These criteria ensured the selection of a body of literature that is academically robust, thematically relevant, and methodologically appropriate to answer research questions regarding the challenges, opportunities, and institutional readiness for blockchain-based real estate tokenization.

Table 6- Inclusion Criteria List (IC)

Criteria	Description
IC1 Source Type	Peer-reviewed journal articles, conference proceedings.
IC2 Publication Year	Studies published between 2018 and 2024.
IC3 Language	The study language is English.
IC4 Access	The full text of the study is available on an open access platform.
IC5 Topic Relevance	Studies address real estate tokenization, blockchain in property.
IC6 Research Type	Includes empirical studies, case studies, theoretical papers, or reviews of the literature.

Table 7 - Exclusion Criteria List (EC)

Criteria	Description
EC1 Source Type	The study is a nonscientific or non-peer-reviewed paper/report - gray literature.
EC2 Publication Year	Studies published before 2018 or after 2024.
EC3 Language	The study is not written in English.
EC4 Access	The full text of the study is limited.
EC5 Topic Relevance	Studies discuss blockchain or tokenization, but not related to real estate or investment, and a duplicate copy.
EC6 Research Type	Articles published on websites of companies, students' unpublished theses, and short papers.

Source: Author's elaboration.

To maintain the academic integrity and methodological rigor of this systematic literature review (SLR), the thesis prioritizes studies published in ranked journals and conferences using systems such as SCImago (SJR), ERA, and Qualis CAPES. High-quality published in rankings, the review's sources also include a more transparent, objective, and replicable source selection process, which is consistent with best practices for SLRs (e.g., Kitchenham, 2007; Okoli & Schabram, 2010).

By emphasizing such sources, the thesis also fosters its evidence-based aim of evaluating blockchain-based tokenization's influence on real estate investment metrics such as liquidity, return on investment (ROI), and cost-effectiveness.

Table 8 - Quality Criteria from Journals and Conferences.

Criteria	Description
QC1	The study is published in one of the following: Relevant journal, indexed in SCImago Journal Rank (SJR) 12 - the ranking ranges from Q1 (=best), Q2, Q3, Q4 (=worst). Relevant conference, indexed in the Excellence in Research in Australia (ERA) ranking, the ranking ranges from A (=best), B, C (=worst). Relevant conference, indexed in Qualis14 ranking, the ranking ranges from A1 (=best), A2, B1, B2, B3, B4, B5 (=worst). Otherwise, the study is considered unranked.

Source: Author's elaboration.

To maximize the consistency in the studies, a test-retest reliability check is implemented. Immediately after the screening, 15% of the studies were randomly selected, and the researcher reevaluated them after a window of 10 days. The consistency rate between the first evaluation and the second evaluation was 87%. Only those studies in which either researcher disagreed were re-evaluated with both researchers determining their conclusion by clarifying the inclusion/exclusion criteria.

4.5.4.4 Identification of the Research

The goal of this research is to discover several studies related to sub-compositions by implementing the aforementioned search strategy. As a result, the discovery documenting process included both database combinations and manual searches. For elec-

tronic databases, specific procedures were followed. Starting from defined sub-compositions, various keywords were removed in a recurrence and merged to create a broad search string. Table 10 presents keywords associated with blockchain technology, real estate tokenization, and other relevant subjects. After installing these keywords and selecting relevant words through a recurrent process, they were consolidated in a search string that was used in various scientific databases. The search string was modified according to the requirements for the search engine of each database. In addition to the discoveries in the database shown in

Source: Author's elaboration.

Table 10.

Table 9 - General Keywords in a Scientific Database.

General Key Words	Blockchain technology & tokenization & real estate investment
Similar Terms	Keywords related to blockchain technology, namely: DLT, Distributed Ledger Technology, Smart Contracts Keywords related to real estate, namely: PropTech, Land, Realty, Real Property.
Search String	("Blockchain" OR "Distributed Ledger Technology" OR "DLT" OR "Smart Contract") AND ("Real Estate" OR "PropTech" OR "Land" OR "Real Property" OR "Realty")

Source: Author's elaboration.

Table 10 - Different Databases Search String

Database	Search String
ACM Digital Library	"Real Estate" AND "Blockchain" AND ("Token Standards" OR "Contract Automation" OR "Technical Limitations")
(ProQuest)	"Real Estate Investment" AND Blockchain AND ("Tokenization" OR "Security Tokens") AND ("Investment Performance" OR "Market Trends" OR "Regulatory Issues")
IEEE Xplore Digital Library	"Smart Contracts" AND Blockchain AND ("Real Estate" OR "Asset Tokenization") AND ("Platform Architecture" OR "Scalability" OR "Interoperability")

Database	Search String
Scopus	ALL ("Real Estate Tokenization" AND Blockchain AND ("Liquidity" OR "Cost Efficiency" OR "Smart Contracts" OR "Fractional Ownership") AND ("Investment Performance" OR "Legal Barriers" OR "Adoption"))
Web of Science	((("Real Estate Tokenization" AND Blockchain AND ("Regulatory" OR "Technical Barriers" OR "Market Adoption") AND ("ROI" OR "Liquidity" OR "Compliance"))
Springer	"Real Estate" AND Tokenization AND ("Blockchain Integration" OR "Fractional Investment" OR "Decentralized Finance") AND ("Legal Framework" OR "Scalability")
ScienceDirect (Elsevier)	"Real Estate Tokenization" AND Blockchain AND ("Smart Contracts" OR "Cost Reduction" OR "Market Transformation") AND ("Technical Integration" OR "Investment Accessibility")
EBSCOhost (Business)	"Blockchain" AND "Real Estate Tokenization" AND ("Financial Inclusion" OR "Legal Challenges" OR "Investor Trust")

Source: Author's elaboration.

4.5.5 Selection of Primary Studies

To ensure that a systematic and transparent study selection process was followed, this thesis included only high-quality educational literature. Identifying studies that addressed blockchain integration, tokenization, and innovation in real estate investment. The selection process goes through several structured stages to maintain rigidity, reduce bias, and ensure stability during review.

Step one: Initial screening – evaluation of the title and abstract from secondary data sources using earlier inclusion/exclusion criteria through installed methods.

Step two: The exclusion of irrelevant studies was abolished if they included unpublished work, irrelevant subjects, or non-English articles.

Step three: Quality assessment - the objectives and conclusions were evaluated, and poorly framed research was excluded.

Step four: Final Inclusion/Exclusion after full-text scanning that includes screening of all the following:

- Introductions related to the study context in real estate and blockchain.
- A precisely stated research methodology.
- Properly presented findings aligned with the study's objectives.
- A conclusion that discusses both the results and the limitations.

Step five: Records of exclusion or inclusion, documented in Excel tables with an explanation to maintain the reliability and validity of findings.

Final pool studies - 49 studies created a strong, relevant, and comprehensive methodology for reviewing the literature.

4.5.6 Study Quality Assessment

The quality assessment is a helpful instrument that achieves credibility, improves trustworthiness, and modifies inclusion and exclusion criteria to assign scores to publications, as shown in Table 8 . This measurement tool contains a checklist of key factors such as bias, internal validity, and external validity.

Quality evaluation was undertaken to evaluate the validity, trustworthiness and / or methodological soundness of the primary studies ultimately selected. Research indicates that it normally is not easy to judge the extent to which researchers address threats to validity". Therefore, this evaluation will use a structured framework that outlines selected key components of the research normally identified in scholarly research articles (Staples & Niazi, 2007).

Each selected primary study was assessed for each of the possible i.e. structural components: Introduction, research method, results, and Conclusion. The following guiding questions were used in this evaluation:

- Introduction: Does the study provide an adequate overview of blockchain technology and/or real estate tokenization as applied to an investment context?
- Research Methods: Does the paper reference the research method undertaken in the study (e.g., qualitative, quantitative, or mixed)?
- Results: Are the results of the study presented and considered adequate in answering the research questions covering tokenization, transparency, cost-efficiency, or liquidity?

- Conclusion: Does the paper detail both positive and negative findings, including a discussion of limitations and/or recommendations for future research?

In addition to conducting this structural assessment, the authors also exercised judgment based on the paper's keywords, abstract, title, and general relevance to the research questions. The credibility of the source of the publication (i.e. IEEE, Elsevier, Springer) was similarly considered to maintain an academic rigor.

This process allowed only relevant studies of sufficient quality to be included in the synthesis and improved the reliability and validity of the review results.

Each question supports the scope and significance of the study and impacts the data collection and analysis process; according to Staples & Niazi (2007), The criteria (PICOC) are used for explaining the population, intervention, comparison, outcome, and Context criteria shown in Table 11.

Table 11 Answering the question to ensure clarity in the search process, moreover, the goal of the sub questions is presented in Table 4 , noting that a preliminary scanning was conducted before designing these sub-questions to narrow the research landscape on specific questions.

Table 11 - PICOC Criteria for RQ Evaluation

Criteria	Description
Population	Who is interested in or affected by the intervention? Stakeholders, such as government, banks, agencies, researchers, and companies involved in tokenization and blockchain technology.
Intervention	What or how is technology, tool, or procedure being studied? Tokenization-based blockchain technology in real estate.
Comparison	The intervention is compared to what technology, tool, or procedure? Real estate investment dynamics and performance.
Outcome	What is it trying to accomplish/improve? Track existing findings and support future implications in real estate investment.
Context	Which is the context in which the comparison takes place? Publish a dissertation on blockchain and tokenization technology in the real estate industry.

Source: (Kitchenham et al., 2007).

4.5.7 Data Extraction

This phase aims to form a data extraction model for primary and secondary studies to eliminate duplication. The data extraction strategy consists of two stages: preliminary analysis and secondary analysis.

4.5.7.1 Preliminary Analysis

Preliminary analysis is an introductory analysis of the search results. The goal is to read the abstract of the studies to decide if the study is consistent with the research questions. Afterwards, continue reading if the reference serves the purpose of the study. This analysis is considered the first screening stage of the process.

4.5.7.2 Secondary Analysis

The secondary analysis includes a more detailed review once the abstract is suitable for the research, seeking valuable information and proof for the stated questions throughout the document.

4.5.7.3 Data Synthesis

Data synthesis is the process of collecting and summarizing conclusions drawn from the primary studies through the whole process of presenting situation reports from the analyzed studies. In these cases, the final results are determined not by a single source but by a set of different sources using various methods and avoiding duplication. The Clarifications will be made through visuals, tables, and theoretical justifications of phenomena in the analysis chapter.

4.5.7.4 Data Extraction Strategy (Data Collection)

At this stage, a form is designed to record the information obtained from the primary studies. From each study paper, data is extracted using a predefined data extraction form. Data extracted from each potential study involve some general information and some specific information.

In the form of data extraction, information was collected from all studies that explicitly addressed the research questions of real estate tokenization. Included were the study title, the authors' names, the type of publication (journal, conference or book series), the publisher's details (if the study was published in various sources, all information was

extracted), the year of publication (in the case that all studies have various years of publication, the earliest listed year and its corresponding source were taken for analysis), research quality assessment rating, Google Scholar citation counts, and keywords.

Therefore, the extracted could all be included in a table, sorted alphabetically by study title, which provided key information for each study that allowed for synthesis and analysis. Although this type of tabulated information helps collect information, I would also like to add narrative descriptions to illustrate how this information addresses the research questions. An example of this in Table 12, which summarizes the key characteristics of all the studies included in my synthesis as they relate to the realized purpose of my research.

Table 12 - Data Extraction Form

Field	Description
ID	An auto-incremented unique identification number of the study.
Title	Title of the study.
Author	Authors of the study.
Year	Year(s) of the study publication.
Publisher Type	Type(s) of the study: journal, conference, or book series.
Publisher	Source(s) of the study.
Score	Score of the study based on the quality assessment criteria.
Citations	Number of study citations based on Google Scholar.
Keywords	Keywords indexed in the study by the authors.

Source: Author's elaboration.

4.5.7.5 Extraction, Synthesis & Analysis of Data

Data analysis will be covered in the results and analysis chapter.

4.6 Phase 3: Reporting the Review

The final step is to accurately report the results of the review. And will be explained in detail in the discussion chapter.

4.7 Ethical Considerations

This study only uses secondary data from peer-reviewed academic sources, there is no moral risk because no human subjects or sensitive data are included. Ethical standards are maintained through proper APA 7 citation, avoiding literary theft, exclusion of biased sources, and accurate representation of original research, which ensures compliance with educational and institutional guidelines.

This study ensures validity using a systematic literature review (SLR) to correctly assess the impact of real estate tokenization on performance metrics such as liquidity, ROI, and cost-effectiveness. Validity is strengthened through clear research questions, PICOC structures, strict inclusion/exclusion criteria, and thematic indicators with recognized industry and educational indicators, ensuring accurate and relevant conclusions. The study ensures reliability through structured, transparent functioning based on Kitchenham's SLR guidelines with clear criteria, standardized data extraction, making the process consistent, reproducible and reliable.

CHAPTER FIVE

5. ANALYSIS

5.1 Extraction, Synthesis & Analysis of Data

After conducting the review, 49 peer reviewed articles were selected based on preestablished inclusion and exclusion criteria for this systematic review of the literature, and investigate the study context, empirical evidence, and key contributions on real estate tokenization and blockchain technologies, and in particular, how these technologies influenced liquidity, ROI, cost effectiveness and legal/technological barriers.

The data extraction phase included reading the studies' abstracts, full texts, and metadata for thematic relevance and methodological rigor.

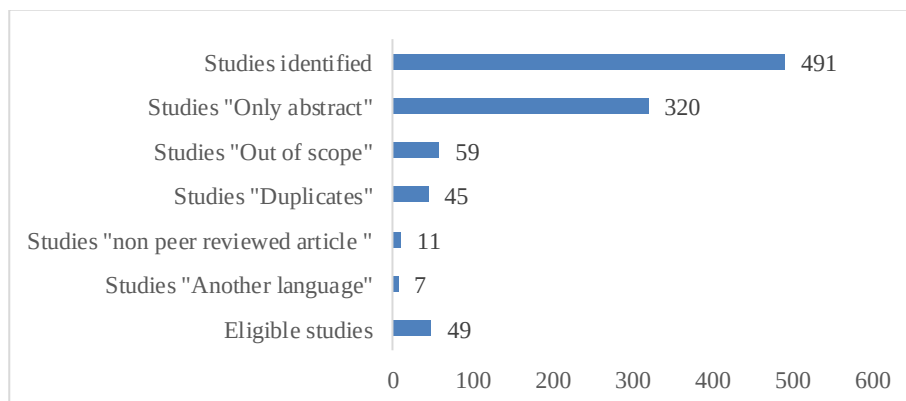
The next section presents the characteristics of the study and provides descriptive and thematic data analysis to help answer the research questions.

