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Designing a smart contract process model based on blockchain technology Using Meta-Synthesis Research Method

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Abstract
Due to the growing future of blockchain applications such as smart contracts and the widespread use of smart contracts in the Internet of Things (IoT) and the lack of Persian resources in this field, it is necessary to conduct comprehensive and integrated researches for a systematic study of past studies and provide interpretive perspectives and create new knowledge. In this research, using mixed research method (first, using the Meta-Synthesis Research Method, by combining qualitative findings of previous studies and combining different perspectives, a model in the process of smart contracts on the blockchain platform is presented and then for evaluation and analysis of the modeled, structural equations quantitative method and confirmatory factor analysis with Smart PLS3 software have been used. The lack of a standard framework for analyzing and comparing smart contract-based systems identifies the need to design a smart contract model that allows smart contract developers to identify bottlenecks and improve system-based smart contracts.

Keywords: Smart Contract Model, Smart Contract Process, design Smart Contract, Smart Contract Architecture, Smart Contract platform.

1. INTRODUCTION

Decentralized systems face major problems, including scalability and privacy as well as multi-identity issues. Nowadays, experts are trying to design decentralized protocols like blockchain that are scalable and optimized in addition to being resistant against attacks.

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Analysis of such protocols requires extensive knowledge in areas such as distributed systems, cryptography, game theory, and information theory concepts. The transfer of power from closed, unclear mechanisms to people and society is one of the most important concepts in the new world. In this regard, blockchain technology can facilitate the move toward a more uniform and equal society.

The vast scope of blockchain technology applications, including smart contracts, goes back to its basic concept of a fully transparent, publicly accessible, secure, decentralized database without the need to trust a third party or central entity [1].

Smart contract eliminates the supervisory interface and thus reduces costs. Other benefits include the automatic payment of contract fees, and it's transparent as well as having decentralized nature. However, despite the benefits and considerable applications of smart contracts, they face a variety of challenges in practice, since they are new emerging technologies. Thus, this study aims at presenting a systematic and comprehensive smart contract process model based on blockchain technology and distributed ledger, using a meta-synthesis qualitative research method and Sandelowski and Barroso's (2006) seven-step model.

2. LITERATURE

2.1. Smart Contract

The term smart contract was first coined by computer and cryptography scientist, Nick Szabo, in 1994[2]. He outlined the general principles, but there was no adequate space and infrastructure at that time for the realization of his ideas. With the advent of blockchain technology, the idea of smart contracts became operational. As the world's first decentralized digital currency, Bitcoin was the foundation of some kind of contract in the blockchain, but the Bitcoin protocol was only designed to create a private currency and could not fulfill all the needs and processes [3]. Ethereum platform made smart contracts possible for most projects, taking a new step toward globalization.

Smart contracts are the digitalized model of traditional contracts and can be defined as blockchain-based computer software whose contents in the "source code" are automatically executed and cannot be modified by the parties because of storage in the blockchain. A smart contract is a tool through which trading is possible transparently and without conflict or the need for intermediary services, money, assets, stocks, or anything valuable [4].

2.2. Blockchain

Given that the smart contract is incorporated in blockchain, blockchain can be called a distributed database of documents or a general ledger of "all digital events or transactions" jointly executed by its constituents. Each transaction is recorded in the general ledger by the agreement of the majority of system components. Information once entered into the system, will never be removed. Blockchain can be considered as a data storage structure based on chains of interrelated data blocks that are collectively generated, retrieved, and maintained by the nodes participating in the system [5]. Changes to each block will cause invalidity of the following blocks. Each new block is prepared and added to the chain from the new data generated in the system in a competitive mechanism by one of the participants. New blocks are accessible and verifiable by other people participating in the system. If a block contains a storage error, it is detected by other nodes in the network and is not registered in the main chain. As long as more than 50% of the network nodes agree on the current chain, the chain will be valid [6]. Due to the chain structure and each block's close association with its previous blocks, changing the data agreed upon by the majority of the network requires enormous computational power which cannot be supplied and in turn, makes the system resistant to cyber-attacks [7].

Smart contracts have lower legal and transaction costs than traditional contracts since the consumer relates directly to the centralized currency exchange.

Ethereum is currently the most advanced smart contract platform. This blockchain protocol has been designed to solve the fundamental constraints of Bitcoin in programming [8]. Ethereum is aimed primarily at storing and executing smart contracts. It supports the full Turing feature, allowing for advanced and customized contracts. In theory, full Turing means the capability of being used to solve any computational problem. Ethereum is prominent because, unlike Bitcoin, it is aimed not only at creating a crypto-currency but also acts as an alternative protocol for creating decentralized applications [9].

The smart contract code stored in the blockchain on the Ethereum platform is first called, verified, and then executed on the Ethereum virtual machine, after satisfying the usual contract terms (Fig.1).

