A Model Proposal on Smart Contracts For Commercial Property Leases

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Contents

- Problem Statement & Purpose

- Research Questions and Hypothesis

- Literature Findings

- Methodology

- Survey

- Survey Analysis

- Stages of the Model

- Conclusion

Problem Statement

Complexity of the leasing processes in commercial real estates and the handling of the process with different actors and methods make the whole leasing process open to errors.

Purpose

- Investigating the Potential of Smart Contracts
- Addressing Challenges and Legal Considerations
- Analyzing Stakeholder Perspectives
- Providing Practical Recommendations
- Designing a Model Proposal
- Investigating the possibility of implementing smart contracts

Hypothesis

Implementing smart contracts in commercial property leases can enhance efficiency, transparency, and security while reducing costs and risks.

Sub-questions
- What are the,
- Features of smart contracts that make them suitable for commercial property leases?
- Current challenges and limitations in traditional lease agreements?

Digital distribution/disintermediation

Cryptography

Consensus

Immutability

Time-stamps

Resilience

Security

Source:Structured Finance Industry Group

Author(s)	Year	Source Type	Findings
Türe,	2022	Journal	Shopping Center lease agreements are businesses with their **own unique features and have their own characteristics.**
Kim et. al.	2022	Journal	There is a **need to improve** the laws and systems for shopping malls.
Lundgren et. al.	2022	Working Paper	**Seven factors** that are effective in the lease **negotiation process: regional and industrial growth, rent and vacancy, GDP growth, E-commerce, customer orientation, external information and trust.**
Orr et. al.	2022	Conference	**Three problems** of commercial real estate market: increasing **complexity,** need for **data sharing and transparency,** key changes in the **return/risk of retail** investment
Aldana et. al.	2020	Journal	On rental market dynamics, **a model can be used to quantify risk** and reward for real estate strategies.
Cho et. al.	2007	Journal	Due to the communication and stability between the **shopping center owners and the tenants, intermediary costs are reduced with a model.**

• Various perspectives were the focus of research on leasing negotiation procedures.

• Market complexity increased,
• Market conditions change, the parties must evaluate the process,
• There is a demand for increased information sharing and transparency, by the pandemic,

Author(s)	Year	Source Type	Findings
Wang et.al.	2020	Journal	Blockchain can be used as an **effective system for correcting the customer flow** of the mall.
Latifi et. al.	2019	Conference	Blockchain technology can **provide solutions for issues such as accessibility, transparency and trust, reducing costs, creating smart contracts, and P2P transactions.**
Wouda et.al.	2019	Journal	Blockchain technology will **change the transaction process and improve the existing process with efficiency, trust and transparency.** Use of smart contracts will **shorten the negotiation process due to the high level of trust and information reliability between the parties.**

- Blockchain technology can provide solutions for current complex process.

- There is a need to change and improve the transaction process with efficiency.

Literature Findings-Smart Contract

Author(s)	Year	Source Type	Findings
Hewa et. al.	2021	Journal	Blockchain based smart contracts are used in domains such as **financial, healthcare, eGovernment, IoT, telecommunication, logistics, and different industrial contexts.**
Rodler et. al.	2021	Symposium	New applications will **increase the trustworthiness and acceptance** of smart contracts as it allows developers to quickly react on reported vulnerabilities.
Clack, et. al.	2016	Journal	A holistic study and collaboration is required by the financial services industry, **standardization organizations, academia and lawyers to ensure the direct processing of secure financial contracts with automated codes**.
Deepak et. al.	2021	Journal	Smart contracts provide **a secure, roaming and shared decentralized record** that is exchanged between owners and tenants on equal terms.
Fernandes et. al.	2021	Journal	Smart contracts eliminate the need for human management. Advantages are **reliability in the process, unwavering quality standard and lifetime, faster replacement and lower replacement costs.**
Gupta et. al.	2021	Journal	Smart contracts with artificial intelligence has **difficulties: Security, Scalability, Vulnerabilities, Cyber attacks, Overcharging, Correctness, Efficiency, AI integration, Smart contract standardization, AI program complexity**
Karamitsos et. al.	2019	Journal	Smart contracts ensure that the **lease agreement is signed, the rent is paid on time, and the contract termination is implemented in accordance with the terms.**

- In smart contracts, the codes created for the contract clauses agreed upon by the two parties are used.
- Reduces the cost and speeds up the process by eliminating the verification processes
- Quality standard and lifetime, faster replacement and lower replacement costs
- Proposed blockchain real estate systems provide liquidity and eliminate the need for human management
- Ensure that the lease agreement is signed, the rent is paid on time and the contract termination is implemented in accordance with the terms.

