

# Potential Development Paths of Artificial Intelligence-Enabled Smart Contract Technology to Enhance the Efficiency of Economic Transactions

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**Abstract** Smart contracts, as an automatically executed programmatic protocol, offer new possibilities for economic transactions. This study explores the potential development path of smart contract technology supported by artificial intelligence to enhance the efficiency of economic transactions. A smart contract economic transaction model is constructed based on blockchain technology, and the feasibility and efficiency advantages of the model are verified by simulation analysis through Matlab R2020a calling Python program. The study used random function to generate economic transaction data, set the number of network nodes from 200 to 4000, and compared and analyzed the traditional economic transaction model and smart contract economic transaction model. The results show that the smart contract economic transaction model significantly reduces the transaction verification time compared with the traditional model, especially when the number of transaction subjects is huge, the efficiency advantage is significant. The path validation analysis shows that the transaction efficiency value of the economic transaction efficiency development path (D2) based on smart contract technology is consistently higher than that of the traditional path (D1), e.g., the transaction efficiency of D2 in the 20th set of data reaches 0.9939, while that of D1 is only 0.9620. The smart contract economic transaction model constructed by the research can effectively reduce the intermediary links, lower the transaction cost, improve the transparency of capital flow, optimize the experience of enterprise financial management through the two main development paths of payment process transparency and financial accounting intelligence, and provide technical support for the enhancement of the efficiency of economic transactions in the era of digital economy.

**Index Terms** Smart contract technology, economic transaction efficiency, blockchain, development path, payment process transparency, financial accounting intelligence

## I. Introduction

With the rapid development of crypto-digital currencies such as Bitcoin and the application of blockchain technology in industries such as finance, Internet of Things, cloud computing, and supply chain, blockchain has gradually attracted global attention [1], [2]. Blockchain integrates innovative technology and credible data, and systematically enhances economic and social trust and collaboration by optimizing data organization and application paradigm, providing basic support and capacity guarantee for the good operation of digital economy [3]-[6]. It accelerates the transaction efficiency of the digital economy that pulls land, labor, capital and other factors with technology and data, and effectively realizes high-quality and sustainable economic and social development [7]-[9].

Blockchain, as an emerging technology with great potential, provides a programmable environment for smart contracts [10]. Smart contracts are computerized protocols designed to informally disseminate, validate, or enforce contracts, allowing trusted transactions to be conducted without a third party [11]. These transactions are traceable and irreversible, and are intended to provide security that is superior to traditional contracting methods and to reduce other transaction costs associated with contracts [12], [13]. Therefore, smart contracts are a perfect match for blockchain technology with their high efficiency of formulation, low cost of maintenance, and high accuracy of execution, and it can be said that smart contracts are one of the characteristics of blockchain technology [14], [15]. However, at present, smart contracts are limited by the performance of the blockchain system itself, which is not yet able to deal with complex logic and high throughput data, and lack of privacy protection, and there is still a certain degree of difficulty in realizing cross-chain [16], [17]. Improving the throughput of the blockchain system itself to enhance the efficiency of smart contract transactions has become a direction for further research in the future.

The development of the digital economy era has given rise to a new type of transaction mode and the need for efficiency optimization, and the problems of numerous intermediaries, long processes, and non-transparent

information existing in the traditional economic transaction mode have restricted the improvement of transaction efficiency. As an important form of blockchain technology application, smart contract provides a new technical means to improve the efficiency of economic transactions by virtue of its automatic execution, non-tampering and decentralization characteristics. A smart contract is a digitally defined commitment containing an executable protocol for participating entities that is capable of automatically executing specific operations when preset conditions are met, without the need for third-party intervention. This technology gives the transaction process greater transparency, security and execution efficiency, effectively reducing human intervention and potential risks in traditional transactions.

The combination of artificial intelligence technology and smart contracts opens up a wide space for the improvement of economic transaction efficiency. Artificial intelligence algorithms can optimize the design and execution logic of smart contracts to achieve more accurate transaction matching, risk assessment and decision support. Through machine learning technology, smart contracts can continuously learn from historical trading data, adjust trading strategies, and improve the accuracy and adaptability of contract execution. This technology integration not only simplifies the transaction process, but also significantly reduces transaction costs, accelerates transaction speed and enhances market liquidity.