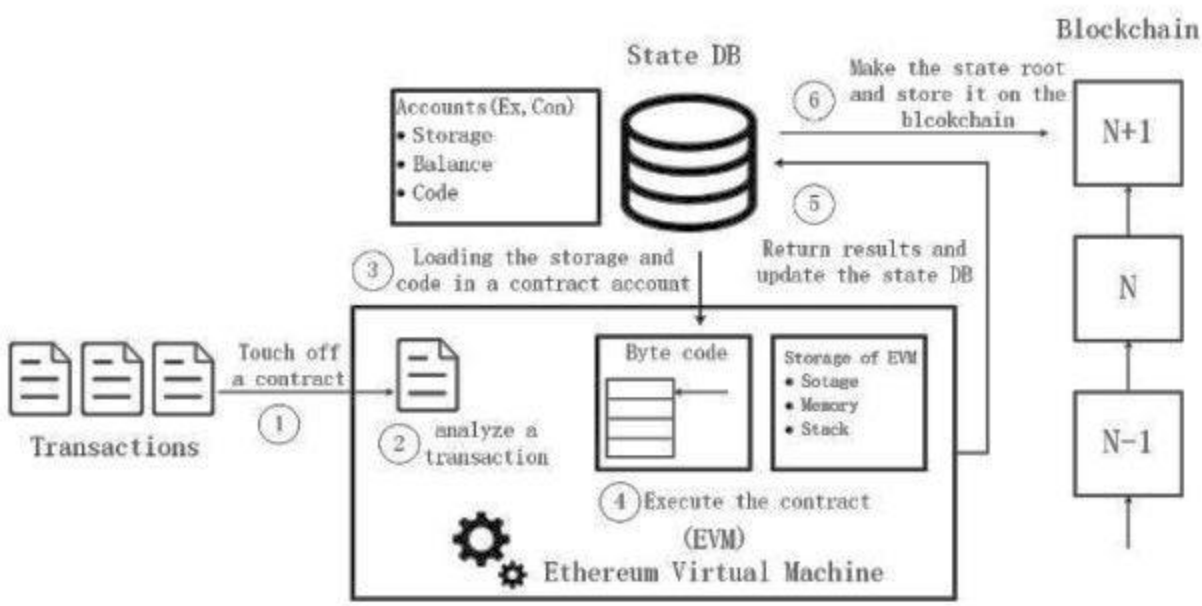


Fig.1. Execution of Smart contract in Ethereum platform and interaction with blockchain technology.

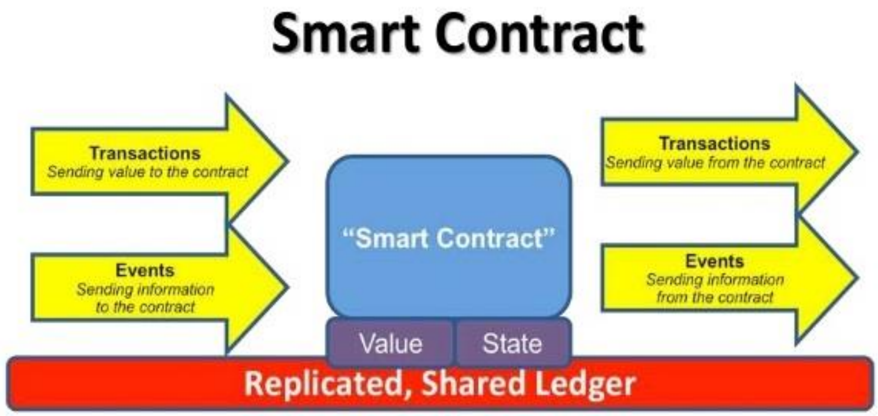


Fig.2. Smart Contract.

With the growing need for data flows to blockchain followed by smart contracts, discussions, and innovations around Oracle have formed. Oracles are data sources of external systems that import critical information into the blockchains [10]. Smart contracts need these data to run. Oracle is authentic information outside of the system, used to execute smart contracts. Oracles retrieve and verify data from external sources through web APIs and market data sections for blockchains and smart contracts [11]. The data required by smart contracts include information such as prices, weather, and so on.

As shown in Fig.2, financial transactions and events are represented as input and output in the smart contract, where oracle is used if the input is from external credible sources. Also, the output of the smart contract is stored in the smart contract blockchain or can be used as another smart contract input.

Considering the numerous legal, civil, technical, and organizational challenges to implementing smart contracts and given the scattered studies in this field, it is imperative to have a comprehensive and systematic approach to identifying and classifying the process of small contracts based on blockchain technology and the distributed ledger to provide a systematic and holistic model. Therefore, the present study has provided this model based on Sandelowski and Barroso's (2006) seven-step model in addition to introducing the meta-synthesis qualitative method.