- **Contract clauses that were previously simple become complex.**
- Business conditions and market **conditions change, the parties also need to revaluate the process.**

- Changes in the retail market, **tenant types and needs** affect **the negotiation process** in lease agreements.
- Different and **more flexible methods** are in demand by tenants.

- Emergence of many **unforeseen costs, different regulations, the excess of intermediaries, the lack of transparency and the illiquidity in nature.**

Challenges

| passive flow | asymmetric information | inefficient | high cost |

- Leasing income plays a key role in **valuing real estate investments and calculating return.** Lease agreements set the terms of the lease and the **duration of the cash flow.**

- In commercial real estate, lease agreements are the most important tool in **determining the value of real estate.**
Standardization of contracts will be easy and valuable.
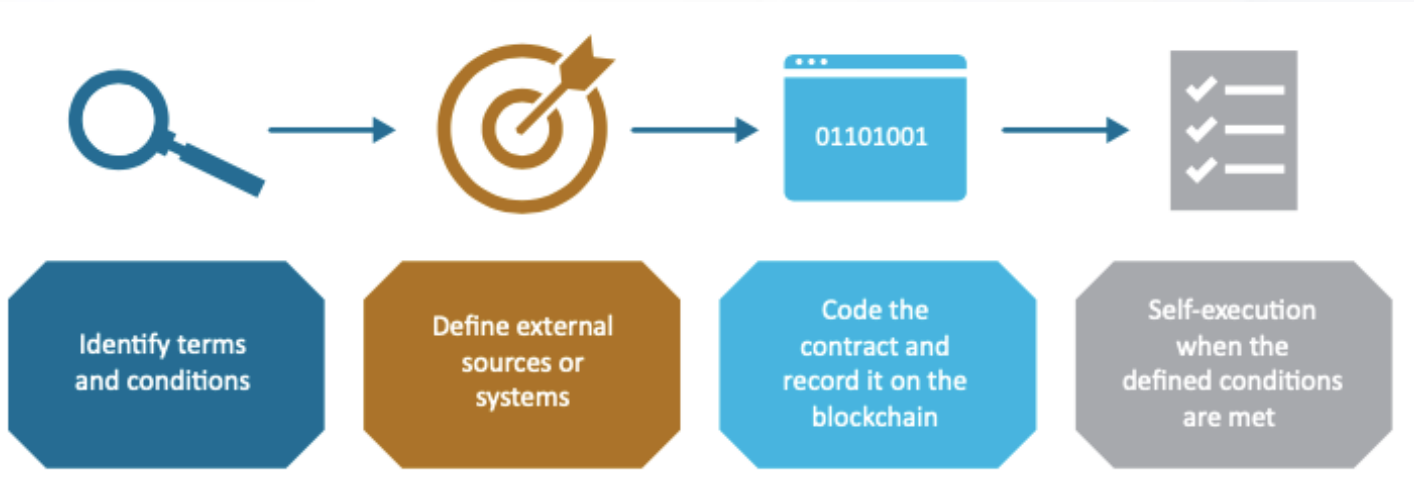
Current smart contract developers are mostly focused on these three areas:

1. **Security:** Developers are aiming to ensure that only participants with the right permission status can view or modify smart contracts.

2. **Accessibility:** Smart contract technology is becoming more seamless and standardized, to make it more accessible to users who are not IT experts.

3. **Legal certainty:** Even though smart contract proponents recognize the inherent enforceability of code-based contracts, more judicial decisions will be needed to give parties greater certainty.

Source:Structured Finance Industry Group

Blockchain Based Smart Contract Opportunities
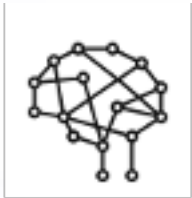
Speed, efficiency and accuracy
•Smart contracts are digital and automated,
there's no paperwork to process,
no time spent and manually filling in documents.