Most of the current research focuses on the security, reliability and application scenarios of smart contract technology itself, and there is a relative lack of systematic research on its efficiency enhancement in economic transactions. In particular, how smart contract technology supported by artificial intelligence can optimize economic transaction efficiency through specific development paths still needs to be explored in depth. Smart contract technology has significant potential for payment process transparency and financial accounting intelligence, but how to construct contract models suitable for different economic scenarios and how to assess its actual impact on transaction efficiency are key issues facing current research.

Based on the above background, this study explores the potential development path of smart contract technology supported by artificial intelligence to enhance economic transaction efficiency. The study firstly comprehends the concept, model and infrastructure of smart contract technology from the theoretical level, and constructs an economic transaction model based on smart contracts; secondly, through experimental simulation and simulation analysis, it compares the efficiency performance of the traditional economic transaction model with that of the economic transaction model of smart contracts under different scenarios; then it verifies the validity of the development path of the economic transaction efficiency based on the smart contract technology; and finally, it proposes that payment process Transparency and financial accounting intelligence are the two main development paths. The study adopts Matlab R2020a to call Python program for the simulation of blockchain verification and bookkeeping node propagation process, and systematically analyzes the influence of the number of nodes, the number of transactions, and other factors on the efficiency of the transaction by setting different transaction scenarios and parameters. The study also verifies the superiority of the economic transaction efficiency development path based on smart contract technology by comparing and analyzing the transaction efficiency values of development paths D1 and D2.

## II. Research on Economic Transaction Efficiency Based on Smart Contract Technology

### II. A. Smart Contract Technology

This section will summarize and conclude the concepts and theories related to smart contract technology in terms of its concepts, models, infrastructure, and operation mechanism.

#### II. A. 1) Smart Contract Technology Concept

From different perspectives, smart contracts are conceptualized differently, in this paper, from a computer science perspective, smart contracts are conceptualized as a set of promises defined in a digital form, including protocols by which the participating entities can execute these promises [18], [19]. The digital form indicates that the smart contract consists of code and will be executed automatically and honestly. Commitments indicate the purpose of the smart contract, including contract terms and operations. Agreements are rules that govern the behavior of the entities involved in the contract. From the definition of a smart contract it can be represented as a dichotomy, i.e.:

$$SC = \{C, P\} \quad (1)$$

where  $SC$  denotes a smart contract,  $C$  denotes a set of numerically defined commitments, and  $P$  denotes an agreement by which the participating entities can execute these commitments.

#### II. A. 2) Smart Contract Model

A smart contract is a computer program that runs on a replicated and shared ledger, the smart contract model is shown in Figure 1. It can process information as well as receive, store and send value. Blockchain-based smart

contracts include transaction processing and saving mechanisms, as well as a complete state machine for accepting and processing various smart contracts [20]. Moreover, transaction storage and state processing are done on the blockchain. The triggering of a smart contract requires the fulfillment of a trigger condition in the time description information. When the trigger condition is satisfied, the preset data information will be automatically sent from the smart contract. The core idea of the smart contract system is to input a set of transactions and events into the smart contract, then the smart contract processes this set of transactions and events, and finally the smart contract outputs a set of transactions and events. From this, it can be seen that the purpose of the smart contract system is to make a complex set of digital promises and can correctly execute its triggering conditions according to the will of the participants.

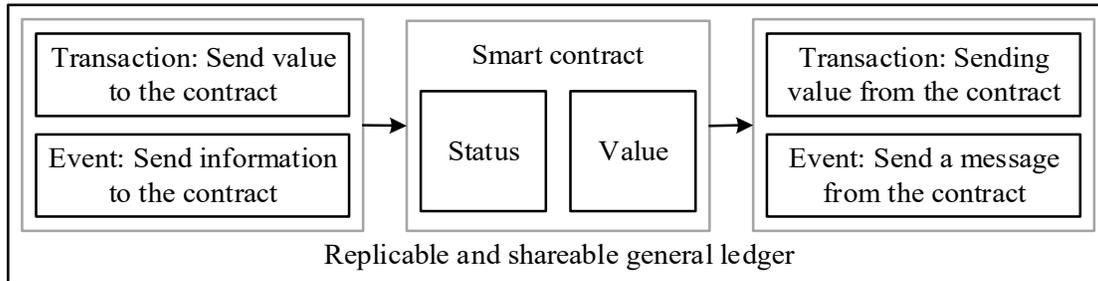


Figure 1: Smart contract model

The mathematical expression for the smart contract model is:

$$O = f(I) \tag{2}$$

where  $O$  denotes transactions and events output from the smart contract,  $f$  denotes the smart contract, and  $I$  denotes transactions and events input to the smart contract.