3. RESEARCH METHODOLOGY

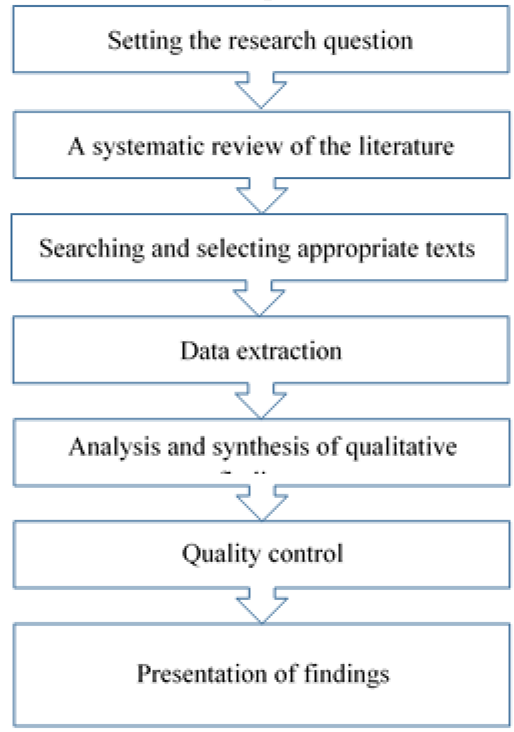
The research method of this study is qualitative and a kind of meta-study called meta-synthesis. In the application of meta-synthesis to identify factors influencing the process of smart contracts based on blockchain technology and the general ledger, similar to meta-analysis, it is used to integrate multiple studies and generate comprehensive and interpretive findings. Since most of the articles in the field of study are qualitative without quantitative data, the meta-synthesis method has been used as a suitable method to obtain a comprehensive combination of this topic based on the translation of limited qualitative studies. As stated, meta-synthesis is a type of secondary study, with the aim of a structured review of qualitative studies, focusing on the qualitative findings derived from related and similar studies[12] On the other hand, meta-synthesis is not an integrated review of the associated qualitative literature and does not necessarily involve much of the related literature on the topic. Also, it is not an extract from the interpretations of similar studies, but rather an integration of the interpretation of the main findings of the studies selected to create comprehensive and interpretative findings [13], indicating a deep understanding of the researcher [14]. That is, instead of providing a comprehensive summary of the findings, it creates an interpretive combination of them. Meta-synthesis explores new and fundamental metaphors and themes by providing a systematic approach to researchers by combining various qualitative research, thereby expanding current knowledge and providing a holistic and comprehensive view[15]. Meta-synthesis requires that the researchers show a more comprehensive representation of the phenomenon under investigation [13]. In this research, the seven-step method of Sandelowski and Barroso, summarized in Table 1, has been used.

Moreover, each step has been discussed in detail in the following sub-sections [16]:

3.1. The First Step: Setting the Research Question

Various parameters were used to set the research question, such as the population under study, the method, and the time of the study. The following question was explored in the present research:

Table 1. ***Sandelowski and Barroso's (2006) seven-step model.***



1. Identification and grouping of smart contract process to provide the model of smart contract based on blockchain and the general ledger

The study population consisted of articles published in internationally accredited journals and theses that were reviewed between 2016 and 2019. The selection was performed by purposeful sampling and census-based on inclusion and exclusion criteria.

It is worth noting that the last 4 years (from 2016 to 2019) were considered for the selection of the articles to collect the most up-to-date scientific results in the field under study.

3.2. The Second Step: Systematic Review of the Literature

At this step, the researcher focused on the systematic search based on internationally accredited scientific journal articles, and theses were reviewed between 2016 and 2019 to select the relevant keywords. The related articles were investigated using the keywords of Smart Contract Model, Smart Contract Process, design Smart Contract, Smart Contract Architecture, Smart Contract platform in databases of OATD (Open Access Theses and Dissertations), Proquest, Science Direct, Springer, Scopus, Civilica, SID, IRANDOC, ISC, Emerald, IEEE, as well as Google scholar specialized database.

3.3. The Third Step: Searching and Selecting Appropriate Texts

In this step, the researcher removed several articles in each review, which would not be considered in the meta-synthesis. Articles were evaluated based on inclusion and exclusion criteria (study parameters) and according to Table 2. The inclusion criteria for this study were the followings:

1. Articles published in internationally accredited journals and theses reviewed between 2016 and 2019;
2. Articles related to the title and research question as well as articles published with valid scientific research methods;
3. Articles approved by expert referees and published in journals confirmed by the ministries.

Exclusion criteria for this study included the followings:

1. Articles irrelevant to the title and research question as well as articles published with invalid scientific research methods;
2. Articles lacking the necessary scientific quality and published in invalid journals;
3. Articles with similar titles and objectives.

Based on the inclusion and exclusion criteria (study parameters) and according to Table2, 32 articles were eventually left from the initial 119 articles found for data extraction.

Once the articles have been reviewed to fit the study parameters, the methodological quality of the studies should be then evaluated. This step aims at removing articles whose findings are not reliable; therefore, articles that should be included are also likely to be removed. Critical Appraisal Skills Program (CASP) is used for early investigations of qualitative studies. CASP is a tool commonly used for evaluation through 10 questions and helps the researchers determine the accuracy, reliability, and importance of qualitative research studies. These questions focus on the following items: 1. Research objectives; 2. The logic of the method; 3. Research design; 4. Sampling method; 5. Data collection; 6. Reflectiveness (including the relationship among the researcher and participants); 7. Ethical considerations; 8. Accuracy of data analysis; 9. Clear and transparent statement of the findings; and 10. Research value. At this point, the researcher gives each of these questions a quantitative score and then creates a form. So, it is possible to review the collection of articles and observe the evaluation results. The scores given to each article are then summed and the articles with scores lower than 21 are easily removed based on CASP 50-point Rubric: scores of 41-50 are excellent, 31-40 very good, 21-30 good, 11-20 poor, and 0-10 very poor. According to scores given to each article, the minimum mean score was respectively 18 and 19 and the maximum was 45; as a result, during the CASP evaluation process, two articles were removed from the 35 remaining articles, and finally, a total number of 33 articles were left for data analysis.