Trust and transparency
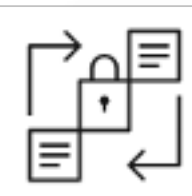•There's no third party involved, and
records of transactions are shared with participants,
there's no need to question whether information has been used for personal benefit.

Security
•Blockchain transaction records are encrypted, which makes them very hard to hack.

Savings
•Smart contracts remove the need for intermediaries to handle transactions and their time delays and fees.

Blockchain Based Smart Contract Challenges

Regulatory Compliance

Standardization

Scalability

Integration with Current Systems

User Adoption and Education

Legal Constraints

Technical Expertise

- **Analytic Hierarchy Process Method**

- The scoring system determines which of these criteria are more important than the others.

- Participants in the survey were asked which criterion they preferred over the others.

- The survey using the AHP method revealed,
- the criteria and features that the leasing process must promise for the use of smart contracts.

- As a result,
- priority criteria have been determined for integrating smart contracts into the commercial property leasing process.

- **Analytic Hierarchy Process Method**

- The Analytic Hierarchy Process (AHP) was developed by T. L. Saaty in 1980 and remains a widespread multi-criteria decision method that helps prioritize alternatives based on multiple criteria.

Stages,
- Hierarchy is defined as main criteria and sub criteria
- Pairwise comparisons
- Weight Calculation
- Consistency Check
- Priority Calculation
- Sensitivity Analysis

- Pairwise comparisons

$$M = \begin{bmatrix} 1 & i_{12} & \cdots & i_{1m} \\ i_{21} = \frac{1}{i_{12}} & 1 & \cdots & i_{2m} \\ \vdots & \vdots & 1 & \vdots \\ i_{m1} = \frac{1}{i_{1m}} & i_{m2} = \frac{1}{i_{2m}} & \cdots & 1 \end{bmatrix}.$$

m specifies the number of items

- Weight Calculation

$$w_i = \frac{t_i}{\sum_i t_i}, \sum_i w_i = 1 (i = 1, \ldots, m),$$

$$\begin{bmatrix} 1 & i_{12} & \cdots & i_{1m} \\ \frac{1}{i_{12}} & 1 & \cdots & i_{2m} \\ \vdots & \vdots & 1 & \vdots \\ \frac{1}{i_{1m}} & \frac{1}{i_{2m}} & \cdots & 1 \end{bmatrix} \quad \begin{array}{l} t_1 = 1 + i_{12} + \cdots + i_{1m} \\ t_2 = \frac{1}{i_{12}} + 1 + \cdots + i_{2m} \\ \vdots \\ t_m = \frac{1}{i_{1m}} + \frac{1}{i_{2m}} + \cdots + 1 \end{array}$$

Coordinates of the vector of weights,
w = (w1, w2, . . . wm), represent shares of prefer