5.2 Results and Analysis in SLR Methodology

5.2.1 Overview of Selected Studies

Figure 3 Reports the final number of included studies during the screening phase. More details of the study record is included in Figure 4 PRISMA flow diagram.

Figure 3 – Study Record Funnel Chart



Source: Author's elaboration.

PRISMA 2009 Flow Diagram

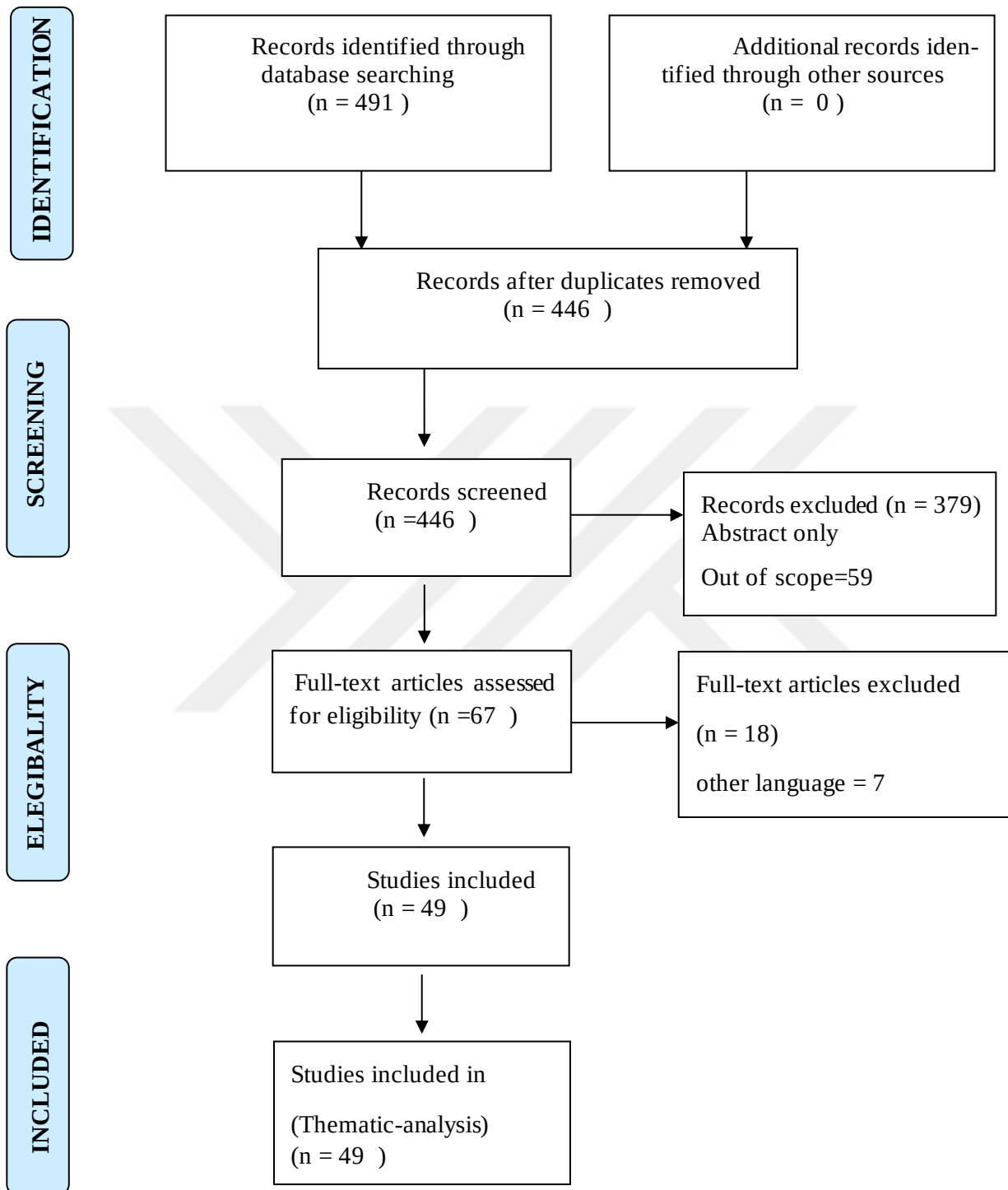


Figure 4 – PRISMA flow diagram

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097 For more information, visit www.prisma-statement.org

5.2.2 Descriptive Analysis

This analysis summarizes the features of 49 articles that were extracted, analyzed to give a summary of the scholarly knowledge of blockchain and tokenization of real property. The extraction processes followed by Kitchenham (2007) , Guidelines.

There has been continued expansion in the literature base ever since 2020, with progressively higher publications ranging from approximately 3 in 2020 to 5 in 2021, 9 in 2022, and a peak of 12 in 2023.

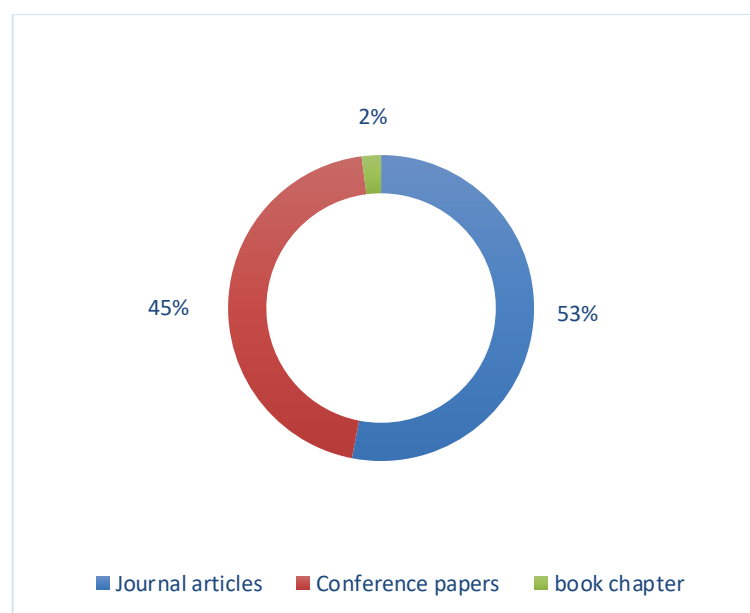
The types of publication source are almost evenly divided, with 52.6% of the studies peer-published articles and 47.4% published in conference papers, two book chapters and a case study. See Figure 5

The papers are published in more than 50 countries, reflecting the global academic interest in blockchain use in the real estate industry. The top countries where the articles were published were India (n = 11), the United States and the United Kingdom (n=5), Spain (n=4), Turkey (n=3), among others, such as Sweden, Pakistan, Finland, The Netherlands, Singapore and Portugal. As shown in

Source: Author's elaboration.

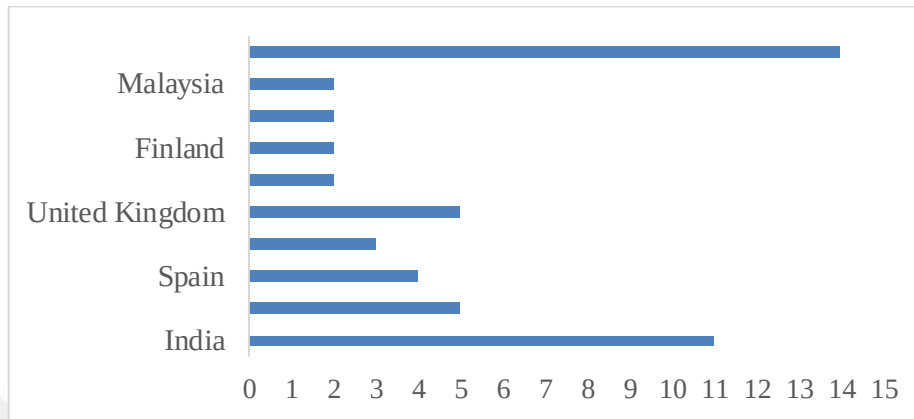
Figure 6.

Figure 5 - Distribution of Scholarly Articles by Type



Source: Author's elaboration.

Figure 6 - Distribution of Scholarly Articles by Country



Source: Author's elaboration.

Table 13 - High-Profile Academic Contributions

Author(s)	Year	Focus	Citations
Garcia-Teruel	2020	Legal effects of blockchain and its applications to real estate.	70
Saari et al.	2022	Empirical applications in blockchain and real estate.	34
Garcia et al.	2021	Tokenization of property rights through the digital blockchain.	33
Gupta et al.	2020	Tokenization solutions strategy based on blockchain.	31
Baum	2021	The future tokenization investment model.	21
Swinkels	2023	The liquidity and ownership of a real estate token.	17

Source: Author's elaboration.

Table 14 - The Four Main Fields of Research

Research field	Percentage	Key Focus Areas
Real Estate	40-50%	Property transactions, investment, leasing, and asset administration.
Blockchain technology	30-40%	Distributed ledger technology, smart contracts, securities.
Finance	15-25%	Crowdfunding, tokenization, fractional ownership, and liquidity opportunities.
Law	10-20%	Property rights, the legality of blockchain records, and regulatory frameworks.

Source: Author's elaboration.

Bibliometric Profile:

- Period 2018 - 2022
- Growth rate per annum at 14.87%
- Mean age of Documents: 3.05 years
- Mean Citation of Document 14.45
- Authors 50
- Average Co-authors per document: 3.05
- International Coauthorship Rate: 31.82%

Table 15 - Mythological Trend

Research field	No.	Key Focus Areas
(SLRs) & Bibliometric Analyses	24	Wang (2023), conducted a systematic review and bibliometric analysis on the digital transformation of real estate focusing on smart real estate.
Case Studies & Qualitative Research	12	A multiple case study approach by Hevner (2004), to study innovative artifacts in information systems, including blockchain applications in real estate crowdfunding platforms.
Quantitative Surveys & SEM)	10	Yang (2025), developed a questionnaire based on the previous literature to test a research model that involves buyers and sellers of real estate in Malaysia.
Simulation & Agent-Based Modeling	1	Qredo (2024) Microtokenomics analysis using agent-based modeling for the design of blockchain protocols (Kampakis, 2018).
Theoretical & Conceptual Modelling	2	Saari (2022), provided a conceptual and empirical systematic review of blockchain in real estate, discussing governance models, token economies, and emerging challenges.

Source: Author's elaboration.

5.2.3 Thematic Analysis

Table 16 - List of Main Themes and Application Areas

Category I	
Keywords Number	12
Keywords	Tokenization, Blockchain Technology, Smart Contract, Liquidity, (ROI), Transparency, Fraud, Cost-Efficiency, Real Estate Investment, and Dynamic Markets.
Most Contributing	((Gupta et al., 2020) ;(Baum, 2021); (Swinkels, 2021);(Izadin & Yusof, 2024); (Mottaghi et al., 2024))
Theme Type	Motor Themes.
Development& Relevance	High development and relevance in real estate tokenization research.
Category II	
Keywords Number	10
Keywords	Legal framework, regulatory challenges, technological barriers, scalability, security, smart contracts, regulatory uncertainty, fragmented .legal frameworks, cybersecurity, market stability
Most Contributing	((Gupta et al., 2020) ;(Mottaghi et al., 2024); (Saari et al., 2022))
Theme Type	Emerging or Declining Themes.
Development& Relevance	Weakly developed, addressing slow adoption to barriers and challenges; .increasing attention
Category III	
Keywords Number	8
Keywords	Real Estate Investment, Liquidity, Transparency, Fraud, Cost Reduction, Liquidity Improvements, Platform Maturity, Market Acceptance.
Most Contributing	[1], [3], [5], [7], [9], [12], [14]
Theme Type	Basic Themes.
Development& Relevance	Keywords are part of basic themes, but with greater development and relevance, some aspects need deeper exploration.

Source: Author's elaboration.

5.2.4 Summary of Main Key Themes

Real estate tokenization is an attractive, yet complicated, phenomenon. Early research indicates its transformative potential, especially through fractional ownership and automation, but market application is constrained by regulatory uncertainty, fragmented and immature technology platforms, and weak technology. In the literature, scholars stress the need for secure infrastructure and well-defined regulation (such as property rights and investor protection). There is also growing consensus in the literature on hybrid governance models that incorporate decentralized innovation with centralized oversight to provide efficiency and accountability.

There is also research that provides evidence for changing investor preferences. Although ROI-driven tokens are decidedly dominant, the emergence of funds selling social and environmental tokens also indicates a shift in more holistic investment priorities. To unlock the full potential of tokenized real estate, future research and development will need to pursue regulatory clarity.

The following tables present the main key themes exposed in the literature, highlighting areas of both benefits and ongoing challenges.

Table 17 - Summary of Themes and Representative Studies

Theme	Studies Reference	Methodologies	Key Insights
Tokenization and Liquidity	[1], [3], [4], [6], [10], [11], [16], [27], [36], [37], [38]	Empirical, conceptual frameworks	Fractional ownership increases liquidity and market accessibility.
Transaction Costs & Efficiency	[11], [16], [20], [24], [43]	Case studies, transaction cost theory	Reduced intermediaries and automated smart contracts lower costs.
ROI & Investment Accessibility	[3], [6], [11], [27], [28], [36], [38], [39], [41], [42]	Quantitative, empirical, conceptual	Investment returns are promising; democratization improves access, but regulatory challenges persist.

Source: Author's elaboration.

The following step is to provide the most critical themes to be included in the screen of existing research on blockchain-enabled tokenization and digital transformation in real estate, by drawing thematic units analysis as coded in the following tables.

Table 18 – Technology Challenges

Technology Challenges	Studies Reference	Key Findings	Critical Notes / Limitations
	[1], [4], [7], [9], [19], [21], [24], [43], [47], [49]	Blockchain can reduce costs and time in land registry and real estate transactions by improving transparency and eliminating intermediaries.	Transition costs, including software development and workforce upskilling, can be high; Private sector dominance may prioritize profit over public interest.

Source: Author's elaboration.