3.4. The Fourth Step: Data Extraction

Across the meta-synthesis, the researcher repeatedly reviewed the selected and finalized articles to gain insights into the individual content in which the original studies were conducted. In the present study, the information of the articles has been categorized as follows: The reference to each article, including article code, article name, author's name, year of publication, and type of research was recorded. Table 3 shows the information of 10 selected articles from a total of 32 articles.

Table 2. ***Steps taken to investigate the articles found.***

The first step: Review of the titles		
120 articles	36 articles	84 articles
The first step: Review of the abstracts		
84 articles	23 articles	61 articles
The first step: Review of the results		
61 articles	14 articles	47 articles
The first step: Review of the content		
47 articles	12 articles	35 articles

3.5. The Fifth Step: Analysis and Synthesis of the Qualitative Findings

Meta-synthesis aims at creating a new and integrated interpretation of the findings. This method is adopted to clarify concepts, patterns, and results in refining existing states of knowledge and the emergence of operational models and theories [17]. Throughout the analysis, the researcher looks for themes that have emerged among the studies in the meta-synthesis. These cases are known as "thematic investigations". When the themes are identified, a categorization is formed after which similar and associated categories are placed in a theme that can best describe them. Themes provide the foundation for creating "explanations, models, and theories or assumptions" [16]. In the present study, all the factors extracted from the studies are considered as open codes. Then, the game codes that have a common concept or related task in a similar concept (axial code) are categorized by considering the concept of each of these codes. Eventually, similar concepts create categories (domains) to form the research model. The open codes extracted from the final articles are presented in Table4 along with categorization of the concepts (axial code) and categories (domains).

3.6. The Sixth Step: Quality Control in Meta-Synthesis Method

Table 3. ***the information of 10 selected articles from a total of 32 articles.***

No	Article's Title	Author	Year of Publication	Journal or Conference
1	Security, Performance, and Applications of Smart Contracts: A Systematic Survey	SARA ROUHANI AND RALPH DETERS	2019	IEEE
2	DLT/BLOCKCHAIN ARCHITECTURE AND REFERENCE FRAMEWORK	Claudio Lima, Ph.D. Blockchain Engineering Council – BEC, Co-Founder IEEE DLT/Blockchain Standards, Vice-Chair, Chair	2018	IEEE
3	An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends	Zibin Zheng1, Shaoan Xie1, Hongning Dai2, Xiangping Chen4, and Huaimin Wang3	2017	IEEE 6th International Congress
4	Blockchain White Paper	China Academy of Information and Communication Technology	2018	China Academy of Information and Communication
5	An Overview of Smart Contract: Architecture, Applications, and Future Trends	Shuai Wang1,2, Yong Yuan*1,3 (Corresponding author, Senior Member, IEEE), Xiao Wang1,3, Juanjuan Li1,3, Rui Qin1,3, Fei-Yue Wang1,3,4(Fellow, IEEE)	2018	IEEE, Intelligent Vehicles Symposium
6	Design of the Blockchain Smart Contract: A Use Case for Real Estate	Ioannis Karamitsos1, Maria Papadaki2, Nedaa Baker Al Barghuthi2	2018	Journal of Information Security, 2018, 9, 177-190
7	An Overview of Smart Contract and Use cases in Blockchain Technology	Bhabendu Kumar Mohanta-Debasish Jena -Soumyashree S Panda	2018	9th ICCCNT 2018 July 10-12, 2018, IISC, Bengaluru Bengaluru, India
8	A Vademecum on Blockchain Technologies: When, Which and How	Marianna Belotti, Nikola Božić, Guy Pujolle, Stefano Secci	2019	SUBMISSION TO IEEE COMMUNICATIONS SURVEYS AND TUTORIALS 1
9	Blockchain-based Smart Contracts - Applications and Challenges	Madhusanka Liyanage-Ahsan Manzoor-Kanchana Thilakarathna-Guillaume Jourjon	2019	Researchgate
10	ISO/TC 307-Blockchain and distributed ledger technologies	Geo Goodell (UK)-Victoria Lemieux (CA)-Heather Kreger (US)	2018	ISO

The researchers considered the following procedures to maintain the quality of the study:

1. Throughout the research, it was tried to take steps by providing clear explanations for the options available in the research;
2. Researchers used both electronic and manual search strategies to find relevant articles;
3. Researchers applied the quality control methods used in original qualitative research studies;