The consensus process of smart contracts is summarized as follows: smart contracts are propagated throughout the blockchain through a peer-to-peer (P2P) network. The validation node first saves the received contracts in memory and waits for the consensus to be triggered and processes the contracts. When the consensus time arrives, the validation node packages all the contracts saved in the recent period into a contract set, calculates the hash value of this contract set, assembles it into a block structure, and then propagates it to the whole network [21], [22]. Upon receiving the contract set, the other validation nodes compare it with their saved contract set and then send their approved copy of the contract set to the other validation nodes. Through multiple rounds of sending and comparing, all the validation nodes finally reach a consensus on the latest contract set within a specified time.

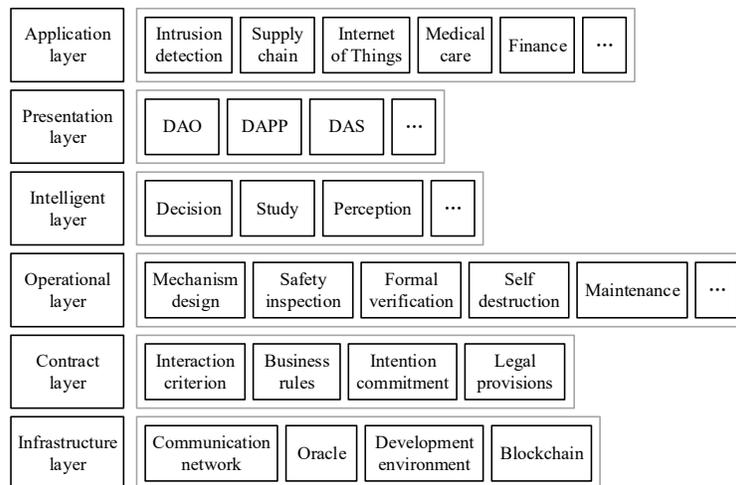


Figure 2: Smart contract infrastructure

### II. A. 3) Smart Contract Infrastructure

The smart contract infrastructure is shown in Figure 2. According to its operation mechanism, the life cycle of smart contract can be summarized into five stages: negotiation, development, deployment, operation and maintenance,

learning and self-destruction. The infrastructure of smart contracts should not only include the key technologies in the whole life cycle of smart contracts, but also delineate the key elements in the technical system of smart contracts. Therefore, the infrastructure of smart contracts has six layers, including infrastructure layer, contract layer, operation and maintenance layer, intelligence layer, performance layer and application layer.

#### II. A. 4) Smart Contract Operation Mechanism

The smart contract operation mechanism is shown in Figure 3, the smart contract has two attributes, value and state, and the contract code is preset with the rules of clause triggering and event occurrence. The smart contract is agreed upon by multiple parties involved, and the contract will be signed after consensus is reached by all parties. After the contract is signed, the user will submit the contract by initiating a transaction. After the contract is propagated through the blockchain network and verified by the miners, it will be stored in a specific block of the blockchain, at which time the user will obtain data information such as the contract address and the contract interface. After obtaining the contract address and interface, the user can interact with the contract by initiating a transaction.