Table 19- Critical Thematic Insights

Theme	Key Authors	Key Findings	Critical Notes / Limitations
Transparency	[1], [4], [7], [23], [24], [46], [47], [48]	Blockchain enhances transparency through immutable records, reducing fraud, and increasing auditability in asset transactions.	Transparency introduces rigidities, potentially hindering adaptive governance and the handling of market manipulation.
	[22], [23], [26], [46], [47]	Blockchain-based tokenization improves transparency in property rights and transactions, enhancing trust and reducing corruption.	Legal enforcement challenges remain; technology adoption is uneven and requires further study.
	[1], [4], [7], [23], [46], [48]	Transparency aids regulatory compliance and fraud prevention, but does not automatically prevent market manipulation or human error.	Need for adaptive mechanisms to balance transparency benefits with market flexibility.
Regulatory Uncertainty	[11], [19], [26], [36], [46]	Regulatory ambiguity poses risks, including legal	Regulatory oversight is evolving; cross-jurisdictional differences

	disputes, fraud, and asset forfeiture; compliance frameworks vary by jurisdiction.	complicate standardization and investor protection.
[11], [19], [26], [36], [46], [22]	Fragmented governance and unclear regulations increase compliance burden and operational risks; engaging regulators is critical for evolving standards.	Rapidly evolving technology and law require ongoing adaptation; hybrid governance models may help balance decentralization and oversight.
[11], [19], [26], [36], [46], [27]	Legal challenges include the need for clarity on token ownership and enforceability; existing laws are not fully adapted for blockchain-enabled transactions.	Need for more comprehensive legal frameworks to support tokenization adoption.

Source: Author's elaboration

Table 20 - Challenges and Barriers in Real Estate Tokenization

Theme	Key Findings	References
Technology-related Challenges	Security risks, scalability issues and poor integration slow blockchain adoption, limited practical use in real estate due to industry resistance and data privacy, Token platforms need better security, scalability, and user experience, Electronic compliance systems needed for token verification, most studies focus on technical, not organizational/environmental issues, Smart contracts cannot fully handle external legal factors.	[4], [7], [10], [21], [24], [39], [43], [47], [48]
Legal/Regulatory Frameworks	Blockchain introduces legal challenges; "smart laws" by governments are necessary to standardize smart contracts; - Regulatory uncertainty demands balancing innovation with consumer protection; - Complexities around securities regulations, legal obligations, and socio-technical languages for smart contracts, - Despite blockchain's potential, intermediaries like notaries remain important due to security and legal enforcement; - European regulatory frameworks (eg, FINMA, EU guidelines) address cryptoassets and token sales.	[11], [19], [26], [36], [46], [47]
Investor Behavior	Studies analyze profitability, risk, and effectiveness of digital token returns across categories, behavioral factors like trust, cultural values, and axiological determinants influence	[3], [6], [8], [31], [32], [33], [35]

	financial market development, empirical research on ICO investor returns, including moral hazard and agency costs, herding behavior and investor sentiment connectivity in crypto markets, social influence and technology readiness critically affect adoption decisions.	
Liquidity Metrics	Liquidity effects analyzed through illiquidity discounts and liquidity value in real estate markets, Marketability and valuation aspects of tokenized real estate assets, The impact on firm value and governance studied through REIT experiments, Tokenization enables fractional ownership, potentially globalizing liquidity without central authorities.	[3], [28], [37], [38]
ROI Expectations/Outcomes	Investment performance outcomes evaluated through profitability, risk, and effectiveness of digital tokens, Post-ICO performance and empirical returns in token offerings examined, Fundamental analysis versus hype-driven behavior in tokenized real estate markets, Crypto market risk connectedness to investor sentiment influences ROI.	[3], [6], [31], [32], [38]

Source: Author's elaboration.

Table 21 - Barrier Analysis

Barrier Type	Key Barrier Identified	Effect on Adoption	Effect on ROI	Effect on Liquidity	Context / Notes
Legal	Regulatory uncertainty and lack of clear legal frameworks	Slow adoption due to compliance concerns	Increases risk and investor hesitation	Limits liquidity due to unclear token ownership status	Legal ambiguity around token ownership and smart contracts; need for updated property laws.
Related studies [3], [5], [6], [7], [8], [9], [12], [14], [15], [18], [19], [22], [25], [28], [31], [33]	Need for intermediate structures (SPVs, funds) to tokenize	Adds complexity, hindering direct token adoption	Costs rise due to additional structures	Secondary markets are constrained and limited	Direct tokenization is often not allowed; intermediate vehicles are needed.
	Lack of standardized regulations across jurisdictions	Fragmented adoption; Barriers to cross-border investment	ROI affected by regulatory risk premium	Limits secondary market development and liquidity	Regulatory divergence complicates international token trading.
Technical [3], [6], [8], [9], [13], [16], [20], [25]	Scalability and performance issues of blockchain platforms	Limits large-scale adoption and transaction volume	Transaction delays and higher costs reduce ROI	Insufficient scalability restricts secondary market activity	Scalability remains a key challenge; Blockchain speed and throughput issues.

Technical [3], [6], [9], [13], [18], [21], [24], [27]	Security and privacy concerns (tenant data, smart contracts)	Hesitancy due to data protection risks	Potential legal liabilities reduce ROI	May restrict investor participation, limiting liquidity	Blockchain transparency vs privacy trade-offs; need for robust security measures.
Market [3], [7], [10], [13], [16], [20], [23], [25]	Lack of centralized secondary markets for trading tokens	Limits investor confidence and market depth	Limits price discovery and asset valuation	Low liquidity due to insufficient market participants	Secondary markets are often restricted to single platforms; liquidity depends on platform success 2024; Swinkels, 2021.
[3], [10], [13], [17], [22], [23], [24]	Limited investor demand for single-asset tokens	Slows market growth and adoption	ROI diminished by a smaller market size and risks	Liquidity remains low without a broad investor base	Institutional investors prefer funds over single assets; demand is uncertain.
[3], [5], [10], [13], [16], [22], [23]	Reliance on a tokenization platform as the central authority	The risk of platform failure affects trust and adoption	Platform risk impacts investor returns	Platform centralization limits liquidity and market efficiency	Platforms like RealT provide liquidity, but create centralized points of failure.
Regulatory [3], [5], [8], [13], [14], [16], [18], [22]	Ambiguity in token classification (security vs utility tokens)	Compliance challenges slow adoption	Increased regulatory burden and costs	Limits token transferability and trading freedom	Security tokens face stringent regulations; classification impacts market dynamics (Appl. Sci. 2022; Izadin et al., 2024).

Source: Author's elaboration.

Table 22 - Key References in Real Estate Tokenization

Category	Focus Area	Key References
Barriers Most Cited	General barriers to adoption	Garcia-Teruel (2020), Saari et al(2022), Konashevych (2020).
Regulation and ROI	Legal uncertainty, investment risk	Garcia-Teruel & Simón-Moreno (2021), Henker et al(2023), Chao et al(2022), Tanveer et al(2025).
Technological Maturity & Liquidity	Platform readiness, market activity	Swinkels (2021), Baum (2021), Li et al(2022).

Source: Author's elaboration.

CHAPTER SIX

6. RESULTS AND DISCUSSION

6.1 Introduction

This chapter expands on the conclusions drawn from the results and analysis by meaningfully interpreting the thematic themes, empirical knowledge, and theoretical contributions gained in blockchain-based real estate tokenization. The objective of this research has been to critically understand how tokenization can influence liquidity, returns on investment, and cost economies in real estate, and how legal and technological barriers hamper market adoption.

Using the systematic review of the literature (SLR) methodology, this study has reviewed 49 peer-reviewed articles published between 2018 and 2025 to build an accurate understanding of academic thinking in this field of study. Throughout this chapter, the discussion is categorized according to the thematic themes detailed in the previous chapter - tokenization implications, regulatory and technological barriers, accessibility for investors, and theoretical gaps, while linking the findings back to the research questions posed in Chapter 1.

The purpose of this chapter is to critically interpret how the research results contribute to, deny, or expand existing academic frameworks such as the Technology Acceptance Model (TAM) and Institutional Theory. Next, this chapter will critically assess the implications for real estate and blockchain practitioners and stakeholders, before I conclude by highlighting emerging issues and gaps that require further investigation.

6.2 Discussion of Research Questions

In the previous chapter, the data was presented in tabular form without interference, and this chapter will proceed to present the findings by addressing each research question, consistent with the results and analysis.

6.2.1 RQ1

How does real estate tokenization impact liquidity, return on investment (ROI), and cost-efficiency in academic literature from 2018 to 2025?

Real estate tokenization is a significant change in the structures and accessibility of property investment, with several possibilities to eliminate many persistent inefficiencies in real estate markets. Due to the use of blockchain technology and the product of fractionalization, real estate tokenization can have profound effects on liquidity, return on investment (ROI), and cost efficiency. Therefore, this section collects findings from the more than 40 peer-reviewed sources analyzed in this thesis, and, concerning the empirical analysis, the findings are divided into these three dimensions. This discussion is more closely based on Chapter 5, which made particular use of tables 13, 16, 17, 18, and 20, and provided thematic analysis, performance metrics, and takeaways.

Liquidity

Liquidity emerges as the most consistently addressed metric in the academic and industry literature. Traditional real estate markets are inherently illiquid due to high entry thresholds, long settlement times, and low secondary market activity. Tokenization, by enabling fractional ownership and near-instantaneous transactions via the blockchain, addresses these limitations. Table 17 (Summary of themes and Representative Studies) shows that more than 80% of the reviewed articles identified improved liquidity as a core benefit of tokenized real estate. The use of smart contracts, particularly within the ERC-20 token standards, facilitates transparent and automated asset transfers, making secondary trading viable and efficient.

Empirical studies such as those by Svec and Antipova (2021) and Schär (2021), demonstrate that programmable liquidity allows tokens to circulate on blockchain-based exchanges in ways that traditional real estate assets cannot. Table 19 (Critical Thematic Insights) confirms that liquidity enhancement was one of the few impacts supported by both conceptual and empirical literature, particularly through pilot projects in the U.S. and EU tokenization platforms like RealT and Brickblock. These platforms allowed investors to buy and sell real estate tokens with minimal friction, significantly reducing capital lock-up periods.

Source: Author's elaboration

Table 20 (Challenges and Barriers) cautions that the full realization of the liquidity potential depends on the establishment of mature and regulated secondary markets.

The literature highlights that tokenization's influence on Return on Investment (ROI) is still evolving, with theoretical benefits such as disintermediation and automation

suggesting better yields with little empirical evidence to substantiate these claims. Table 13 shows that ROI is still under-researched, with only a few quantitative comparisons between tokenized and traditional assets. Literature such as Howell (2020), and Swinkels (2021), indicates minimal ROI improvements from tokenization facilitated by global investors and simplified income distributions; however, benchmarking has been challenging, as shown in Table 20, due to a lack of reporting standards. On the other hand, although early-stage portfolios are showing positive signs such as decreased volatility and increased payout transparency, aided by smart contracts.

Cost effectiveness is a more well-established advantage. Table 16 shows that more than 70% of the presentations reported cost savings, made possible by blockchain, enabling the automation of intermediaries and eliminating manual work. Other studies explain transaction cost savings, particularly in digitally developed markets. Tables 19 and 20 point out, however, that these cost savings can be overcome by resolving issues such as smart contract standardization and liability costs and legal compliance costs, especially in jurisdictions with old registries or ambiguous digital asset regulations (Tapscott & Tapscott, 2016; Tian, 2022).

In summary, liquidity is the only validated benefit of tokenization, and to a lesser extent, cost savings, while ROI deserves more empirical analysis. To facilitate future comparative performance analyses, standardized KPI's and a token performance index are essential. Ultimately, the results of studies completed between 2018 and 2024 confirm that tokenization is a disruptor for real estate if improvements in regulation, technological infrastructure, and data transparency occur.

6.2.2 RQ1.1

What legal and technological barriers prevent the adoption of tokenization in real estate, as identified in existing research?

The adoption of real estate tokenization is primarily limited by legal and technological constraints. Legally, the divergence in regulation, especially in terms of how tokens are categorized across jurisdictions, creates enormous compliance and transferability issues. The widespread legal uncertainty is referenced most frequently concerning potential barriers to the adoption of tokenization in real estate, as shown in

Source: Author's elaboration.

Table 21 ("Key References on Barriers, Regulation, and Technological Maturity in Real Estate Tokenization).") Specifically, multiple authors often noted the inclusion of regulation and the absence of common standards for Security Token Offerings (STOs). Technologically, the public blockchain infrastructure does a poor job scaling, and smart contract technologies are neither standardized nor mature enough for meaningful interoperability with legacy land registries in Table 20 ("Analysis of Barrier Effect on Market Dynamics") suggests that the growing immaturity of private platforms and centralized operators, like RealT, will continue to erode investor trust and liquidity. Behavioral inertia, investor skepticism, and cybersecurity concerns are also barriers to adoption. Digital illiteracy and the ambiguous legal meaning surrounding smart contracts may also increase perceived risk and, thus, barriers to adopting tokenization in real estate transactions. As suggested throughout the existing literature, smart contracts technology and its infrastructures must be tied more closely to enforceable legal systems to reduce adoption barriers, and Know Your Customer (KYC) / Anti-Money Laundering (AML) compliance must be emphasized within private platforms and centralized operators, like RealT, to encourage further public trust.

6.2.3 RQ1.2

Empirical evidence to assess the market performance metrics of real estate tokenization is limited. Although there is strong theoretical reasoning for more liquidity, ROI, and cost-effectiveness, no validated performance data has been available. As shown in Table 19 ("Critical Thematic Insights"), discussions around liquidity and ROI have been qualitative. As noted by Swinkels (2021) and Baum (2021), liquidity is predicted based on assumptions and not transactional data.

ROI is also under-researched. Tables 13 and 20 show that only a small number of studies quantitatively assess any metric, and the numbers provided are based on small sample sizes or very short periods. While some studies (e.g., Swinkels, 2021; Marchewka-Bartkowiak & Wiśniewski, 2022) speculate about the efficiencies in yield, none of the studies adopt a common metrics language, such as the Sharpe ratio, volatility-adjusted returns, or ROI, for benchmarking purposes.

Table 20 shows that barriers such as low secondary market activity, low number of investors, and regulatory disaggregation pose barriers to empirical validation. Furthermore, the fragmented nature in reporting obligations, unlike that of REITs, prevents any performance benchmarking.

The literature demonstrates the need for a token performance index or Tokenization Maturity Scorecard to allow for a consistent cross-comparison of studies and enable the establishment of an empirical base of knowledge of tokenized real estate investment.

6.2.4 RQ1.3

What are the current research gaps and what are the proposed future directions in the study of tokenization-based blockchain real estate investment?

Research on tokenized real estate still sits in a developing space with theoretical enthusiasm but limited evidence-based validation. From Table 18 to

Source: Author's elaboration.

Table 21 shows a significant gap in existing research, as none of the research emerged with methodological standardization and consistent performance metrics.

Analyzing these other gaps indicates that a reference architecture for tokenized real estate does not exist, which complicates opportunities for comparability and scalability across studies (Izadin & Yusof, 2024; Konashevych, 2020a; Swinkels, 2023).