Table 4. ***Results of analysis using the meta-synthesis research method.***

Category (Domain)	Concept (Axial Code)	Open Code
Smart Contract Definition	Buyer and seller evaluation	Authentication and identify management-access management-membership service-
	Prerequisites for the agreement of the parties regarding the assets and rights of the parties	Rules-condition agreed-the asset and right of the parties
	Select the type of smart contract platform	Blockchain platform-ethereum-nxt-neo-eos
Create Smart Contract	Set conditions and events	Event-set condition-agreement identification-FSM-Finate State Machin
	Coding the business logic of smart contracts	Smart contract code-programming language-solidity
Deploy Smart Contract	Waiting for the contract conditions to occur to execute the smart contract	Waiting for the contract conditions- Waiting for smart contract execution
	digital signature	Public key-private key-PKI-digital signature-electronic signature
	Save smart contract code in the blockchain	Add code smart contract to blockchain-store smart contract-add code contract
Execution of a smart contract	Automatic execution of smart contracts	Consensus protocol-proof of work (POW)-proof of stake(POS)-Mining Algorithms-execute EVM-Smart contract execution engine
	Transfer of money and value according to the terms of the smart contract	Smart contract value transfer-transfer value
	Execution of another related contract according to the terms of the smart contract	Send message-message contract-event distribution
Save and update output results	Update all network nodes	Update Node- Update Network-p2p network
	Save smart contract execution results in blockchain and related accounts	-Transaction Propagation-submit Transaction-submit block-block synchronization-broadcast transaction

4. Researchers used the CASP tool to evaluate meta-studies for the synthesis of the main studies.

The validity and reliability of the designed model consisted of 4 categories (domains) and 15 axial codes (concepts). After completing the meta-synthesis methodology steps, the designed model was presented in focus group meetings with 5 experts. During these sessions, both two levels of the model were examined and no changes were made. New dimensions and components were not added or removed, indicating the validity of the designed model. Since in the model design process, the criteria of the previous models were considered as codesand considering the semantic similarities between the codes, they were merged and concepts were created. The kappa indicator was used to measure the reliability of the model. In this way, another person (from elites) attempted to classify the codes into concepts, without knowing how the codes and concepts had been merged by the researcher. Then the concepts presented by the researcher were compared with the concepts presented by this individual. Finally, the kappa indicator was calculated based on the number of similar and different concepts created. As can be seen in Table 5, the researcher created 15 concepts, while the other person from the elite created 12 concepts, of which 11 were common.

$$Observed\ Agreements = \frac{A+D}{N} = \frac{9}{14} = .64$$

$$Random\ Agreements = \frac{A+B}{N} \times \frac{A+C}{N} \times \frac{C+D}{N} \times \frac{B+D}{N}$$

$$K = \frac{Observed\ Agreements - Random\ Agreements}{1 - Random\ Agreement}$$

$$\text{Random Agreements} = \frac{11}{14} * \frac{12}{14} * \frac{3}{14} * \frac{2}{14} = .02$$

$$K = \frac{.64 - .02}{1 - ..02} = .63$$

Table 5. ***Calculation of Kappa Coefficient to Measure Model Reliability.***

		Researcher's Opinion		
		Total	**No**	**Yes**
Another Person's Opinion	Yes	11	B=2	A=9
	No	3	D=0	C=3
	Total	14	2	12

Table 6. ***Status of Kappa Indicator.***

Agreement Status	Kappa Indicator Numerical Value
Poor	Less than zero
Unimportant	0-0.2
Average	0.21-0.4
Suitable	0.41-0.6
Valid	0.61-0.8
Excellent	0.81-1

As shown below, the value of the kappa indicator was calculated to be 0.67, which is the valid agreement level according to Table 6.

3.7. The Seventh Step: Presentation of Findings

At this step of the meta-synthesis approach, the findings from the previous steps are presented. The 30 articles selected by the researchers were carefully reviewed and the required information was identified based on the main purpose of this paper, which was to identify and group the process of the smart contract based on the blockchain technology and distributed ledger. The findings were categorized into 4 categories (domains) and

15 concepts (axial codes) after application of the expert opinions (5 professors of IT and management), which is presented in Table 4. The next page indicates the desired model in 4 categories (domains) and 15 concepts (axial codes) graphically. Also, a summary of the model of the process Smart Contract Based on Blockchain Technology is presented in Table 7.

4. QUANTITATIVE METHOD OF STRUCTURAL EQUATIONS FOR EVALUATION AND VALIDATION OF INTEGRATED SMART CONTRACT MODEL BASED ON BLOCKCHAIN TECHNOLOGY

In the second step, to validate a bit based on the secondary model of research in the conceptual framework of the research, a researcher-made questionnaire consisting of three questions related to the definition of smart contract, two questions related to the component of smart contract creation, and three questions related to the component of smart contract establishment and two questions related to the component of smart contract update, was prepared and distributed among 63 experts (middle experts). Researchers in the field of smart contracts and blockchains and cryptocurrencies have been selected in educational and academic centers and active companies in the IT field of the country and due to the lack of experts in this field, sampling has been done purposefully. Content validity of the questionnaire through consultation with several experts and calculating the values. The mean of the extracted variance (AVE) was confirmed and the reliability of the questionnaire was calculated by Cronbach's alpha, which was 78.4%