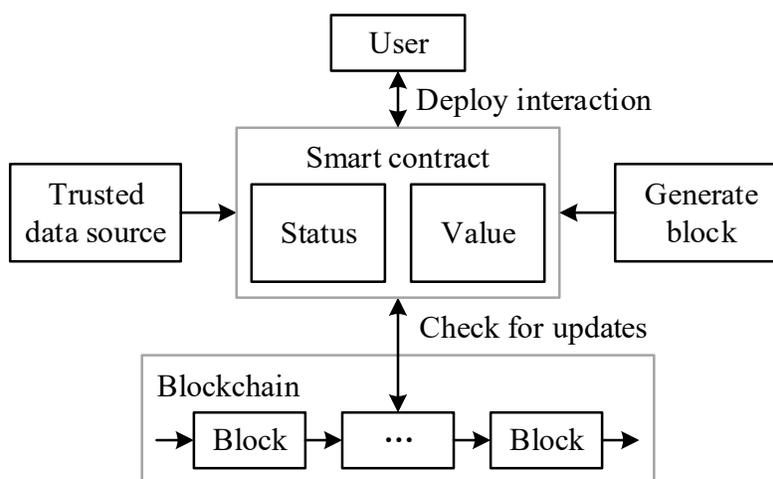


Figure 3: Smart contract operation mechanism

#### II. A. 5) Classification of Smart Contracts

Smart contract execution is characterized by an “event-triggered” mechanism. Blockchain-based smart contracts include transaction processing and storage mechanisms, as well as a complete state machine for receiving and processing various smart contracts. In addition, the smart contract will periodically traverse the state machine and the trigger conditions for each contract, and push the contracts that meet the trigger conditions into the queue for validation. According to the current development of smart contracts, blockchain-based smart contracts can be divided into three categories, including "Chaincode", "Smart Legal Contracts" and "Smart Application Contracts".

### II. B. Economic transaction model based on smart contract technology

The digital economy mainly relies on the pre-set consensus mechanism and smart contract terms to conduct transactions, and the generation, processing and storage of systematic transaction data are realized through the method of consensus reached by the nodes of the economic transaction system at the stage of confirmation of transaction information. The economic transaction process based on smart contract technology can be subdivided into six transaction steps according to the sequence: identity and quota authentication, initiation of economic transactions, transaction matching, transaction authentication, transaction execution, clearing and settlement, and storage of transaction data.

#### II. B. 1) Authentication of identity and quotas

In the construction of the economic transaction model, identity authentication and quota authentication is an essential link and its basic link, which needs to be strengthened by the government-based regulatory nodes for supervision and verification. The buyer and seller of the trading body participate in the economic transaction after authentication, first of all, the user must register an account on the trading platform, and the node corresponds to the account one by one. Each node adopts asymmetric encryption technology, and needs to upload the application information about identity information to the network after encrypting it with the public key of the supervisory body, and only the supervisory body can decrypt the identity information and audit its legitimacy and validity with the

private key, so as to ensure that the identity information will not be leaked and to improve the security of the transaction information. When the node passes the identity audit, the result will be signed with the private key and submitted to the transaction system, which decrypts it and writes the identity code of the node that passes the audit result into the new block. For the audit failed nodes will be canceled account, can not participate in the next economic transactions. In the economic trading market is the digital economy as the subject of the transaction, in the transaction subject through the identity authentication into the trading platform, the government-based regulatory nodes, according to the prescribed economic allocation criteria to each trading node to allocate the initial economic quota.

#### **II. B. 2) Initiation and declaration of digital economy transactions**

At the present time, economic transactions are at the initial stage of free quotas, whereby enterprises are allocated initial economies based on economic allocation criteria, but for some enterprises, the economy consumed for production may be either insufficient or excessive, resulting in a waste of economic resources. Therefore, in order to rationally use the allocated economy and maximize its economic and social benefits, each enterprise actively participates in the economic trading market through the economic trading platform and buys or sells the corresponding economy. According to their own needs and wishes, economic trading subjects initiate orders to the trading system in order to make trade declarations. Orders are uploaded in the form of data packets containing information such as identity codes, commodity quantities and quotations, and the order information needs to be encrypted by the node with a public key to ensure the safety and reliability of the information. After receiving the order, the transaction management system uses the private key to decrypt the order, and inquires and audits the authenticity of the order to determine whether it meets the transaction standards and requirements.

#### **II. B. 3) Transaction matching**

Upon receipt of a request for an order, the economic transaction management system is required to categorize the order by buyer and seller, and may match the request only if the seller declares an amount not higher than his holdings and the sum of the buyer's purchases and holdings is not higher than the amount set by the Government. Economic transaction matching is based on the smart contract algorithm to deal with trading orders, the order information will be screened, filtered and sorted, and then according to the system monitoring data and smart contracts for economic buy/sell market players to match the transaction data, in order to avoid the waste of arithmetic resources, it is necessary to set a set number of iteration times and the upper limit of the transaction matching time to constrain the matching of the transaction, the order that exceeds the upper limit and has not been matched successfully information will be returned to the subject of the transaction.

#### **II. B. 4) Transaction matching authentication and execution**

In the digital economy trading platform reached on the transaction matching need to carry out two processes of matching authentication, the first step, when the transaction matching success, by the buyer and the seller of the transaction together to confirm the transaction order, in both parties to confirm the output function of the transaction will be accompanied by the seller's private key signature. Then the second step, the economic transaction system needs to verify the rationality, legality and executability of the transaction order, generally according to the smart contract for its authentication, in the authentication of the passed order to sign the public key. As long as the above two authentication processes must be passed at the same time, as long as one of the authentication process fails, the matching order can not pass the matching authentication, and the regulatory nodes also need to strictly investigate and deal with the reasons for its authentication failure. After the transaction matching authentication is completed, the trading system executes the transaction strictly according to the economic transaction order, and records and broadcasts the transaction volume and transaction price.