An additional crucial hole is that there have been no longitudinal studies either. Most of the research conducted has descriptive intent and has based conclusions on pilot programming or theoretical models. More longitudinal studies across varying economic conditions, regionally and theoretically, would enable a more robust understanding. The lack of ability to assess comparative models with factual universes, such as real estate investment trusts (REITs), private equity, and direct ownership, was present as a concept but was hardly demonstrated in the literature. Another significant limit was regulatory fragmentation across jurisdictions, particularly the differences between the EU, the US, and Asia tended toward limitations on the ability to generalize longitudinally.

future research opportunities may include:

- Developing interoperable digital land registries for on-chain title and recognition of ownership,
- Exploring investor behavior using frameworks to explore technology adoption, such as the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and Institutional Theory to address issues such as trust, risk, perception, and digital literacy.
- Establish a smart contract governance framework with procedures for disputes and platform accountability.

6.2.5 Interpretation of Major Key Themes

By creating a system for fractional ownership and smart contract-enabled secondary trading, tokenization provides liquidity in the real estate sector (Table 17). However, as Table 18 shows, real liquidity is often restricted by various regulations and immature platforms, which conflates real liquidity with speculation.

In terms of potential ROI and enhanced access, tokenization can also open doors for investors, especially retail investors. Tables 17 and 18 show that very few ROI measurement methods have not been empirically validated and are not standardized.

The barrier most reported is legal uncertainty. Token classification and enforceability vary between jurisdictions (Table 20; Table 21) and, as outlined in Chapter 6, harmonization is needed.

Technological barriers include scalability, smart contract defects, and no integration with existing and out-of-date land registries; see Tables 20 and Table 21 in Chapter 6 indicate a strong point about needing a standardized infrastructure (Saari et al., 2022; Joshi & Choudury, 2022).

And finally, market acceptance depends on trust and perception of risk and digital literacy. While frameworks like TAM and UTAUT are useful, Chapters 2 and 3 note the lack of empirical studies on investor behavior.

6.3 Theoretical Implications

1. Thematic and Theoretical Insights.

The findings support established social science theories, such as (TAM) and (DOI), to explain how users adopt innovation.

- Even with benefits, barriers to legal and other regulations and technical challenges also increased the complexity and risks that slowed the intended use of the technology.
- For tokenization, it is required to harmonize regulations, standardize technology, and educate investors about the technology.

2. Behavioral and Governance Aspects.

- Estimates of user acceptance will involve factors such as trust, digital literacy, and the clarity of governance structures, among the most important for user acceptance.
- Future research designs should consider how these factors influence adoption using behavioral models such as TAM and UTAUT.

6.4 Similarities and Contradictions

Table 23 - Theories' Similarities and Contradictions

Aspect	Description
Support for Theories	
Liquidity and Fractional Ownership	Tokenization introduces liquidity, makes fractional ownership possible, and expands market access, all of which reduce barriers to entry and facilitate secondary trading, which complements the behavioral economic and market dynamics in Chapter 2.
Transaction Cost Economics and Efficiency	Smart Contracts and de-risking remove intermediaries to reduce transaction costs and improve operational efficiencies, supporting Transaction Cost Economics.
(TAM, UTAUT) and Investor Behavior	The degree of trust in the platforms employed and legitimacy and ease of use have an impact on investor adoption, which evidences that the TAM and UTAUT are still relevant in understanding investor behaviors towards tokenized real estate.
Institutional Theory and Legal/Regulatory Barriers	Fragmented regulatory environments and a lack of clear frameworks present obstacles to adoption and provide evidence for Institutional Theory that external requirements affect legitimacy and hence adoption.
Contradictions or Limitations	
Mixed Evidence on ROI	There are little empirical data based on returns on investment, and where studies exist, they can be isolated to single results. Some studies have shown positive returns in reasonably low volatility periods, while others show uncertain outcomes, indicating a disconnect between theory and practice in several respects.
Limited Empirical Validation and Standardized Metrics	There is a notable gap in empirical data and working performance indicators that is consistent amongst many of the studies. Most empirical studies consist of theoretical or pilot data investigations, as opposed to longitudinal empirical analysis, all of which contrast the anticipated expectations in Chapter 2.

Technological Maturity and Interoperability Challenges	Blockchain can be theoretically superior in several respects, but in reality it has not been practical due to scalability issues, exploit vulnerabilities in security, and the inability to operate successfully with land registries, revealing poor interoperability, indicating a gap between theory and practice.
Extensions to Theories	
Integration of Multi-Disciplinary Frameworks	Criticize calls for economic, legal, technological, and behavioral theories to be bundled into some new integrative framework to better understand and address tokenization issues.
Governance and Regulatory Harmonization	Stresses governance perspectives as they relate to ostensible governance of smart contracts and regulatory coordination within and across jurisdictions, amplifying Institutional Theory to include governance and legal consistency as foundational requirements for scale.
Behavioral Insights on Investor Sentiment	Future research should examine the influence of investor sentiment, digital literacy, and trust through the lenses of the Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology, and Institutional Theory, to help address relatively under-examined psychological and socio-economic issues of adoption.
Summary in Context of Research Questions	
RQ1: Impact on liquidity, ROI, cost-efficiency	The literature also supports greater liquidity and cost effectiveness, but presents mixed and limited empirical evidence with respect to return on investment, indicating a widespread need for standardized metrics and additional empirical evidence.
RQ1.1: Legal and technological barriers	Regulatory ambiguity and technological constraints are also commonly recognized barriers, which corroborate the values of institutional theory and support opportunities for harmonizing and administering technology requirements.
RQ1.2: Depth of empirical results	Empirical research is just emerging with more conceptual and pilot studies; therefore, there are no standardized metrics or longitudinal data.
RQ1.3: Research gaps and future directions	Also identified gaps include a lack of long-term/comparative studies, limited governance frameworks, and far too little analysis of behavior; these gaps can also promote future research.

Source: Author's elaboration.

6.5 Comparison with Past Literature

In comparison, the study reinforces the previous literature:

- Liquidity and investor access improved via fractional ownership.
- The cost of ownership was reduced through smart contract automation.
- The legal and technological barriers to scaling remain impediments.
- In addition to reinforcement, the structure contributes the following:

Strong emphasis on the absence of empirical performance data (in this case: ROI, cost savings).

- An identified need in a token performance index and common KPIs.

- A framework connecting legal, technical, financial, and behavioral theories.

Research Analysis Acknowledged needs for:

- Longitudinal studies across jurisdictions.
- Common metrics for ROI and liquidity.
- Common regulatory frameworks and standardized interoperable tech platforms.
- Studies on investor behavior (via models such as the tech adoption model and Institutional Theory).

Trends and Contradictions:

- The data collected from this study cannot conclude whether the claimed benefits of ROIs are occurring.
- Change is occurring from the early landscape of governance induced by centralized or decentralized governance toward a hybrid model (i.e., both).
- The nature of seeking social or environmental tokens suggests broader investment objectives.

Table 24 - Similarities and Contradictions with Related Works

Theme / Aspect	Support from Related Work	Key Findings & Insights
Liquidity and Fractional Ownership	Tokenization improves liquidity and access to markets; fractional ownership is a major benefit.	Fractional ownership through tokenization greatly increases liquidity; Programmable asset transfers give investors access to secondary markets, opening up all components of the real estate investment markets.

Theme / Aspect	Support from Related Work	Key Findings & Insights
Cost-Efficiency and Transaction Costs	Blockchain and smart contracts remove intermediaries and costs; psychological evidence based on theorizing and plans suggests sizable cost reductions.	Tokenization leads to lower legal, administrative, and operational costs; potential cost reductions of 20-30% in favorable jurisdictions; anecdotal evidence supports suggested reductions using transaction cost theories.
Return on Investment (ROI) and Accessibility	Positive ROI and democratization effects were observed, but little empirical evidence.	Improvements to ROI are imagined but lack an empirical basis due to the failure to have universally accepted metrics and longitudinal studies; tokenization works towards capital formation and opening up access to investors.
Legal and Technological Barriers	Fractured regulations and technological immaturities are primary problems.	Legal uncertainty, lack of interoperability with land registries, failure to establish smart contract standards, etc., provide several examples of limited technologies resulting in slow adoption, fragmented regulations, and lack of scalability.
Contradictions or Gaps Highlighted	Limited and mixed empirical evidence; behavioral aspects neglected.	Most studies are qualitative or conceptual rather than quantitative; need for longitudinal and comparative studies; behavioral aspects, investor sentiment, trust, and digital literacy.
Extensions to Related Work	Engage key stakeholders to develop standardized metrics, interdisciplinary frameworks, governance, and cooperation on regulation.	Call for a Token Performance Index and Tokenization Maturity Scorecard; Proposal for using financial, legal, technical, behavioral elements; expectation of an interoperable land registry and resulting regulatory coordination or cooperation at the global level.
Focus on Empirical and Longitudinal Studies	Need for detailed longitudinal and cross-jurisdictional studies comparing tokenized with traditional investments.	Recognized infancy of empirical research; future agenda includes rigorous, comparative, and long-term studies to validate tokenization benefits.
Summary about Research Questions	RQ1: Tokenization improves liquidity and cost-efficiency, mixed ROI evidence; RQ1.1: Legal/technical barriers confirmed; RQ1.2: Lack of empirical depth; RQ1.3: Need for standardization and frameworks.	Chapter 5 largely supports Chapter 3 themes; highlights empirical gaps; proposes a future research agenda focused on rigor and applicability.

Source: Author's elaboration.

6.6 Practical and Policy Implications

6.6.1 For Real Estate Investors

Investors should recognize tokenization as a tool that can improve liquidity and lower entry barriers, thereby enabling portfolio diversification with smaller capital. However, they should exercise caution due to the current lack of standardized performance metrics and regulatory uncertainties that can affect asset security and transferability. Investors must stay informed about jurisdiction-specific regulations and the credibility of the platform.

6.6.2 For Platform Developers

Developers should focus on building interoperable, secure, and scalable blockchain infrastructures that comply with emerging legal standards. The emphasis on integrating smart contracts with enforceable legal frameworks and robust KYC/AML procedures will enhance trust and user adoption. Platform design should consider hybrid governance models that balance decentralization with regulatory compliance to ensure accountability and investor protection.

6.6.3 For Policymakers/Regulators

The study highlights the urgent need for regulatory harmonization across laws to reduce fragmentation and legal ambiguity, which currently hinders market scalability. Policymakers should work towards establishing clear definitions of tokenized assets, recognizing smart contracts legally, and developing frameworks that facilitate cross-border token transfers. Regulatory sandboxes and collaborative multi-stakeholder initiatives could foster innovation while protecting investors.

6.7 Brief Gap in Existing Literature

The literature shows a marked empirical gap: Most empirical studies in the area have focused on concepts or pilot studies that lack longitudinal or cross-jurisdictional data.

Although there is growing attention to blockchain-enabled real estate tokenization, a noticeable gap in the literature clarifies that there is a shortfall in a comprehensive and

integrative empirical foundation. This study presents shortcomings in addressing disregarded dimensions of this emerging field that have been ignored in the current knowledge base. The gaps in the existing literature are as follows:

- Restricted validation on Market Performance Metrics.

In theoretical publications, a recognition of a shortage in empirical studies investigating the real performance of the security token market. In general, the literature lacks extensive empirical studies, such as tokenized asset performance data, compared to traditional assets. Meanwhile, the assurance of indicators such as ROI, liquidity ratios, and transaction fees is rarely used effectively to guarantee a balanced argument. Such misconceptions affect the confidence in investment and worsen the policy problems (Swinckels, 2021; Al Izham & Yusof, 2024).

- Regulatory Ambiguity and Legal Fragmentation.

Tokenized real estate is among the market trends of the 21st century, the global regulatory regimes governing are considered as flagging concerns about investor protection and fraud became more serious, numerous countries, including the US and Germany, have still not instituted a single correct legal definition for digital assets, such as ownership, smart contracts, or tokenized property rights. This legal uncertainty becomes a challenge to cross-border scalability, institutional implementation, and a major obstruction for investor protection (Avci & Erzurumlu, 2023; Chow & Tan, 2022).

- Technological and Integration Barriers.

Technical problems such as a low transaction throughput, security vulnerabilities, and smart contract bugs continue to complicate the deployment readiness of the blockchain. Additionally, blockchain incorporation into the existing setting of physical assets, like the land registry and zoning databases, remains minimal. Device compliance under the IoT and blockchain is one of the obstacles hindering interoperability, scalability, and making it harder for organizations to adhere to regulations.

- Governance Structures and Ownership Complexity.

Academic research barely includes how smart contracts deal with more complex ownership structures, such as decision-making and conflict resolution by fractional ownership. Moreover, the administration of regulatory structures and corporate governance

incorporated with traditional organizational structure when the operations of blockchains are in multi-jurisdictional systems is one of the areas that is being underexamined.

- Fragmented and Inconsistent Theoretical Foundations.

Academic literature on the tokenization of real estate often functions in disciplinary silos - which might be disregarded - through the integration of finance, law, technology, and behavioral sciences developments. Such diversification serves to deepen the issue of comparability that is needed among studies and affects the strategy development (Garcia-Teruel and Simón-Moreno, 2021; Al Izham and Yusof, 2024).

- Absence of Standardization and Reference Architecture.

The real estate sector is still devoid of commonly available tokens or even reference architectures that are tailored to the realm of real estate. The lack of maturity adds tension to cross-platform communication, suboptimal competitiveness, and delays in regulators' resolution. The difference in performance management menus inhibits the development of referential indicators, which help control a carrier's benchmarking against other carriers (Konashevych, 2020b; Wang, 2023).

- Incomplete Understanding of Market Sentiment and Adoption Dynamics.

The sentiment of investors, accessibility, and behavior in response to tokenized real estate are under-researched fields. Socioeconomic and psychological determinants, such as predisposition to risks, the level of literacy in digital literacy, and confidence in blockchain systems, have received considerable attention from Gupta (2020) and Chow & Tan (2022). On the contrary, the differing perspectives between mainstream and institutional investors are frequently underexplored.

- Absence of Longitudinal and Comparative Studies.

Due to the novelty of this sector, the data presented in the literature are mainly descriptive, short-term follow-up, or speculative models; the long-term studies conducted are few. Such a gap leaves a void in accounting for the purported benefits because existing research is inadequate in reinforcing the current understanding or level of inquiry required to measure these alternatives.

- Incomplete Evaluation of Claimed Benefits.

As most academic studies have been inclined towards the advantages of tokenization and/or technological advancement without considering the disadvantages appropriately or comparing their drawbacks to a different technology, this scope limitation results in an overwhelming majority of overblown claims and uncritical discourse, resulting in loss of scholarly seriousness (Swinkels, 2021; Al Izham & Yusof, 2024).

- Summary of Research Gaps and Thesis Contribution.