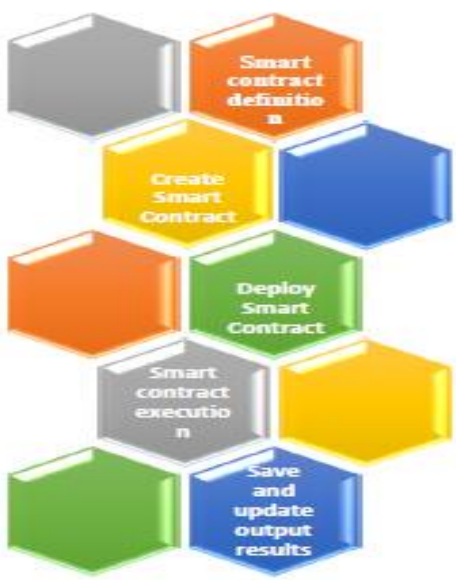


Fig.3. Summary of the Model of the process Smart Contract Based on Blockchain.

Then, in order to determine the type of method in SPSS22 software to determine the statistical

normality of the raw data, we used the Kolmogorov-Smirnov test, which showed that the results of this test showed that the data were not normal.

Considering that the significance level of the test for variables is less than .05 and due to the limited number of samples, 63 samples, and the normality of the data, structural equation modeling and confirmatory factor equation modeling and confirmatory factor analysis method have been used in SmartPLS3 software to evaluate and validate the proposed framework. After examining the path coefficients and the significance coefficient (t-value), the proposed framework of research based on redundancy and shared indicators is investigated.

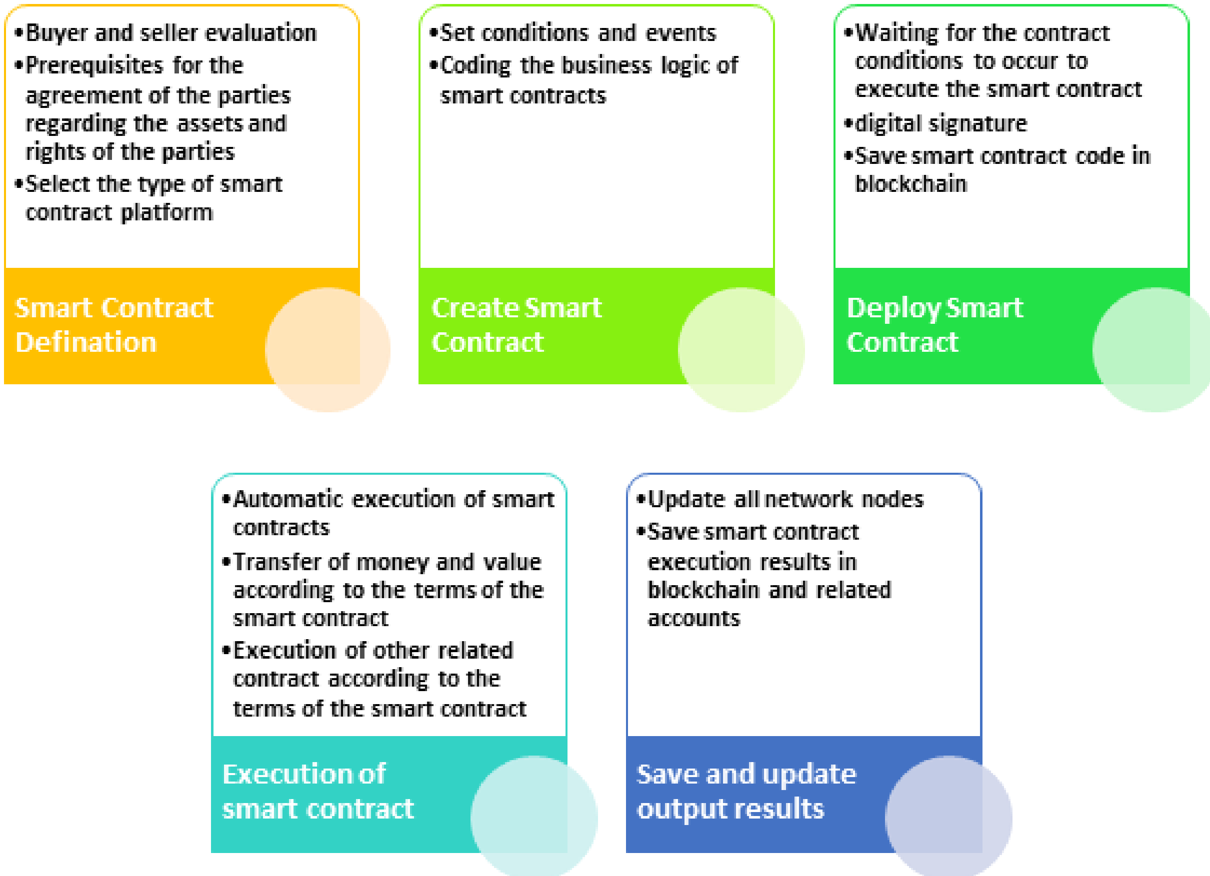


Fig.4. Model of the process Smart Contract Based on Blockchain Technology.