- Consistency Check

$$\lambda_i = \frac{row_i(M) \times W^T}{w_i}, i = 1, \ldots, m.$$

defining a vector of eigenvalues, calculate coordinates
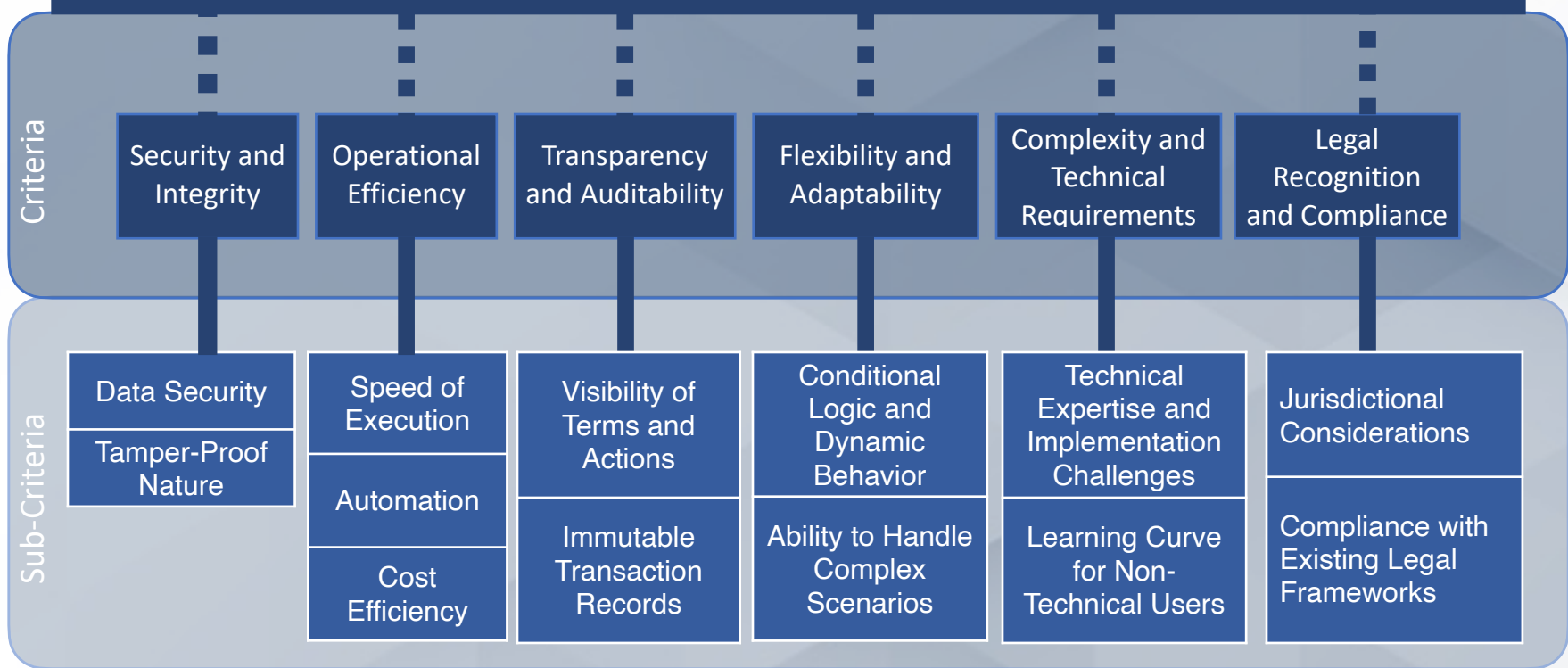
$$CI = \frac{\lambda_i^{max} - m}{m - 1}$$ λ^{max} represents the maximum coordinate value in the vector λ, while m is the number of items

$$CR = \frac{CI}{RCI}$$ Consistency ratio (CR) represents the ratio of CI and random consistency index (RCI)

Find Criteria For Using Smart Contracts in Commercial Property Leasing

Criteria

Security and Integrity	Operational Efficiency	Transparency and Auditability	Flexibility and Adaptability	Complexity and Technical Requirements	Legal Recognition and Compliance

Sub-Criteria

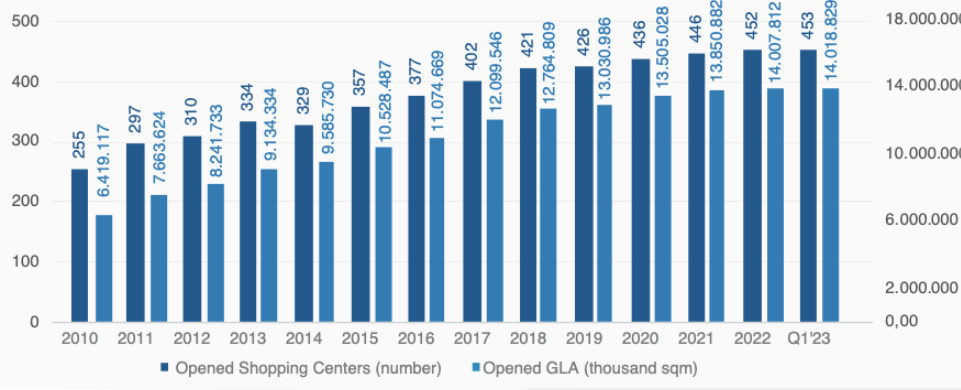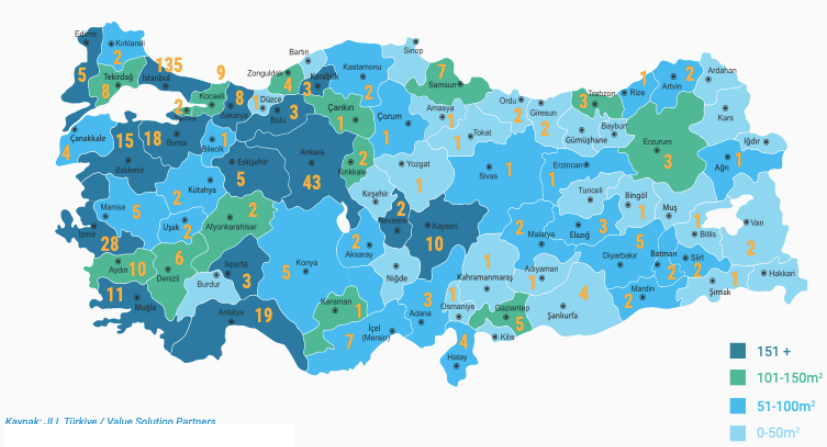| Data Security / Tamper-Proof Nature	Speed of Execution / Automation / Cost Efficiency	Visibility of Terms and Actions / Immutable Transaction Records	Conditional Logic and Dynamic Behavior / Ability to Handle Complex Scenarios	Technical Expertise and Implementation Challenges / Learning Curve for Non-Technical Users	Jurisdictional Considerations / Compliance with Existing Legal Frameworks