#### **II. B. 5) Authentication and accounting of the results of the implementation of the digital economy**

In order to ensure the high efficiency and credibility of trade execution, it is necessary for the economic trading system and market players to certify the results of trade execution. The economic trading system must monitor the aggregated trading information in real time and broadcast it, then monitor the execution of orders according to the default smart contract algorithm and real-time data, and then output the trading results. At the same time, the market trading body must ensure the accuracy of the corresponding transaction execution list and transaction detection data by installing the smart contract settings to calculate and detect the data, and then check the order with the platform to clear the list of transaction data with the public key encryption to complete the results of the authentication of the order. The smart contract economic trading platform will make statistics on the results of the certification of economic trading orders. If the execution list cleared by the trading platform and the results jointly verified by the trading market subjects are inconsistent, the results jointly verified by the market subjects shall prevail.

## **II. B. 6) Settlement and transfer of value**

Smart contract technology realizes the whole process of automatic uploading, matching, trading, execution and value transfer to complete digital economy transactions. Its decentralized trading system can reduce system risk and improve system security. The openness and transparency of smart contract technology can promote the effective transmission of market transaction information, reduce the occurrence of information asymmetry, enhance the market activity of the transaction subject, and realize the balanced development of economic transaction pilot, and the existence of smart contract and consensus mechanism improves the efficiency of the economic transaction system, and ensures the fast and accurate execution of the transaction.

## **II. C. Potential development paths**

### **II. C. 1) Transparency in the payment process**

In the traditional payment process, enterprises rely on multiple intermediaries to carry out the flow of funds, which is a lengthy process and prone to problems such as information lag and data inconsistency, leading to opaque capital flows and high audit costs. Smart contracts can automatically trigger the payment operation when the predetermined conditions are met, ensuring a fast, efficient and safe payment process. In the specific payment process, smart contracts usually involve the following key nodes of the flow. The first is the payment initiation link, when the enterprise or contractual party completes the delivery of relevant services or goods, the payment conditions are triggered. The smart contract judges whether the payment conditions are met according to the pre-set payment rules, such as the fulfillment of contract terms, acceptance of goods, service quality, etc. If the conditions are met, the contract automatically proceeds to the next step. If the conditions are met, the contract automatically moves to the next step. Next, the contract executes the payment instruction and initiates the fund transfer. In this process, the smart contract determines the payment amount, payment object and payment time according to the contract terms, and automatically initiates the payment request to ensure the accuracy of the fund flow. In addition, all transaction information and fund flow during the payment process will be recorded on the blockchain, ensuring that every aspect of the payment has a clear history for inquiry and traceability. Once the payment funds are initiated, the smart contract will also automatically confirm the success of the payment and send a notification to the payer and payee to ensure that both parties can obtain confirmation of the payment result in real time. Finally, after the payment process is completed, the smart contract will automatically carry out settlement and reconciliation, and the relevant financial data will be automatically recorded and interfaced with the enterprise's financial system to achieve synchronized updates with the accounting system, further reducing manual checking and manual processing errors.

### **II. C. 2) Financial accounting intelligence**

The application of smart contract technology in the field of financial accounting, especially the introduction of smart contracts, has revolutionized the improvement of transaction efficiency. As an automatically executed contractual program, smart contracts are based on the non-tamperability of smart contracts, which can ensure that transactions are automatically executed according to preset conditions without human intervention. This technology encodes complex business logic and validation rules into smart contracts to automate the processing of transactions, greatly reducing the degree of human involvement and significantly improving execution efficiency.