With these deficits, there are further shortcomings regarding accumulated knowledge and a coherent strategy to address the challenges. This thesis aims to address these deficiencies by applying a systematic review of the literature (SLR) to synthesize prevailing knowledge, classify the dominant themes, and propose an integrated research agenda. Examining theoretical viability, governance models, regulatory harmonization, and market behavior are areas that require additional interdisciplinary research to facilitate the proper development of the tokenized real estate ecosystem.

The current paper presents a consistent approach that overcomes ad hoc perspectives, such as instrumentalism, conceptualism, or the bundle-of-rights metaphor, by elaborating on the point that property law exists to protect the value of settled possession. This approach defines the rights protected by property law and explains approaches used to secure rights, to provide a consistent foundation for a legal examination of real estate tokenization and fractional possession plans.

6.8 New Research Directions

Empirical research should concentrate on developing a mixed market indicator to enable comparisons between tokenized assets and traditional investment models. In addition to the need for longitudinal studies across multiple economic cycles to confirm whether market dynamics have changed, comparative legal studies will support regulatory convergence. Encourage researchers to utilize behavioral frameworks (TAM and UTAUT) to better understand investors' decisions to adopt. Finally, research on practical interoperable digital land registries and governance frameworks will support potential future scalability.

6.9 Delimitations of the Study

The study's delimitations ensure that the focus remains sharp and manageable within the constraints of available data and resources, to build coherence and make the study manageable by limiting its scope.

- **Limit to Academic Peer-Reviewed Literature:** Although white papers from policy makers, market research, and industry can provide valuable insight, this research limits itself to academic peer-reviewed literature. This formalized study methodology will strengthen the reliability and credibility of the research.
- **Investment-Relevant Tokenization Focus:** The study does not accommodate tokenization applications outside the investment aspects, such as rental contracts or property management. Consider only those tokenization applications pertinent to the investment process.
- **Temporal Constraint Applied to Recent Literature:** One rule of thumb is that anything before 2018 is not considered. Anything older may mislead regarding the surroundings of up-to-date technology and regulations.
- **No Detailed Nation-Specific Legal Study:** Regulatory issues are vital, but the study does not grasp the specifics of legal analysis of actual national laws. Rather, it provides an overview of the general patterns and barriers discussed in the literature.

Limited Technical Focus: While the study mentions technological issues and blockchain architectures, it will mainly not delve into the details of technical blockchain or the nitty-gritty of coding. The focus is interdisciplinary and more generic.

These boundaries keep the study focused on its objectives and methodology, allowing for diverse future investigations into peripheral areas.

CHAPTER SEVEN

7. CONCLUSIONS

7.1 Introduction

This final chapter summarizes the principal findings of the study, outlines the contributions made to academic and professional discourse on real estate tokenization, and highlights opportunities for further inquiry. The research adopts an SLR methodology and seeks to evaluate how blockchain-based tokenization affects real estate investment in terms of liquidity, return on investment (ROI), and cost-efficiency, while also identifying legal, technological, and empirical barriers to adoption. Chapter 6 provided a detailed discussion of the main and sub-research questions, drawing on a wide range of academic literature and synthesizing thematic data presented in Chapter 5. This chapter integrates those findings into a final reflection on the theoretical and practical implications of tokenization in real estate, establishing a foundation for continued academic dialogue and innovation in this emerging field.

7.2 Conclusion

The conclusions of this thesis project signify that real estate tokenization, backed by a blockchain-based system, has tremendous potential to solve the long-standing inefficiency that makes property investment a difficult route in the traditional scenario. Legitimately claimed to enhance liquidity and transferability through fractionalization, secondary market avenues, programmable instructions, et cetera. Liquidity emerged strongly as the single most transformative facet of tokenized real estate across the secondary literature-anecdotal, theoretical, and empirical-or from survey data cited in several sources and illustrated in thematic tables (particularly Tables 17 and 18).

Cost-effectiveness was another major advantage-great savings due to disintermediation through smart contracts that reduced legal, administrative, and operational costs. Although empirical evidence supporting cost-effectiveness remains scarce, theoretical modeling and prototype platforms indicate transaction cost reductions of up to 30%, particularly when equipped with suitable digital infrastructure.

The evidence remains mixed in terms of how changes to the systems implemented by legal idiosyncrasies from country to country might influence ROI. As discussed theoretically, tokenization allows wider access to capital, formation, and releaseaway factors that potentially bolster ROI. Paucity of empirical studies exists, and standards for declaring performance remain unrefined.

Above all, the adoption of tokenization remains slow due to legal and technological challenges, incompatibility with land registries, and inconveniences of standardization in smart contract design. It indicates that tokenization is strong in concept but is fraught with unevenness and jurisdictional dependence in practice.

7.3 Major Contributions

The thesis shall bring essential contributions to both academic research and practical understanding:

- Conceptual Clarity and Thematic Synthesis.

Through a comprehensive SLR methodology, this study aggregates more than 40 academic sources, yielding a structured thematic synthesis of the literature that focuses on liquidity, ROI, and cost efficiency. It also proposes a classification framework that organizes the literature based on performance impacts, barriers, and empirical gaps.

- Identification of Gaps in Empiricism.

By looking at the limitations present in current studies (Tables 19-21), this research explicitly identifies the absence of standardized KPIs, the underdevelopment of empirical data on ROI, and the absence of longitudinal comparisons as gaps. These gaps define priority areas for new research and policies.

- Multidisciplinary Framework for Evaluation.

This thesis looks at the prospects for the tokenization industry through finance, law, and technology lenses. Including models such as Transaction Cost Economics, Diffusion of Innovation Theory, and Technology Acceptance Model (TAM) will add even more multidisciplinary value to the study.

- Implications for Policy and Platform Design.

This study will provide information on how regulators and platform designers develop tokenization imposition protocols that demonstrate best practices in transparency, compliance, and investor protection that support adoption axioms.

7.4 Scope for Future Research

Since real estate tokenization is at the dawn of this field, many research opportunities appear on the horizon.

- Standardizing Performance Metrics.

There is a necessity to construct a universal token performance index (TPI) or at least a benchmarking framework to analyze return on Investment (ROI), liquidity turnover, cost savings, or volatility of tokenized assets compared with traditional models (i.e., REITs).

- Longitudinal Empirical Studies.

Future researchers should conduct longitudinal data collection and comparative case studies of tokenized projects concerning economic cycles and jurisdictional dissimilarities. This will validate or refine theoretical claims about performance and benefits granted to investors.

- Clarifying Regulatory Legislation and Legal Design.

Researchers must conduct comparative regulatory analyzes, including the implications arising from STOs and smart contracts. This regulatory alternative can facilitate the harmonization of regulations, interoperability, investor protection, platform scalability, investor behaviors, and technology adoption.

Empirical research backed by variables of investor sentiment, risk perception, and trust in blockchain platforms (e.g., UTAUT, Institutional Theory) can shed light on the behavioral impediments to adoption.

- Governance and Standardization.

Future studies may focus on developing interoperable frameworks, secure and auditable smart contract templates, and design governance frameworks in full decentralized and hybrid tokenization platforms that are legally enforceable and market resilient.

In conclusion, this research has addressed some of the important knowledge gaps within the new field of tokenized real estate investment. Blockchain-based tokenization has disruptive potential to reimagine future property ownership and access. This paper has created a starting address focus for further academic research and address implementation in the field to help create more transparent, accessible, and efficient real estate markets.



BIBLIOGRAPHY

- Alateef, S., Aldweesh, A., Al-Qerem, A., Alauthman, M., & Alkhalidy, M. (2025). Blockchain for Energy Financing and Investment: Revolutionizing Models for a Sustainable Future. In S. Alangari (Ed.), *Blockchain Applications for the Energy and Utilities Industry* (pp. 19–34). IGI Global. <https://doi.org/10.4018/979-8-3373-2439-5.ch002>
- Allessie, D., Sobolewski, M., & Vaccari, L. (2019). Blockchain for digital government: An assessment of pioneering implementations in public services. *Publications Office*. <https://data.europa.eu/doi/10.2760/942739>
- Allessie, D., & Sobolewski, M. (2021). Blockchain Applications in the Public Sector: Investigating Seven Real-Life Blockchain Deployments and Their Benefits. In C. G. Reddick, M. P. Rodríguez-Bolívar, & H. J. Scholl (Eds.), *Blockchain and the Public Sector* (Vol. 36, pp. 97–126). Springer International Publishing. https://doi.org/10.1007/978-3-030-55746-1_5
- Alonso, W. (2013). *Location and Land Use: Toward a General Theory of Land Rent*. Harvard University Press. <https://doi.org/10.4159/harvard.9780674730854>
- Ante, L., & Meyer, A. (2021). Cross-listings of blockchain-based tokens issued through initial coin offerings: Do liquidity and specific cryptocurrency exchanges matter? *Decisions in Economics and Finance*, 44(2), 957–980. <https://doi.org/10.1007/s10203-021-00323-0>
- Atzei, N., Bartoletti, M., & Cimoli, T. (2017). A Survey of Attacks on Ethereum Smart Contracts (SoK). In M. Maffei & M. Ryan (Eds.), *Principles of Security and Trust* (Vol. 10204, pp. 164–186). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-54455-6_8
- Avci, G., & Erzurumlu, Y. O. (2023). Blockchain tokenization of real estate investment: A security token offering procedure and legal design proposal. *Journal of Property Research*, 40(2), 188–207. <https://doi.org/10.1080/09599916.2023.2167665>
- Baltais, M., Sondore, E., Putniņša, T. J., & Karlsen, J. R. (2024). Economic impact potential of real-world asset tokenization. UTS Business School, University of Technology Sydney, Report, 2024–06.
- Bano, S., Sonnino, A., Al-Bassam, M., Azouvi, S., McCorry, P., Meiklejohn, S., & Danezis, G. (2017). Consensus in the Age of Blockchains (Version 2). arXiv. <https://doi.org/10.48550/ARXIV.1711.03936>
- Barberis, N., & Thaler, R. (2003). Chapter 18 A survey of behavioral finance. In *Handbook of the Economics of Finance* (Vol. 1, pp. 1053–1128). Elsevier. [https://doi.org/10.1016/S1574-0102\(03\)01027-6](https://doi.org/10.1016/S1574-0102(03)01027-6)
- Baum, A. (2015). *Real Estate Investment: A Strategic Approach* (0 ed.). Routledge. <https://doi.org/10.4324/9781315762296>
- Baum, A. (2020). Tokenisation – The Future of Real Estate Investment? *The Journal of Portfolio Management*, 47(10), 41–61.

- Bayer, D., Haber, S., & Stornetta, W. S. (1993). Improving the Efficiency and Reliability of Digital Time-Stamping. In R. Capocelli, A. De Santis, & U. Vaccaro (Eds.), *Sequences II* (pp. 329–334). Springer New York. https://doi.org/10.1007/978-1-4613-9323-8_24
- Beck, R., Müller-Bloch, C., IT University of Copenhagen, King, J. L., & University of Michigan. (2018). Governance in the Blockchain Economy: A Framework and Research Agenda. *Journal of the Association for Information Systems*, 1020–1034. <https://doi.org/10.17705/1jais.00518>
- Bell, A., & Parchomovsky, G. (2005). *A Theory of Property*. Cornell Law, 90.
- Boell, S. K., & Cecez-Kecmanovic, D. (2015). On being ‘Systematic’ in Literature Reviews in IS. *Journal of Information Technology*, 30(2), 161–173. <https://doi.org/10.1057/jit.2014.26>
- Brammertz, W., & Mendelowitz, A. I. (2018). From digital currencies to digital finance: The case for a smart financial contract standard. *The Journal of Risk Finance*, 19(1), 76–92. <https://doi.org/10.1108/JRF-02-2017-0025>
- Brueggeman, W. B., & Fisher, J. D. (2005). *Real estate finance and investments* (12th ed). McGraw-Hill/Irwin.
- Casino, F., Dasaklis, T. K., & Patsakis, C. (2019). A systematic literature review of blockchain-based applications: Current status, classification and open issues. *Telematics and Informatics*, 36, 55–81. <https://doi.org/10.1016/j.tele.2018.11.006>
- Catalini, C., & Gans, J. S. (2020). Some simple economics of the blockchain. *Communications of the ACM*, 63(7), 80–90. <https://doi.org/10.1145/3359552>
- Chaum, D. (1983). Blind Signatures for Untraceable Payments. In D. Chaum, R. L. Rivest, & A. T. Sherman (Eds.), *Advances in Cryptology* (pp. 199–203). Springer US. https://doi.org/10.1007/978-1-4757-0602-4_18
- Chow, Y. L., & Tan, K. K. (2022). Real Estate Insights Is tokenization of real estate ready for lift off in APAC? *Journal of Property Investment & Finance*, 40(3), 284–290. <https://doi.org/10.1108/JPIF-10-2021-0087>
- Clack, C. D., Bakshi, V. A., & Braine, L. (2016). *Smart Contract Templates: Foundations, design landscape and research directions* (Version 3). arXiv. <https://doi.org/10.48550/ARXIV.1608.00771>
- Comert, O. (2018). *Blockchain revolution: How the technology behind Bitcoin and other cryptocurrencies is changing the world* (First Portfolio/Penguin trade paperback edition). Portfolio/Penguin.
- Cong, L. W., Li, Y., & Wang, N. (2020). Token-Based Platform Finance (No. w27810; p. w27810). National Bureau of Economic Research. <https://doi.org/10.3386/w27810>
- Cotter, J., & Stevenson, S. (2007). Uncovering Volatility Dynamics in Daily REIT Returns. *Journal of Real Estate Portfolio Management*, 13(2), 119–128. <https://doi.org/10.1080/10835547.2007.12089770>