4.1. Evaluation and Grace of Smart Contract Model

In this section, we have used confirmatory factor analysis and causal relationships based on structural equation modeling to test the proposed framework [18]. This test can be performed by SmartPLS3 software in the external and internal frameworks of the test, which we have initially addressed the external framework.

The external framework of co-currency is the measurement framework in the frameworks of structural equations based on covariance, which indicates the relationship between the present variables and the observed markers (obvious variables). In addition to experts' approval, confirmatory factor analysis has been used to investigate internal relationships and measure the relationships between hidden variables and their items to confirm each of the indicators considered in the framework of the research, factor loads, and meaningful coefficient (t-value) of each of them by SmartPLS3 software. It was calculated. In fact, the power of the relationship between the hidden variable and visible variable (items) is shown by factor load.

Table 7. ***Cronbach's alpha and the extracted mean-variance of smart contract mode.***

	Cronbach's alpha	rho_A	Reliability	AVE
Execution of smart contract	0.79	0.794	0.905	0.826
Deploy Smart Contract	0.882	0.907	0.976	0.807
Create Smart Contract	0.732	0.764	0.88	0.786
Save and update output results	0.72	0.72	0.877	0.781
Smart Contract Defination	0.804	0.824	0.884	0.719

Table 8. ***Standard coefficient and meaningful coefficient of intelligent contract model.***

	Standard coefficient	Sample average	STDEV	T-Value
Execution of smart contract	0.787	0.827	0.047	16.758
Deploy Smart Contract	0.647	0.663	0.05	13.013
Create Smart Contract	0.686	0.709	0.045	15.233
Save and update output results	0.761	0.797	0.053	14.375
Smart Contract Definition	0.804	0.828	0.029	27.761

Table 9. ***Factor load values and significance of smart contract model items***

	Standard coefficient	Sample average	STDEV	T-Value
sc-q1-def<-Smart Contract Defination	0.806	0.806	0.025	31.733
sc-q10-exe<-Execution of smart contract	0.917	0.924	0.012	76.628
sc-q12up<-Save and update output results	0.888	0.902	0.017	53.122
sc-q12-up<-Save and update output results	0.88	0.887	0.032	27.103
sc-q2-def<-Smart Contract Defination	0.93	0.931	0.015	62.938
sc-q2-def<-Smart Contract Defination	0.802	0.808	0.029	27.288
sc-q4-cre<-Create Smart Contract	0.916	0.922	0.013	71.121
sc-q5-cre<-Create Smart Contract	0.856	0.864	0.052	16.476
sc-q6-dep<-Deploy Smart Contract	0.904	0.902	0.05	17.913
sc-q7-dep<-Deploy Smart Contract	0.918	0.923	0.015	69.83
sc-q8-dep<-Deploy Smart Contract	0.872	0.88	0.023	37.993
sc-q9-exe<-Execution of smart contract	0.901	0.911	0.028	32.154