- The survey will be based on the shopping center leasing contracts, which have a very large volume in the Turkish market.
- The surveys will be conducted with specialist from different positions in the shopping center sector.

SHOPPING MALLS

Total Stock
- 453 Shopping malls
- 14 million 19 thousand m² GLA
- Under Project 39 shopping malls

Leasable Area Per 1.000 persons
- 164,4 m² Q1'23

Turnover Index
- %111,37 FEB'23

Visitor Index
- %14,49

*Compared to the same month of the previous year

Shopping Malls Opened by Years and GLA

Year	Opened Shopping Centers (number)	Opened GLA (thousand sqm)
2010	255	6.419.117
2011	297	7.663.624
2012	310	8.241.733
2013	334	9.134.334
2014	329	9.585.730
2015	357	10.528.487
2016	377	11.074.669
2017	402	12.099.546
2018	421	12.764.809
2019	426	13.030.986
2020	436	13.505.028
2021	446	13.850.882
2022	452	14.007.812
Q1'23	453	14.018.829

GLA* Volume and Number of Shopping Malls according to Cities

Kaynak: JLL Türkiye / Value Solution Partners

Legend:
- 151 +
- 101-150m²
- 51-100m²
- 0-50m²

- A survey will be applied to experts in different positions in the shopping mall leasing processes. This survey, which was planned to be conducted with min. 60 experts, was first applied to the focus group.
- With the 1-9 scoring method, it will be requested to compare the order of importance among the criteria.
- From right to left, importance of the right factor in comparison to the left factor decreases.

How important are criteria 1 compare to criteria 2 for you in commercial real estate leasing contracts?

Criteria 1	Extremely Important	Very Strongly Important	Strongly Important	Slightly Important	Equal Important	Slightly Important	Strongly Important	Very Strongly Important	Extremely Important	Criteria 2
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	

Criteria 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Criteria 2
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Tamper-Proof Nature
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Speed of Execution
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Automation
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost Efficiency
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Visibility of Terms and Actions
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Immutable Transaction Records
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Conditional Logic and Dynamic Behavior
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Ability to Handle Complex Scenarios
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Technical Expertise and Implementation Challenges
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Learning Curve for Non-Technical Users
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Jurisdictional Considerations
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Compliance with Existing Legal Frameworks
Data Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Speed of Execution

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- The criteria of priority that emerged after the results of the survey are the criteria that should be prioritized while creating the model.

Priorities
- Resulting weights for the criteria based on pairwise comparisons which applied to the focus group,

Decision Matrix
- The resulting weights are based on the principal eigenvector of the decision matrix:

Cat		Priority	Rank	(+)	(-)
1	Data Security	4.5%	7	4.5%	4.5%
2	Tamper-Proof Nature	7.2%	6	5.6%	5.6%
3	Speed of Execution	19.5%	1	9.4%	9.4%
4	Automation	16.7%	2	7.2%	7.2%
5	Cost Efficiency	2.2%	12	2.0%	2.0%
6	Visibility of Terms and Actions	1.8%	13	1.4%	1.4%
7	Immutable Transaction Records	11.7%	4	6.4%	6.4%
8	Conditional Logic and Dynamic Behavior	13.3%	3	6.0%	6.0%
9	Ability to Handle Complex Scenarios	9.2%	5	7.7%	7.7%
10	Technical Expertise and Implementation Challe	4.0%	8	4.9%	4.9%
11	Learning Curve for Non-Technical Users	2.3%	11	1.7%	1.7%
12	Jurisdictional Considerations	3.7%	10	3.2%	3.2%
13	Compliance with Existing Legal Frameworks	4.0%	9	3.2%	3.2%