For example, by incorporating smart contract technology, an enterprise can automatically generate data on the transportation of goods in the supply chain and automatically perform VAT calculations and invoicing based on preset conditions. The application of this technology avoids the transmission of a large number of paper documents and manual data entry between enterprises, and realizes the digitization and automation of the entire business process. Specifically, enterprises can adopt alliance chain frameworks such as Hyperledger Fabric (open source smart contract distributed ledger) to develop smart contracts for supply chain management. By adding relevant enterprises to the network as bookkeeping nodes, smart contracts integrate key information such as VAT algorithms and invoice format definitions, and interface with IoT systems such as Radio Frequency Identification (RFID) and Global Positioning System (GPS) to acquire logistics data in real time. When the goods arrive at the destination, the smart contract will automatically calculate the tax payable according to the tax rate, generate the electronic invoice and complete the payment settlement, and the whole process requires no manual intervention. Compared with traditional manual operation, this smart contract-based solution can increase the efficiency of supply chain account processing by 3 to 5 times. For cross-border transactions, the improvement in efficiency is even more significant, thus bringing enterprises a more efficient and transparent financial management experience.

### III. The impact of smart contract technology on the efficiency of economic transactions

#### III. A. Analysis of modeling examples

##### III. A. 1) Building the experimental environment

In the paper, the blockchain validation and bookkeeping node propagation process is simulated using Matlab R2020a calling Python program on a computer configured with 4.6GHz CPU, 36GB of running memory, and 64-bit operating system. A random function is used to generate economic transaction data and the number of agreed transactions are within the allowed range.

##### III. A. 2) Transaction efficiency analysis of different economic transaction models

In the simulation, the network bandwidth is set to be 400MB/s, the block size is 4MB, and the total proposed rated transaction power is 40,000kW·h. In order to reflect the transaction time under the 2 different smart contract economic transaction models and the impact of the number of nodes on the transaction time, the following transaction scenarios are set up:

Scenario one. The number of network nodes is set to 4000, and 20 simulated transactions are carried out for the traditional economic transaction model and the smart contract power transaction model respectively, and the comparison results of the transaction time are shown in Fig. 4.

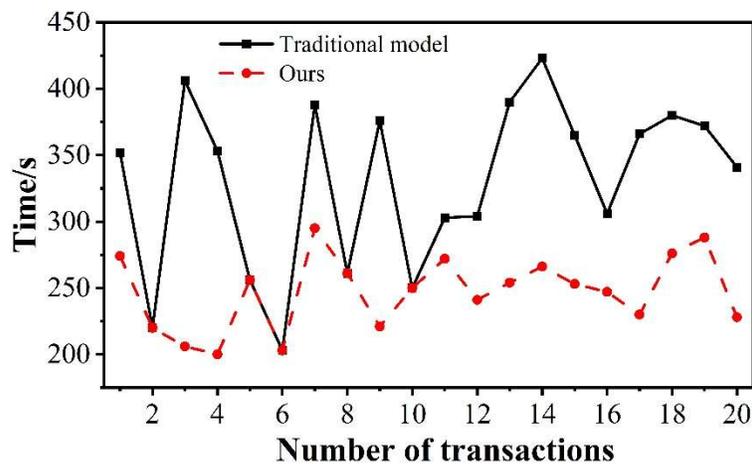


Figure 4: Comparison of trading hours

Scenario two. The number of network nodes is set to increment from 200 to 4000 in steps of 200, and the transaction is simulated for the traditional economic transaction model, and the relationship between the number of nodes and the transaction time under the traditional economic transaction model is shown in Fig. 5.

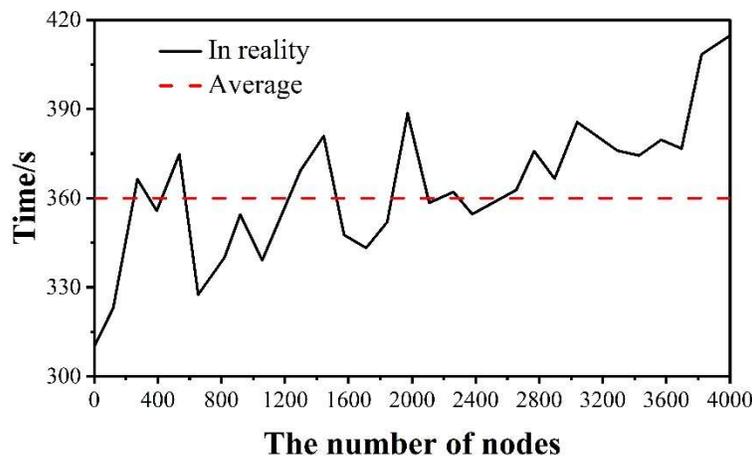


Figure 5: The relationship between quantity and time in the traditional model

Scenario Three. The number of network nodes is set to increment from 200 to 4000 in steps of 200, and the smart contract power trading model is simulated for trading, and the relationship between the number of nodes and the trading time under the smart contract power trading model is shown in Fig. 6.