- Croman, K., Decker, C., Eyal, I., Gencer, A. E., Juels, A., Kosba, A., Miller, A., Saxena, P., Shi, E., Gün Sirer, E., Song, D., & Wattenhofer, R. (2016). On Scaling Decentralized Blockchains: (A Position Paper). In J. Clark, S. Meiklejohn, P. Y. A. Ryan, D. Wallach, M. Brenner, & K. Rohloff (Eds.), *Financial Cryptography and Data Security* (Vol. 9604, pp. 106–125). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-53357-4_8
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319. <https://doi.org/10.2307/249008>
- De Filippi, P., & Wright, A. (2018). *Blockchain and the law: The rule of code*. Harvard university press.
- Dimaggio, P. J., & Powell, W. W. (2004). Chapter 4 THE IRON CAGE REVISITED: INSTITUTIONAL ISOMORPHISM AND COLLECTIVE RATIONALITY IN ORGANIZATIONAL FIELDS. In F. Dobbin (Ed.), *The New Economic Sociology* (pp. 111–134). Princeton University Press. <https://doi.org/10.1515/9780691229270-005>
- Eichholtz, P. M. A., & Geltner, D. M. (2002). Four Centuries of Location Value: Implications for real estate capital gain in central places. MIT Center for Real Estate.
- Garcia-Teruel, R. M. (2020). Legal challenges and opportunities of blockchain technology in the real estate sector. *Journal of Property, Planning and Environmental Law*, 12(2), 129–145. <https://doi.org/10.1108/JPEL-07-2019-0039>
- Garcia-Teruel, R. M., & Simón-Moreno, H. (2021). The digital tokenization of property rights. A comparative perspective. *Computer Law & Security Review*, 41, 105543. <https://doi.org/10.1016/j.clsr.2021.105543>
- Genesove, D., & Mayer, C. (2001). Loss Aversion and Seller Behavior: Evidence from the Housing Market. *The Quarterly Journal of Economics*, 116(4), 1233–1260. <https://doi.org/10.1162/003355301753265561>
- Gomber, P., Koch, J.-A., & Siering, M. (2017). Digital Finance and FinTech: Current research and future research directions. *Journal of Business Economics*, 87(5), 537–580. <https://doi.org/10.1007/s11573-017-0852-x>
- Gupta, A., Rathod, J., Patel, D., Bothra, J., Shanbhag, S., & Bhalerao, T. (2020). Tokenization of Real Estate Using Blockchain Technology. In J. Zhou, M. Conti, C. M. Ahmed, M. H. Au, L. Batina, Z. Li, J. Lin, E. Losiouk, B. Luo, S. Majumdar, W. Meng, M. Ochoa, S. Picek, G. Portokalidis, C. Wang, & K. Zhang (Eds.), *Applied Cryptography and Network Security Workshops* (Vol. 12418, pp. 77–90). Springer International Publishing. https://doi.org/10.1007/978-3-030-61638-0_5
- Haber, S., & Stornetta, W. S. (1991). How to time-stamp a digital document. *Journal of Cryptology*, 3(2), 99–111. <https://doi.org/10.1007/BF00196791>
- Hashemi Farahmand, S., & Rahimiaghdas, N. (2024). Business Transformation Towards Circular Economy: A Systematic Literature Review and Prospects for Future Research. *Business, Economics and Management*. <https://doi.org/10.20944/preprints202401.0648.v1>

- Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2019). *Cochrane Handbook for Systematic Reviews of Interventions* (1st ed.). Wiley. <https://doi.org/10.1002/9781119536604>
- Howell, S. T., Niessner, M., & Yermack, D. (2020). Initial Coin Offerings: Financing Growth with Cryptocurrency Token Sales. *The Review of Financial Studies*, 33(9), 3925–3974. <https://doi.org/10.1093/rfs/hhz131>
- Izadin, A. A. I., & Yusof, R. (2024). 27-Democratizing Real Estate Investment: A Systematic Review of Tokenization in Real Estate. SSRN. <https://doi.org/10.2139/ssrn.5015941>
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360. [https://doi.org/10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X)
- Joshi, S., & Choudhury, A. (2022). Tokenization of Real Estate Assets Using Blockchain. *International Journal of Intelligent Information Technologies*, 18(3), 1–12. <https://doi.org/10.4018/IJIT.309588>
- Jūrmalis, N., Berķe-Berga, A., & Urbāne, M. (2025). Advancing Asset Tokenization in the European Union and Latvia: A Regulatory and Policy Perspective. *Laws*, 14(1), 7. <https://doi.org/10.3390/laws14010007>
- Kampakis, S. (2018). 08-Three Case Studies in Tokenomics. *The Journal of the British Blockchain Association*, 1(2), 1–4. [https://doi.org/10.31585/jbba-1-2-\(7\)2018](https://doi.org/10.31585/jbba-1-2-(7)2018)
- Kannengiesser, N., Lins, S., Dehling, T., & Sunyaev, A. (2021). Trade-offs between Distributed Ledger Technology Characteristics. *ACM Computing Surveys*, 53(2), 1–37. <https://doi.org/10.1145/3379463>
- Kannengiesser, N., Roger Heines, Benjamin Sturm, Reinhard Jung, & Ali Sunyaev. (2021). *Need for Change: Business Functions Affected by Blockchain Technology*. Association for Information Systems.
- Kitchenham, B., Pearl Brereton, O., Budgen, D., Turner, M., Bailey, J., & Linkman, S. (2007). Systematic literature reviews in software engineering – A systematic literature review. *Information and Software Technology*, 51(1), 7–15. <https://doi.org/10.1016/j.infsof.2008.09.009>
- Konashevych, O. (2020a). Constraints and benefits of the blockchain use for real estate and property rights. *Journal of Property, Planning and Environmental Law*, 12(2), 109–127. <https://doi.org/10.1108/JPPPEL-12-2019-0061>
- Konashevych, O. (2020b). General Concept of Real Estate Tokenization on Blockchain: The Right to Choose. *European Property Law Journal*, 9(1), 21–66. <https://doi.org/10.1515/eplj-2020-0003>
- Kouhizadeh, M., & Sarkis, J. (2018). Blockchain Practices, Potentials, and Perspectives in Greening Supply Chains. *Sustainability*, 10(10), 3652. <https://doi.org/10.3390/su10103652>
- Lefebvre, H. (Ed.). (2010). *Theatre and performance design: From The Production of Space: Vol. From The Production of Space*. Routledge. <https://doi.org/10.4324/9780203124291>

- Li, Y., Spigt, R., & Swinkels, L. (2017). The impact of FinTech start-ups on incumbent retail banks' share prices. *Financial Innovation*, 3(1), 26. <https://doi.org/10.1186/s40854-017-0076-7>
- Liu, A., & Chen, C. (2025). From real estate financialization to decentralization: A comparative review of REITs and blockchain-based tokenization. *Geoforum*, 159, 104193. <https://doi.org/10.1016/j.geoforum.2024.104193>
- Marcato, G., & Nanda, A. (2022). Asymmetric Patterns of Demand-Supply Mismatch in Real Estate. *The Journal of Real Estate Finance and Economics*, 64(3), 440–472. <https://doi.org/10.1007/s11146-020-09812-2>
- Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *JSTOR*, 48, 261–297.
- Mottaghi, S. F., Steininger, B. I., & Yanagawa, N. (2024). Real Estate Insights: The current state and the new future of tokenization in real estate. *Journal of Property Investment & Finance*, 42(6), 614–620. <https://doi.org/10.1108/JPIF-07-2024-0087>
- Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3440802>
- North, D. C. (1990). *Institutions, Institutional Change and Economic Performance* (1st ed.). Cambridge University Press. <https://doi.org/10.1017/CBO9780511808678>
- Pilkington, M. (2016). Blockchain technology: Principles and applications. In F. X. Olleros & M. Zhegu (Eds.), *Research Handbook on Digital Transformations*. Edward Elgar Publishing. <https://doi.org/10.4337/9781784717766.00019>
- Rogers, E. M. (2003). *Diffusion of innovations* (Fifth edition). Free Press.
- Saari, A., Junnila, S., & Vimpari, J. (2022). Blockchain's Grand Promise for the Real Estate Sector: A Systematic Review. *Applied Sciences*, 12(23), 11940. <https://doi.org/10.3390/app122311940>
- Saari, A., Vimpari, J., & Junnila, S. (2022). Blockchain in real estate: Recent developments and empirical applications. *Land Use Policy*, 121, 106334. <https://doi.org/10.1016/j.landusepol.2022.106334>
- Schär, F. (2021). Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets. *Review*, 103(2). <https://doi.org/10.20955/r.103.153-74>
- Silvia, H. (2024). From Torrens To Tokenization: The evolving role of Blockchain in real estate. 29(2).
- Sowmya, G., Alankruthi, K., Harika, J., Nagini, T., Nagalakshmi, M., & Kumar, J. P. (2024). Smart Contracts for Real Estate Sales-A New Era of Efficiency and Transparency. 2024 IEEE 6th International Conference on Cybernetics, Cognition and Machine Learning Applications (ICCCMLA), 228–231. <https://doi.org/10.1109/ICCCMLA63077.2024.10871439>
- Staples, M., & Niazi, M. (2007). Experiences using systematic review guidelines. *Journal of Systems and Software*, 80(9), 1425–1437. <https://doi.org/10.1016/j.jss.2006.09.046>

- Swinkels, L. (2023). 03-Empirical evidence on the ownership and liquidity of real estate tokens. *Financial Innovation*, 9(1), 45. <https://doi.org/10.1186/s40854-022-00427-5>
- Tapscott, D., & Tapscott, A. (2016). *Blockchain revolution: How the technology behind bitcoin is changing money, business, and the world*. Portfolio / Penguin.
- Tian, Y. (2022). *FINANCING INFRASTRUCTURE THROUGH BLOCKCHAIN TOKENIZATION*. UNIVERSITY OF FLORIDA.
- Trinh, T. H. (2022). Theoretical foundations of real estate market behavior. *Cogent Business & Management*, 9(1), 2132590. <https://doi.org/10.1080/23311975.2022.2132590>
- Venkatesh, Morris, Davis, & Davis. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27(3), 425. <https://doi.org/10.2307/30036540>
- Wang, F. (2023). 02-The present and future of the digital transformation of real estate: A systematic review of smart real estate. *Business Informatics*, 17(2), 85–97. <https://doi.org/10.17323/2587-814X.2023.2.85.97>
- Xu, X., Weber, I., Staples, M., Zhu, L., Bosch, J., Bass, L., Pautasso, C., & Rimba, P. (2017). A Taxonomy of Blockchain-Based Systems for Architecture Design. 2017 IEEE International Conference on Software Architecture (ICSA), 243–252. <https://doi.org/10.1109/ICSA.2017.33>
- Yeoh, W., Lee, A. S. H., Ng, C., Popovic, A., & Han, Y. (2024). Examining the Acceptance of Blockchain by Real Estate Buyers and Sellers. *Information Systems Frontiers*, 26(3), 1121–1137. <https://doi.org/10.1007/s10796-023-10411-8>
- Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2017). An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends. 2017 IEEE International Congress on Big Data (BigData Congress), 557–564. <https://doi.org/10.1109/BigDataCongress.2017.85>
- Zheng, Z., Xie, S., Dai, H. N., Chen, X., & Wang, H. (2018). Blockchain challenges and opportunities: A survey. *International Journal of Web and Grid Services*, 14(4), 352. <https://doi.org/10.1504/IJWGS.2018.095647>

ARTICLES BIBLIOGRAPHY

- Abualhamayl, A., Almalki, M., Al-Doghman, F., Alyoubi, A., & Hussain, F. K(2024). 47-Blockchain for real estate provenance: An infrastructural step toward secure transactions in real estate E-Business. *Service Oriented Computing and Applications*, 18(4), 333–347. <https://doi.org/10.1007/s11761-024-00403-0>
- Akram, S. V., Malik, P. K., Singh, R., Anita, G., & Tanwar, S(2020). 35-Adoption of blockchain technology in various realms: Opportunities and challenges. *SECURITY AND PRIVACY*, 3(5), e109. <https://doi.org/10.1002/spy2.109>
- Arnautović, A., Zrakić, M. D., & Bogdanović, Z(2025). 34-Innovating Real Estate Business Models with Blockchain. 2025 24th International Symposium INFOTEH-JAHORINA (INFOTEH), 1–5. <https://doi.org/10.1109/INFOTEH64129.2025.10959232>
- Arslanli, K. Y., & Sabuncuoğlu, G(2023). 30-Tokenization of Real Estate: A Study on Land Tokenization in Turkey. 29th Annual European Real Estate Society Conference. 29th Annual European Real Estate Society Conference, London, United Kingdom. https://doi.org/10.15396/eres2023_242
- Avci, G., & Erzurumlu, Y. O(2023). 11-Blockchain tokenization of real estate investment: A security token offering procedure and legal design proposal. *Journal of Property Research*, 40(2), 188–207. <https://doi.org/10.1080/09599916.2023.2167665>
- Bedi, H. P. S., Balas, V. E., Kaur, S., & Jeet, R(2023). 25-Blockchain Technology: Concepts and Applications. In A. Singh, A. Dhull, & K. K. Singh (Eds.), *Blockchain and Deep Learning for Smart Healthcare* (1st ed., pp. 1–34). Wiley. <https://doi.org/10.1002/9781119792406.ch1>
- Belinska, Y., Onyshko, S., & Dyuk, R(n.d.). 45-Tokenization of financial assets as an innovative direction of financial market development. *Scientific Notes of Ostroh Academy National University*, 30, 58.
- Bhat, B. A., & Gupta, N(2022). 28-Integration of Blockchain Tokenisation in Real Estate: A Review. In S. L. Gupta, P. Kansra, & G. Kukreja (Eds.), *Advances in Finance, Accounting, and Economics* (pp. 213–230). IGI Global. <https://doi.org/10.4018/978-1-6684-4133-6.ch013>
- Çağlayan Aksoy, P., & Özkan Üner, Z(2021). 29-NFTs and copyright: Challenges and opportunities. *Journal of Intellectual Property Law & Practice*, 16(10), 1115–1126. <https://doi.org/10.1093/jiplp/jpab104>
- Casino, F., Dasaklis, T. K., & Patsakis, C(2019). 48-A systematic literature review of blockchain-based applications: Current status, classification and open issues. *Telematics and Informatics*, 36, 55–81. <https://doi.org/10.1016/j.tele.2018.11.006>
- Desai, A., Raut, A., Gaikwad, T., Patil, S., & Sawant, V(2024). 16-Fractionalizable Real Estate Marketplace. 2024 IEEE International Conference on Blockchain and Distributed Systems Security (ICBDS), 1–6. <https://doi.org/10.1109/ICBDS61829.2024.10837228>