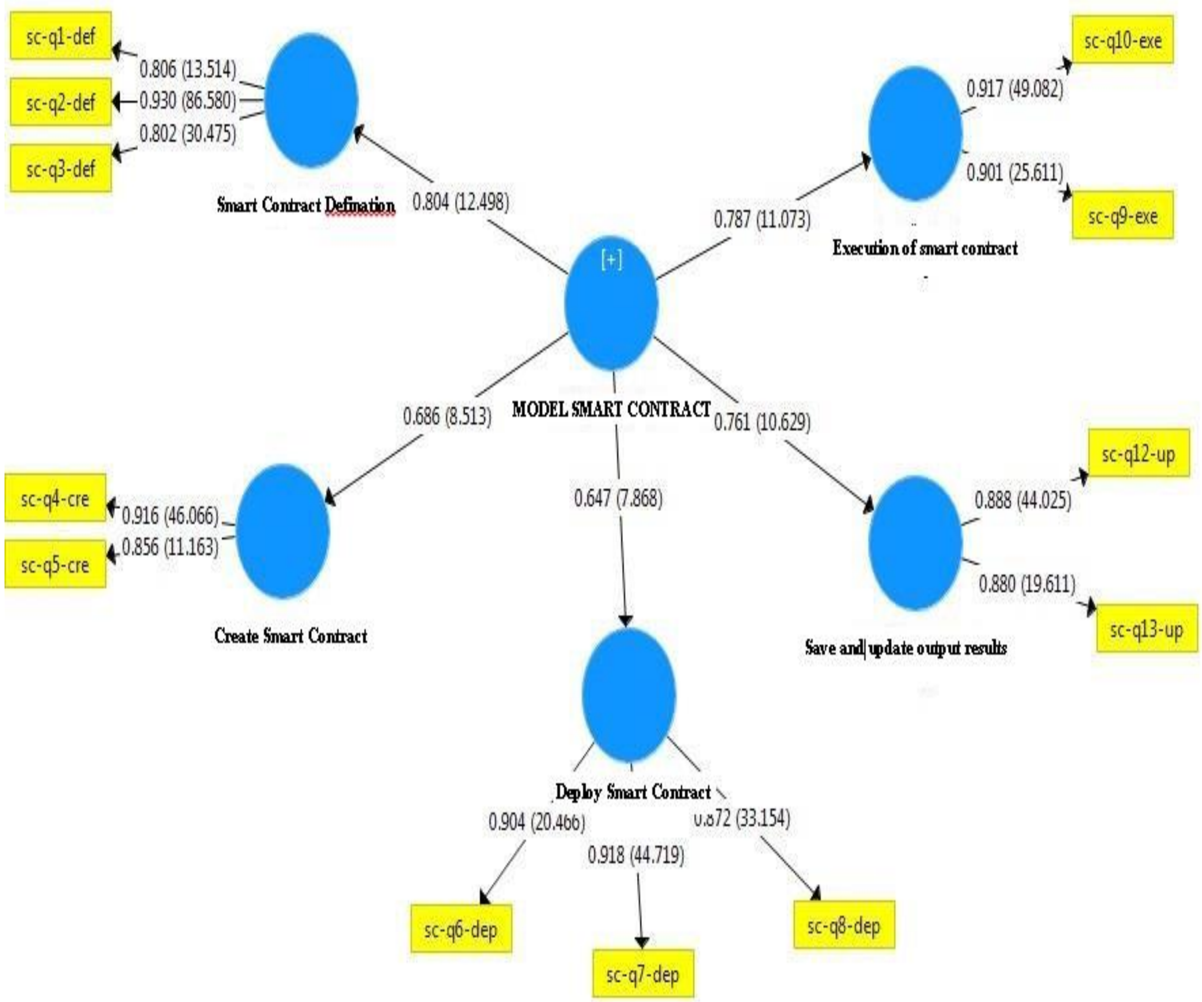


Fig.5. Path Coefficients and Operating Loads of Smart Contract Process Model.

Table 10. ***Shared indicators and redundancy and the coefficient of explanation of smart contract model.***

	R^2	Cross-Validated Redundancy	Cross-Validated Communality
Execution of smart contract	0.86	0.56	0.15
Deploy Smart Contract	0.62	0.49	0.44
Create Smart Contract	0.65	0.5	0.33
Save and update output	0.81	0.63	0.31
Smart Contract Definition	0.85	0.6	0.43

The t-value should also be more than 1.96 in the critical value of .05. In fig.8, the factor load of each item of the smart contract model is shown. As you can see, all the factor loads and value-t values observed are positive and significant.

Various tests are constantly developing and evolving to examine the grace of the research framework, but there is still no public consensus on an optimal test. As a result, different articles have presented different indicators. In this study, to investigate the validity of the proposed framework, the index

of shared validity and redundancy index (quality of the measurement framework of each block) and the coefficient of explanation (R^2) have been used.

5. CONCLUSION

In the smart contract model by the above research method, the qualitative method of Meta-synthesis and quantitative method of structural equations Confirmation in 5 dimensions (categories) and 21 (components) of (axial code) was investigated that the dimensions of the model including, 1-smart contract definition, creation(coding) smart contract, smart contract deployment, smart contract execution and finally smart contract update.

According to path analysis coefficients, it shows that the definition and implementation of the smart contract with the highest standard coefficient with .80 and .79 have the highest correlation with the smart contract model, and the lowest standard coefficient according to the path analysis coefficients of structural equations, respectively. Including deployment and creation of a smart contract with .65 and .69 had the lowest correlation with the smart contract model.

According to the results of the test of research hypotheses and above.5 of all factor loads and more than 1.96 of the significant coefficient (t-value) of variables, it can be concluded that the indicators (research measures hidden variables correctly and on the other hand, the analysis of path coefficients indicates a positive and significant relationship between the dimensions of the model and the smart contract model.

Finally, due to the positive results of the values of shared indicators, redundancy, and explanation coefficient, indicating the optimal appropriateness of the model.

It is recommended that at least technical, legal, educational, and organizational infrastructures related to the implementation and realization of smart contracts should be set up as follows:

- Approving and assigning digital signatures to individuals and accepting their legal validity;
- Approving the laws associated with smart contract, domestic and international accreditation, and resolving legal conflicts;
- Registration of all documents and real estate in blockchain by state-approved cryptographic codes;
- Informing all members of the society about the legal process of the smart contract;
- Establishment of startups and knowledge-based companies related to smart contracts to facilitate the creation and development of the smart contract.

Based on the results of the study, the following suggestions are presented to other researchers:

- Using structural equation modeling to relate the identified categories;
- Using factor analysis to validate the model;

- Application of fuzzy multi-criteria decision-making methods to weigh and prioritize the identified factors;
- Using multi-criteria decision-making methods to rank major factors;
- Using system dynamics modeling to analyze causes of factors systematically and fundamentally and provide scenarios for solving it;
- Using other meta-study methods to evaluate the results of research in this area.

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