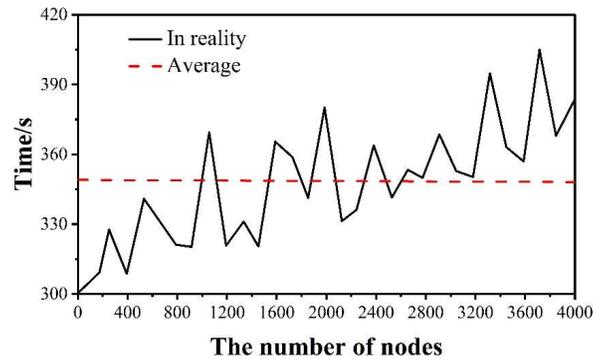


Figure 6: The relationship between the number of nodes and transaction time

The following conclusions can be obtained from the simulation results:

(1) As can be seen from Fig. 4, under a fixed number of network nodes, the smart contract economic transaction model generally spends less time to complete the transaction compared to the traditional economic transaction model. This is due to the introduction of smart contract technology in the traditional economic transaction model, which greatly reduces the transaction verification time and thus improves the transaction efficiency. And at the 2nd, 5th, 6th, 8th, and 10th transactions, the transaction times of the 2 models are the same. This is because when the total transaction power reaches the rated total transaction power formulated by the system, it is necessary to re-examine the transaction verification, and at this time the transaction time spent by the 2 models is consistent.

(2) From Fig. 5 and Fig. 6, it can be seen that with the increase in the number of nodes in the network, the overall trend of the curve increases, indicating that when the number of nodes in the transaction network increases, the transaction time increases, i.e., the transaction efficiency decreases. The smart contract economic transaction model has a shorter average transaction time and higher transaction efficiency compared to the traditional economic transaction model.

In the traditional bitcoin power transaction model, the verification time required for each completed transaction is set to be 400 min. among the 4000 network nodes involved in the transaction, the economic transactions are completed through the bitcoin, traditional economy, and smart contract models, respectively. The number of transactions per hour is set to be 0 to 20. Simulation is performed and analyzed in Matlab, and the variation of validation time for completing 0 to 20 transactions for the three transaction models is shown in Fig. 7. From Fig. 7, it can be seen that the transaction validation time of the traditional economic transaction model is much less than that of the Bitcoin transaction model, while the transaction validation time of the smart contract economic transaction model is even less than that of the traditional economic transaction model. And as the number of transactions increases, the difference in transaction validation time required by the three transaction models becomes larger and larger. Therefore, the smart contract-based power economic model is more efficient in trading, and can be better in the market with a large number of trading subjects and complex trading data.

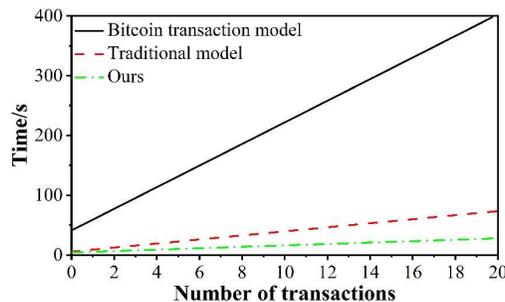


Figure 7: Comparison of verification time of the three models

Table 1: Path verification analysis results

No.	Development path	Trading volume	Residual market volume	Transaction efficiency
1	D1	4262	573	0.8656
	D2	4262	275	0.9355
2	D1	6722	858	0.8724
	D2	6722	440	0.9345
3	D1	18322	631	0.9656
	D2	18322	146	0.9920
4	D1	11415	652	0.9429
	D2	11415	270	0.9763
5	D1	1481	837	0.4348
	D2	1481	309	0.7914
6	D1	13183	693	0.9474
	D2	13183	260	0.9803
7	D1	15907	866	0.9456
	D2	15907	217	0.9864
8	D1	13445	889	0.9339
	D2	13445	350	0.9740
9	D1	9296	766	0.9176
	D2	9296	173	0.9814
10	D1	2208	624	0.7174
	D2	2208	243	0.8899
11	D1	13003	657	0.9495
	D2	13003	360	0.9723
12	D1	1369	885	0.3535
	D2	1369	459	0.6647
13	D1	19200	537	0.9720
	D2	19200	475	0.9753
14	D1	1319	681	0.4837
	D2	1319	472	0.6422
15	D1	2484	843	0.6606
	D2	2484	368	0.8519
16	D1	4432	651	0.8531
	D2	4432	346	0.9219
17	D1	16047	691	0.9569
	D2	16047	395	0.9754
18	D1	18485	770	0.9583
	D2	18485	372	0.9799
19	D1	16155	863	0.9466
	D2	16155	342	0.9788
20	D1	17030	647	0.9620
	D2	17030	104	0.9939