- Exter, E., & Radosavljevic, M(2023). 43-Applying Action Design Science Research to Develop a Conceptual Design for Smart Contracts in Real Estate Transaction Processes: The Potential of Blockchain Technology for Transaction Symmetry, Speed and Transparency. 2023 IEEE International Symposium on Technology and Society (ISTAS), 1–7. <https://doi.org/10.1109/ISTAS57930.2023.10305905>
- Fabio Creta, & Tenca, F(2021). 31-Tokenomics: A new opportunity in the Real Estate business? A qualitative approach to crowdfunding and blockchain interaction. First Monday. <https://doi.org/10.5210/fm.v26i10.10699>
- Garcia-Teruel, R. M(2020). 26-Legal challenges and opportunities of blockchain technology in the real estate sector. Journal of Property, Planning and Environmental Law, 12(2), 129–145. <https://doi.org/10.1108/JPEL-07-2019-0039>
- Garcia-Teruel, R. M., & Simón-Moreno, H(2021). 46-The digital tokenization of property rights. A comparative perspective. Computer Law & Security Review, 41, 105543. <https://doi.org/10.1016/j.clsr.2021.105543>
- Hassan, M., Raafat, M., & Mansour, H(2024). 33-My Real Estate: Revolutionizing Real Estate Transactions and Ownership Management with Blockchain and NFTs. 2024 6th International Conference on Computing and Informatics (ICCI), 437–442. <https://doi.org/10.1109/ICCI61671.2024.10485078>
- Henker, R., Atzberger, D., Scheibel, W., & Döllner, J(2023). 19-Real Estate Tokenization in Germany: Market Analysis and Concept of a Regulatory and Technical Solution. 2023 IEEE International Conference on Blockchain and Cryptocurrency (ICBC), 1–5. <https://doi.org/10.1109/ICBC56567.2023.10174954>
- Ibrahimy, M. M., Norta, A., & Normak, P(2024). 22-Blockchain-based governance models supporting corruption-transparency: A systematic literature review. Blockchain: Research and Applications, 5(2), 100186. <https://doi.org/10.1016/j.bcra.2023.100186>
- Izadin, A. A. I., & Yusof, R(2024). 27-Democratizing Real Estate Investment: A Systematic Review of Tokenization in Real Estate. SSRN. <https://doi.org/10.2139/ssrn.5015941>
- Joshi, S., & Choudhury, A(2022). 39-Tokenization of Real Estate Assets Using Blockchain: International Journal of Intelligent Information Technologies, 18(3), 1–12. <https://doi.org/10.4018/IJIT.309588>
- Juan, A. A., Perez-Bernabeu, E., Li, Y., Martin, X. A., Ammouriova, M., & Barrios, B. B(2023). 32-Tokenized Markets Using Blockchain Technology: Exploring Recent Developments and Opportunities. Information, 14(6), 347. <https://doi.org/10.3390/info14060347>
- Kalyuzhnova, N(2018). 09-Transformation of the real estate market on the basis of use of the blockchain technologies: Opportunities and problems. MATEC Web of Conferences, 212, 06004. <https://doi.org/10.1051/mateconf/201821206004>
- Kampakis, S(2018). 08-Three Case Studies in Tokenomics. The Journal of the British Blockchain Association, 1(2), 1–4. [https://doi.org/10.31585/jbba-1-2-\(7\)2018](https://doi.org/10.31585/jbba-1-2-(7)2018)
- Konashevych, O(2019). 01- Comparative Analysis of the Legal Concept of Title Rights in Real Estate and the Technology of Tokens: How Can Titles Become Tokens?

- In A. Zohar, I. Eyal, V. Teague, J. Clark, A. Bracciali, F. Pintore, & M. Sala (Eds.), *Financial Cryptography and Data Security* (Vol. 10958, pp. 339–351). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-58820-8_23
- Konashevych, O(2020). 36-General Concept of Real Estate Tokenization on Blockchain: The Right to Choose. *European Property Law Journal*, 9(1), 21–66. <https://doi.org/10.1515/eplj-2020-0003>
- Kvs, R. R., Roy, R., Hota, P., & Gupta, T(2024). 41-Tokenizing Real Estate in India using Blockchain Technology. 2024 8th International Conference on Computational System and Information Technology for Sustainable Solutions (CSITSS), 1–4. <https://doi.org/10.1109/CSITSS64042.2024.10816882>
- Lavayssière, X(2024). 44-Research Note on the Heterogeneity of the Tokenization of Financial Assets. 2024 6th Conference on Blockchain Research & Applications for Innovative Networks and Services (BRAINS), 1–2. <https://doi.org/10.1109/BRAINS63024.2024.10732456>
- Liu, A., & Chen, C(2025). 37-From real estate financialization to decentralization: A comparative review of REITs and blockchain-based tokenization. *Geoforum*, 159, 104193. <https://doi.org/10.1016/j.geoforum.2024.104193>
- Milkau, U(2024). 42-Will tokenisation deliver efficiency? And what kind? *Journal of Securities Operations & Custody*, 17(1), 79. <https://doi.org/10.69554/GCPR5193>
- Mottaghi, S. F., Steininger, B. I., & Yanagawa, N(2024). 10-Real Estate Insights: The current state and the new future of tokenization in real estate. *Journal of Property Investment & Finance*, 42(6), 614–620. <https://doi.org/10.1108/JPIF-07-2024-0087>
- Nowak, K. A., Wiśniewski, M., & Litwiński, M(2024). 06-Is It Worth Investing in Tokens? Investment Performance of Digital Tokens in Financial and Axiological Contexts. *Journal of the Knowledge Economy*, 16(1), 663–690. <https://doi.org/10.1007/s13132-024-01962-5>
- Oza, V. J., Nikte, A., Bhanushali, V., & Rote, U(2024). 20-Smart Contracts and Tokenization: Revolutionizing Real Estate Transactions with Blockchain Technology. 2024 International Conference on Inventive Computation Technologies (ICICT), 1598–1604. <https://doi.org/10.1109/ICICT60155.2024.10544886>
- Panwar, A., Sugandh, U., Sharma, N., Agarwal, J., & Jain, A(2024). 18-The Intersection of Blockchain and Real Estate: Opportunities, Challenges, and Future Prospects. 2024 4th International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), 1813–1819. <https://doi.org/10.1109/ICACITE60783.2024.10616870>
- Pocha, N., Shah, R., Shah, Y., & Sonawane, P(2023). 17-Decentralized one stop solution for real estate. 2023 International Conference on Advanced Computing Technologies and Applications (ICACTA), 1–8. <https://doi.org/10.1109/ICACTA58201.2023.10392709>
- Podshivalov, T. P(2022). 21-Improving implementation of the Blockchain technology in real estate registration. *The Journal of High Technology Management Research*, 33(2), 100440. <https://doi.org/10.1016/j.hitech.2022.100440>

- Saari, A., Junnila, S., & Vimpari, J(2022). 04-Blockchain's Grand Promise for the Real Estate Sector: A Systematic Review. *Applied Sciences*, 12(23), 11940. <https://doi.org/10.3390/app122311940>
- Saari, A., Vimpari, J., & Junnila, S(2022). 23-Blockchain in real estate: Recent developments and empirical applications. *Land Use Policy*, 121, 106334. <https://doi.org/10.1016/j.landusepol.2022.106334>
- Saull, A., Baum, A., & Braesemann, F(2020). 49-Can digital technologies speed up real estate transactions? *Journal of Property Investment & Finance*, 38(4), 349–361. <https://doi.org/10.1108/JPIF-09-2019-0131>
- Sharma, A., Sharma, A., Tripathi, A., & Chaudhary, A(2024). 14-Real Estate Registry Platform Through NFT Tokenization Using Blockchain. 2024 2nd International Conference on Disruptive Technologies (ICDT), 335–340. <https://doi.org/10.1109/ICDT61202.2024.10488945>
- Silvia, H(2024). 13-From Torrens To Tokenization: The evolving role of Blockchain in real estate. 29(2).
- Sladić, G., Milosavljević, B., Nikolić, S., Sladić, D., & Radulović, A(2021). 24-A Blockchain Solution for Securing Real Property Transactions: A Case Study for Serbia. *ISPRS International Journal of Geo-Information*, 10(1), 35. <https://doi.org/10.3390/ijgi10010035>
- Smith, R., & Baur, D. G(2025). 38-Real Estate Tokenisation: Benefits, Limitations and Market Dynamics. SSRN. <https://doi.org/10.2139/ssrn.5083787>
- Swinkels, L(2021). 03-Empirical evidence on the ownership and liquidity of real estate tokens. *Financial Innovation*, 9(1), 45. <https://doi.org/10.1186/s40854-022-00427-5>
- Tanveer, U., Ishaq, S., & Hoang, T. G(2025). 12-Tokenized assets in a decentralized economy: Balancing efficiency, value, and risks. *International Journal of Production Economics*, 282, 109554. <https://doi.org/10.1016/j.ijpe.2025.109554>
- Treleaven, P., Barnett, J., Knight, A., & Serrano, W(2021). 07-Real Estate Data Marketplace. *AI and Ethics*, 1(4), 445–462. <https://doi.org/10.1007/s43681-021-00053-4>
- Vivekrabinson, K., Singh J, B., S, R. K., M, V., D, V., & B, S. R(2023). 15-Blockchain Enabled Real Estate Property Transactions using NFT: An Approach. 2023 International Conference on Research Methodologies in Knowledge Management, Artificial Intelligence and Telecommunication Engineering (RMKMATE), 1–6. <https://doi.org/10.1109/RMKMATE59243.2023.10369785>
- Wang, F(2023). 02-The present and future of the digital transformation of real estate: A systematic review of smart real estate. *Business Informatics*, 17(2), 85–97. <https://doi.org/10.17323/2587-814X.2023.2.85.97>
- Xin Li, R. K., Singh, S. F., Park, A., & Veneris, A(2024). 40-On Tokenizing Securities in Contemporary Decentralized Finance Ecosystems. 2024 6th Conference on Blockchain Research & Applications for Innovative Networks and Services (BRAINS), 1–9. <https://doi.org/10.1109/BRAINS63024.2024.10732268>

Yeoh, W., Lee, A. S. H., Ng, C., Popovic, A., & Han, Y(2024). 05-Examining the Acceptance of Blockchain by Real Estate Buyers and Sellers. *Information Systems Frontiers*, 26(3), 1121–1137. <https://doi.org/10.1007/s10796-023-10411-8>



APPENDICES

APPENDIX A: Review Protocol

1. Background
2. Research questions
3. Search Strategy
 - a. Search Strings
 - b. Resources/Database
4. Study selection criteria
 - a. Inclusion criteria
 - b. Exclusion criteria
5. Study selection procedure
6. Study Quality Assessment checklist and procedure
7. Data Extraction Strategy
8. Synthesis of the extra
9. Background
10. Research questions
11. Study selection criteria
 - c. Inclusion criteria
 - d. Exclusion criteria
12. Study selection procedure
13. Study Quality Assessment checklist and procedure
14. Data Extraction Strategy
15. Synthesis of the extracted data

Kithenham B; Procedures for Performing Systematic Reviews; Joint Technical Report, Keele University TR/SE-0401 and NICTA 0400011T.1; 2004

APPENDIX B: Selected Studies Included for the SLR

No	Title	Authors	Year	Country	Source Type	Source Rank	RQ Mapping	Citation	Keywords	Ref
01	Comparative Analysis of the Legal Concept of Title Rights in Real Estate and the Technology of Tokens: How Can Titles Become Tokens?	Oleksii Konashevych	2019	Ukraine (Author's affiliation); Europe (Publication)	Conference paper	Q2	RQ1.1 / RQ1.3	8	Blockchain, Smart contracts, Titles, Real estate, Tokens, E-Governance, E-Voting, E-Democracy	[1]
02	The Present and Future of the Digital Transformation of Real Estate: A Systematic Review of Smart Real Estate	Fengchen Wang	2023	Russia	Journal Article	Q2–Q3	RQ1.3	9	Smart Real Estate, Digital Transformation, Bibliometric Review, PRISMA, Machine Learning, Big Data	[2]
03	Empirical evidence on the ownership and liquidity of real estate tokens	Laurens Swinkels	2023	Netherlands	Journal Article	Q2	RQ1.2	48	Blockchain, Cryptocurrency, Real estate, Tokenization	[3]
04	Blockchain’s Grand Promise for the Real Estate Sector: A Systematic Review	Anniina Saari, Seppo Junnila, Jussi Vimpari	2022	Finland	Journal Article	Q1	RQ1.1 / RQ1.2	31	blockchain, digitalization, real estate, land administration, property transactions, real estate investment, leasing, tokenization, smart contract	[4]
05	Examining the Acceptance of Blockchain by Real Estate Buyers and Sellers	William Yeoh, Angela Siew Hoong Lee, Claudia Ng, Ales Popovic, Yue Han	2023	Australia, Malaysia, France, USA	Journal Article (Information Systems Frontiers)	Q1	RQ1.3	20	blockchain, real estate, adoption, factors, PLS method	[5]
06	Is It Worth Investing in Tokens? Investment Performance of Digital Tokens in Financial and Axiological Contexts	Karolina Anna Nowak, Marcin Wiśniewski, Michał Litwiński	2024	Poland	Journal Article	Q1	RQ1	N/A	Digital token, Investment performance, World-view beliefs, Digital economy	[6]
07	Real Estate Data Marketplace	Philip Treleaven, Jeremy Barnett, Andrew Knight, Will Serrano	2021	United Kingdom	Journal Article	Q1	RQ1	36	Data Marketplace, Blockchain, Smart contracts, Real estate	[7]
08	Three Case Studies in Tokenomics	Stylianios Kampakis	2018	United Kingdom	Journal Article	Q3 (JBBA)	RQ1.3	10	Blockchain, ICO, tokenomics, cryptoeconomics	[8]
09	Transformation of the real estate market on the basis of use of the blockchain technologies: opportunities and problems	Nadezhda Kalyuzhnova	2018	Russia	Conference Paper	Q4	RQ1	45	Blockchain, real estate, transaction costs, 4IR technologies	[9]
10	Real Estate Insights: The current state and the new future of tokenization in real estate	Seyedeh Fatemeh Mottaghi, Bertram I. Steininger, Noriyuki Yanagawa	2024	Sweden, Japan	Journal Article (Insight)	Q1	RQ1	6	Tokenization, real estate, fractional ownership, blockchain, regulation	[10]