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1	0.25	0.12	0.14	5.00	7.00	0.14	0.17	0.12	0.20	7.00	1.00	4.00
2	4.00	1	0.17	0.17	7.00	1.00	1.00	0.25	1.00	6.00	7.00	1.00	1.00
3	8.00	6.00	1	1.00	6.00	7.00	4.00	1.00	4.00	7.00	7.00	6.00	5.00
4	7.00	6.00	1.00	1	7.00	6.00	2.00	1.00	2.00	8.00	8.00	4.00	5.00
5	0.20	0.14	0.17	0.14	1	6.00	0.14	0.14	0.17	1.00	1.00	1.00	0.17
6	0.14	1.00	0.14	0.17	0.17	1	0.14	0.14	0.17	0.14	1.00	1.00	0.50
7	7.00	1.00	0.25	0.50	7.00	7.00	1	1.00	1.00	7.00	6.00	4.00	6.00
8	6.00	4.00	1.00	1.00	7.00	7.00	1.00	1	1.00	7.00	6.00	6.00	1.00
9	8.00	1.00	0.25	0.50	6.00	6.00	1.00	1.00	1	1.00	1.00	1.00	7.00
10	5.00	0.17	0.14	0.12	1.00	7.00	0.14	0.14	1.00	1	1.00	0.25	1.00
11	0.14	0.14	0.14	0.12	1.00	1.00	0.17	0.17	1.00	1.00	1	1.00	1.00
12	1.00	1.00	0.17	0.25	1.00	1.00	0.25	0.17	1.00	4.00	1.00	1	0.50
13	0.25	1.00	0.20	0.20	6.00	2.00	0.17	1.00	0.14	1.00	1.00	2.00	1

Number of comparisons = 78
Consistency Ratio CR = 19.5%

Principal eigen value = 16.643
Eigenvector solution: 7 iterations, delta = 6.8E-8

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- Following the determination of the **priorities of the criteria** according to the survey results, which criteria can be used in commercial real estate contracts will emerge. After the criteria are determined, the stages of a **smart contract in a blockchain-based application model**;

1	Contract Definition	Contract conditions, and requirements are determined, agreed upon by the parties involved.
2	Coding the contract	Expressing the defined terms in the code, determining the logic and behavior of the contract.
3	Installation and compilation	The contract code is compiled into a contract file within the smart contract platform then deployed to the blockchain network or the target blockchain platform and becomes accessible to all network participants.
4	Execution	Payment flow occurs, code is automatically triggered based on the contract's conditions, relies on the consensus mechanism provided by the blockchain network to achieve the contract's functionality.
5	Validation	Ensures the accuracy of transactions, confirmation of transactions by participants,
6	Termination	Objectives are completed or the specified conditions are met

- According to the priority order of the 13 criteria that emerged as a result of the surveys conducted with the focus group, the first criterion is 'speed of execution'.

- Automation and Conditional Logic and Dynamic Behavior are also high priority criteria.

- According to expert opinions in the survey, it is understood that the criteria that shorten the operational process are important and preferred.

- It has been revealed that legal, technical expertise and training issues, which are seen as the challenges of smart contracts, are evaluated as the last criteria, not the priority.

- While integrating the shopping center leasing process into smart contracts, the criteria that are preferred in order of priority should be provided in the model to be created.

- Smart contracts are an important example of the use of Blockchain technology in the shopping center leasing process. Smart contracts can be used to increase commercial efficiency, reduce transaction and legal costs, and facilitate transparent process.

- In the next phase of the study, data will compared with the existing leasing processes and determine the necessary criteria for smart contracts to be preferred.

- The rank of importance of the criteria with the AHP method as a result of the surveys.

- As a result, a pre-model phase is being created for integrating smart contracts into the commercial property leasing process.

Thank you for attention

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