### III. B. Path validation analysis

The market plays a market-oriented role through the economy, and the most important part in the economic transaction efficiency mechanism is the establishment of the development path. In this paper, based on the smart contract technology supported by artificial intelligence, a development path of economic transaction efficiency based on smart contract technology is designed, and the traditional economic efficiency development path is selected as a reference, and the difference between the effects of different economic efficiency development paths is simulated and compared through Matlab2016b, aiming at verifying the development path of economic transaction efficiency based on smart contract technology. The specific development path verification and analysis process is as follows:

#### III. B. 1) Simulation of Digital Economy Types and Simulated Data

Selection of market types for simulation: Since (1) the market size of the day-ahead market accounts for the largest share of the spot market. (2) The market size of the intraday market is small and has high similarity with the market

rules of the day-ahead market. Therefore, the text only selects the digital economy market under the blockchain technology as the simulation simulation market for the comparative analysis of the simulation trading efficiency under different development paths. The number of subjects in each round of simulation trading is not fixed, subject to the number of data entries obtained. The source of data for this research: a digital economy trading center. A digital economy trading center provides the initial data for this subsection of the study, and by organizing and processing all the bidding data from July 2022 to October 2023, the total number of all available data in this paper is 20 sets.

### III. B. 2) Analysis of results

The path validation analysis is shown in Table 1, where D1~D2 represent the traditional economic transaction efficiency development path and this paper's economic transaction efficiency development path, respectively. Through the data performance in the table, it can be seen that the digital economic transaction volume of D1 and D2 in 20 groups of data is the same, the digital economic transaction residual volume of D1 is 500~900, and the digital economic transaction residual volume of D2 is maintained at 100~500. According to the formula for calculating the economic efficiency of each numerical value =  $1 - \text{residual volume} / \text{transaction volume}$ , the value of the transaction efficiency of D1 and D2 can be calculated for each group of data, and it is found that the D2's transaction efficiency is always greater than that of D1, indicating that the introduction of smart contract technology supported by artificial intelligence technology on the basis of the development path is more conducive to improving economic transaction efficiency.

## IV. Conclusion

Smart contract technology provides an effective way to improve the efficiency of economic transactions. Simulation analysis of different transaction models shows that the economic transaction model based on smart contracts has significant efficiency advantages. In the scenario of 4000 network nodes, the time spent on completing the transaction by the smart contract economic transaction model is significantly reduced compared to the traditional economic transaction model, and the transaction verification time is shortened more obviously. The data shows that when the number of transactions reaches 20 times, the transaction verification time of the smart contract model is about 35% lower than that of the traditional economic transaction model, and about 68% lower than that of the Bitcoin transaction model.

The development path validation analysis shows that the development path of economic transaction efficiency based on smart contract technology supported by artificial intelligence (D2) outperforms the traditional economic transaction efficiency development path (D1). In the 20 groups of simulated data, the transaction efficiency value of the D2 path continues to lead, especially when the transaction volume is small, the efficiency gap is more obvious. For example, in the 12th set of data, when the transaction volume is 1,369, the transaction efficiency of the D2 path is 0.6647, while the D1 path is only 0.3535, an improvement of more than 85%.

Payment process transparency and financial accounting intelligence are the two main development paths for smart contract technology supported by artificial intelligence to improve economic transaction efficiency. The former ensures that the payment process is fast, efficient and secure by automatically triggering the payment operation, and improves the transparency of capital flow; the latter realizes automated transaction processing and reduces the degree of manual involvement by encoding complex business logic into smart contracts. In terms of supply chain account processing, smart contract-based solutions can increase efficiency by 3 to 5 times, which is particularly significant for cross-border transactions.

The study shows that smart contract technology supported by artificial intelligence can effectively enhance the efficiency of economic transactions and promote the healthy development of the digital economy by reducing transaction intermediary links, lowering transaction costs, and improving system security and transaction transparency.

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