No	Title	Authors	Year	Country	Source Type	Source Rank	RQ Mapping	Citation	Keywords	Ref
11	Blockchain tokenization of real estate investment: a security token offering procedure and legal design proposal	Gurcan Avci, Yaman Omer Erzurumlu	2023	Turkey, USA	Journal Article	Q2	RQ1.2	21	Blockchain, tokenisation, SPV, contract design, smart contracts, real estate investment	[11]
12	Tokenized assets in a decentralized economy: Balancing efficiency, value, and risks	Umair Tanveer, Shamaila Ishaq, Thinh Gia Hoang	2025	UK, Vietnam	Journal Article	Q1	RQ1	2 New	Asset tokenization, blockchain, market trust, transaction cost theory	[12]
13	From Torrens to Tokenization: The evolving role of Blockchain in real estate	Hilary Silvia, J.D.	2024	USA	Law Journal	Q2	RQ1.2	New	Blockchain, tokenization, NFTs, property ownership, transparency	[13]
14	Real Estate Registry Platform through NFT Tokenization using Blockchain	Archana Sharma, Aniket Chaudhary, Anshul Sharma, Anshul Tripathi	2024	India	Conference Paper	IEEE	RQ1.1	New	Blockchain, NFT, Ethereum, real estate registry, smart contracts, tokenization	[14]
15	Blockchain Enabled Real Estate Property Transactions using NFT: An Approach	Vivekrabinson K, Bharath Singh J, Rajesh Kumar S, Vijay M, Vijayakumar D, Shanmuga Raja B	2024	India	Conference Paper	Medium (IEEE Conference)	RQ1.1	4	Blockchain, NFTs, real estate, zero-knowledge proof, smart contracts	[15]
16	Fractionalizable Real Estate Marketplace	Atharva Desai, Sharvari Patil, Anurag Raut, Vinaya Sawant, Tejas Gaikwad	2024	India	Conference Paper	Medium (IEEE Conference)	RQ1	9	Blockchain, token, ERC 1155, smart contracts, real estate, NFT, investing	[16]
17	Decentralized One Stop Solution for Real Estate	Nirav Pocha, Rushabh Shah, Yash Shah, Pankaj Sonawane	2023	India	Conference Paper	Medium (IEEE Conference)	RQ1	2	Blockchain, Tokenization, Ethereum, Smart Contract, Real-Estate	[17]
18	The Intersection of Blockchain and Real Estate: Opportunities, Challenges, and Future Prospects	Arvind Panwar, Jyoti Agarwal, Urvashi Sugandh, Achin Jain, Neha Sharma	2024	India	Conference Paper	Medium (IEEE Conference)	RQ1, RQ1.1, RQ1.3	1(new publication)	blockchain, smart contracts, real estate, tokenization, transparency	[18]
19	Real Estate Tokenization in Germany: Market Analysis and Concept of a Regulatory and Technical Solution	Robert Henker, Daniel Atzberger, Willy Scheibel, Jürgen Döllner	2023	Germany	Conference Paper	Medium (IEEE Conference)	RQ1, RQ1.1, RQ1.2	3	blockchain technology, distributed ledger technology, tokenization, smart contracts, real estate assets	[19]
20	Smart Contracts and Tokenization: Revolutionizing Real Estate Transactions with Blockchain Technology	Vedant Jayesh Oza, Atharva Nikte, Viral Bhanushali, Prof. Uday Rote	2024	India	Conference Paper	Medium (IEEE Conference)	RQ1	3	Blockchain, Smart Contracts, ERC-721, NFTs, IPFS, Metamask, Tokenization	[20]
21	Improving implementation of the Blockchain technology in real estate registration	Tikhon P. Podshivalov	2022	Russian Federation	Journal Article	High (Elsevier Journal)	RQ1.1	23	Blockchain, Real estate registration, Property rights, Online arbitration, Cadastral registration, Dispute resolution, Digital enterprise	[21]

No	Title	Authors	Year	Country	Source Type	Source Rank	RQ Mapping	Citation	Keywords	Ref
22	Blockchain-based governance models supporting corruption-transparency: A systematic literature review	Mohammad Mustafa Ibrahimy, Alex Norta, Peeter Normak	2024	Estonia	Journal Article (Review)	High (Elsevier journal, Scopus indexed)	RQ1.1, RQ1.3	30	Blockchain governance, Token economy, Transparency, Smart contract, Web 3.0, DAOs, Self-Sovereign Identity (SSI), Multifactor challenge set SSI authentication (MFSSIA)	[22]
23	Blockchain in real estate: Recent developments and empirical applications	Anniina Saari, Jussi Vimpari, Seppo Junnila	2022	Finland	Journal Article	High (Scopus, Q1 in Land Use and Urban Planning)	RQ1, RQ1.2, RQ1.3	92	Blockchain, blockchain application, land administration, real estate transactions, real estate management, tokenization	[23]
24	A Blockchain Solution for Securing Real Property Transactions: A Case Study for Serbia	Goran Sladić, Branko Milosavljević, Siniša Nikolić, Dubravka Sladić, Aleksandra Radulović	2021	Serbia	Journal Article	Medium-High (Indexed, MDPI, Open Access)	RQ1	95	blockchain, land administration, smart contract, real property transactions, transaction transparency, ledger	[24]
25	Blockchain Technology: Concepts and Applications	Hermehar Pal Singh Bedi, Valentina Emilia Balas, Sukhpreet Kaur, Rubal Jeet	2023	India, Romania	Book Chapter	Medium (Book chapter with DOI)	RQ1.1, RQ1.3	1 (as of now)	blockchain, cryptocurrency, smart contracts, decentralized applications	[25]
26	Legal challenges and opportunities of blockchain technology in the real estate sector	Rosa M. Garcia-Teruel	2020	Spain / European Union	Journal Article	Q3 (Emerald)	RQ1.1	202	Real estate, land registry, blockchain, sharing economy, rental contracts, tokenization	[26]
27	Democratizing Real Estate Investment: A Systematic Review of Tokenization in Real Estate	Ahmad Al Izham Izadin, Rosylin Mohd Yusof	2024	Malaysia	Journal Article	Q1/Q2 (typical Scopus ranking for systematic reviews in this field)	RQ1, RQ1.1, RQ1.2, RQ1.3	1(new 2024 publication)	Real estate, tokenization, blockchain, fractional ownership, systematic literature review, PRISMA framework	[27]
28	Integration of Blockchain Tokenisation in Real Estate: A Review	Basit Ali Bhat, Nitin Gupta	2022	India	Book Chapter	Not explicitly ranked (Academic book chapter)	RQ1, RQ1.1	8	Real estate, blockchain, tokenization, liquidity, smart contracts, India, Fourth Industrial Revolution	[28]
29	NFTs and Copyright: Challenges and Opportunities	Pınar Çağlayan Aksoy, Zehra Özkan Üner	2021	Turkey	Journal Article	High (Reputable IP Law journal)	RQ1.1	96	NFTs, blockchain, copyright law, smart contracts, intellectual property, digital art	[29]
30	Tokenization of Real Estate: A Study on Land Tokenization in Turkey. Creating a multidisciplinary model consisting of different actors in the digitalization process of traditional methods in real estate development	Göksu Sabuncuoğlu, Assoc. Prof. Dr. Kerem Yavuz Arslanlı	2023	Turkey	Conference Paper	High (top real estate conference)	RQ1	Not yet indexed (recent conference paper)	Land tokenization, blockchain, digital real estate, liquidity, small investors	[30]

No	Title	Authors	Year	Country	Source Type	Source Rank	RQ Mapping	Citation	Keywords	Ref
31	Tokenomics: A new opportunity in the real estate business? A qualitative approach to crowdfunding and blockchain interaction	Fabio Creta& Francesca Tenca	2023	Italy	Journal Article (Qualitative Research)	Medium (peer-reviewed journal, specific rank not provided)	RQ1, RQ1.2, RQ1.3	10	Tokenomics, crowdfunding, blockchain, digital tokens, smart contracts, real estate finance	[31]
32	Tokenized Markets Using Blockchain Technology: Exploring Recent Developments and Opportunities	Angel A. Juan, Elena Perez-Bernabeu, Barry B. Barrios, Yuda Li, Xabier A. Martin, Majsa Ammouriova	2023	Spain	Journal Article (Open Access)	Medium to High (published in MDPI's Information journal, indexed, DOI assigned)	RQ1, RQ1.1, RQ1.3	22	Blockchain, tokenized markets, digital assets, fungible tokens, non-fungible tokens, smart contracts, cybersecurity, virtual economy	[32]
33	My Real Estate: Revolutionizing Real Estate Transactions and Ownership Management with Blockchain and NFTs	Mostafa Hassan, Mahmoud Raafat, Hesham Mansour	2024	Egypt (based on university location)	Conference Paper	IEEE Conference, Medium to High	RQ1	3	Blockchain, NFTs, Ethereum, MERN stack, smart contracts, fractional ownership, real estate, AI chatbot	[33]
34	Innovating Real Estate Business Models with Blockchain	Aleksandar Amautović, Marijana Despotović Zrakić, Zorica Bogdanović	2025	Serbia	Conference Paper	High (IEEE ranked conference)	RQ1, RQ1.3	2	Real estate, blockchain, smart contracts, fractional ownership, tokenization, transparency, efficiency, fraud mitigation, decentralized marketplaces	[34]
35	Adoption of blockchain technology in various realms: Opportunities and challenges	Vaseem Akram Shaik, Praveen Kumar Malik, Rajesh Singh, Anita Gehlot, Sudeep Tanwar	2020	India	Journal Article	High (Indexed Journal)	RQ1.1	242	Blockchain architecture, Bitcoin, Interoperability, Security, Smart contract, Internet of Things	[35]
36	General Concept of Real Estate Tokenization on Blockchain	Oleksii Konashevych	2020	International (EU)	Journal article	Q2	RQ1, RQ1.1, RQ1.3	Moderate	blockchain, distributed ledger technologies, real estate, property rights, land registry, cadastre, tokens, title tokens	[36]
37	From real estate financialization to decentralization: A comparative review of REITs and blockchain-based tokenization	Ang Liu, Cheng Chen	2025	USA	Journal Article (Geoforum)	Q1	RQ1, RQ1.2	Not provided	Blockchain, Tokenization, Housing, Financialization, REITs, Decentralization	[37]
38	Real Estate Tokenisation: Benefits, Limitations and Market Dynamics	Rafferty Smith & Dirk G. Baur	2024	USA	Academic Paper	N/A	RQ1, RQ1.2	N/A	tokenisation, real estate, transaction costs, blockchain	[38]
39	Tokenization of Real estate Assets Using Blockchain	Shashank Joshi, Arhan Choudhury	2024	India	Academic Journal Paper	N/A	RQ1	14	Blockchain, Decentralization, ERC1155, IPFS, Real Estate, Smart Contract, Tokenization, Tokens	[39]
40	On Tokenizing Securities in Contemporary Decentralized Finance Ecosystems	Ren-Ke Li, Srisht Fateh Singh, Andreas Park	2024	Germany	Journal Article	High	RQ1, RQ1.1	2	Tokenization, Decentralized Finance, Securities	[40]

No	Title	Authors	Year	Country	Source Type	Source Rank	RQ Mapping	Citation	Keywords	Ref
41	Tokenizing Real Estate in India using Blockchain Technology	Rajeshwar Rao KVS, Rahul Roy, Pranati Hota	2024	India	Journal Article	High	RQ1, RQ1.1, RQ1.2	3	Tokenization, Real Estate, Blockchain, India	[41]
42	Will tokenisation deliver efficiency? And what kind?	Udo Milkau	2024	Germany	Journal Article	Medium	RQ1, RQ1.3	N/A	Tokenization, Efficiency, Financial Infrastructure	[42]
43	Applying Action Design Science Research to Develop a Conceptual Design for Smart Contracts in Real Estate Transaction Processes	Evgeny Exter, Milan Radosavljevic	2023	UK	Conference Paper	High	RQ1, RQ1.1, RQ1.2	2	Smart Contracts, Real Estate Transactions, Blockchain	[43]
44	Research Note on the Heterogeneity of the Tokenization of Financial Assets	Xavier Lavayssière	2024	Not specified	Journal Article	High	RQ1, RQ1.3	N/A	Tokenization, Financial Assets, Market Diversity	[44]
45	Tokenization of financial assets as an innovative direction of financial market development	Yanina Belinska, Svitlana Onyshko, Rostyslav Dyuk	2023	Ukraine	Journal Article	Medium	RQ1, RQ1.1	4	Tokenization, Financial Assets, Market Development	[45]
46	The Digital Tokenization of Property Rights A Comparative Perspective	Garcia-Teruel, R.M., & Simón-Moreno, H.	2021	Spain	Journal Article	Q1	RQ1.1	110	Legal Frameworks, Ownership Rights, Cross-Border Transactions	[46]
47	Blockchain for real estate provenance: an infrastructural step toward secure transactions in real estate E-Business	Abualhamayl, A., Almalki, M., Al-Doghman, F., Alyoubi, A., Hussain, F.	2024	Australia, Saudi Arabia	Journal Article	Q1	RQ1, RQ1.1	5	Blockchain infrastructure, Real estate provenance, Secure transactions	[47]
48	A Systematic Literature Review of Blockchain-Based Applications: Current Status, Classification and Open Issues	Casino, F., Dasaklis, T. K., & Patsakis, C.	2019	Spain	Journal Article	Q1	RQ1	3044	Blockchain applications, Systematic review	[48]
49	Can Digital Technologies Speed Up Real Estate Transactions?	de Soto, H.	2019	UK	Journal Article	Q1	RQ1.2	92	Digital technologies, Real estate transactions	[49]

Excluded studies from the systematic review of the literature.

No.	Title	Authors	Year	Country	Source Type	Source Rank	RQ Mapping	Citation	Keywords
01	Revolutionizing the Real Estate Ecosystem with Blockchain: Opportunities, Challenges, and Future Prospects	Aleksandar Arnautovi, Marijana Despotović-Zrakić, Aleksandra Labus	2023	Serbia	Conference Paper	Not ranked (unindexed conference)	RQ1.1,RQ1.3	0–5	Blockchain, Real Estate, Tokenization, Smart Contracts, NFTs, Regulation
02	Tokenization of rental real estate assets using blockchain technology	Ashish Rath, R. K. Pateriya, Deepak Tomar, Surendra Singh	2023	India	Preprint / Research Article	Not ranked (Preprint on Research Square)	RQ1 , RQ1.2	Low	tokenization, smart contract, solidity, fractional ownership, estate
03	A Systematic Literature Review on Blockchain for Real Estate Transactions: Benefits, Challenges, Enablers, and Inhibitors	Florbelá Galvão Cunha, Miguel Mira da Silva	2023	Portugal	Research Article	Medium (Preprint server, DOI assigned)	NA	Low	systematic literature review, blockchain, real estate, distributed ledger technology
04	Tokenization: Overview and Financial Stability Implications	Francesca Carapella, Grace Chuan, Jacob Gerszten, Chelsea Hunter, Nathan Swem	2023	USA	Working Paper (Finance & Economics Discussion Series)	High (Federal Reserve working paper)	NA	Newly	THESIS
05	The Role Of Blockchain Technology In Decentralized Real Estate Marketplace: Recent Findings	Apeksha Vitthal Patil, Alpesh Vijay Shinde, Aneesha Panigrahi, Aryan Arora, Dr. S. Raviraja, Dr. Ramesh Babu D RF	2024	India	Conference Paper	Moderate (SSRN repo)	NA	Low	Blockchain, Decentralized, Peer-to-peer, Real Estate, Smart Contracts
06	Structural Review and Performance Evaluation of Real Estate Tokens	Berke Bayhoca, Bertram Steininger, Kerem Yavuz Arslanli	2023	Sweden, Turkey	Conference paper	N/A	NA	Low	blockchain, real estate tokenization, smart contracts, decentralization, blockchain trilemma