

Potential of Blockchain-enabled smart contract platforms for automated enforcement and dispute resolution^{1, 2}

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ABSTRACT

Over the past few years the word blockchain has been gaining a lot of attention. Bitcoin and Ethereum are the two most widespread blockchain platforms and there are many other platforms which have emerged recently. But not every blockchain based platform uses smart contracts. Smart contracts are self-executing computer protocols that are meant to verify and enforce the performance of contract conditions. The field is evolving and there is still a lot of ambiguity about the concept itself. This makes the selection of the platform a crucial decision from the users' perspective. This paper intends to discuss five different blockchain based smart contract platforms namely Bitcoin, Ethereum, Stratis, Lisk and Neo, and evaluate their potential and limitations. Multi-Attribute Decision Making Analysis is used to compare these platforms based on attributes like Speed, Future Orientation, Scalability, Risk and Programming language. The results are presented in quantified form and most feasible options have been proposed.

Keywords: Blockchain, Smart Contract, Bitcoin, Ethereum, Traditional contracts, Arbitration, Distributed digital ledger, Enforcement

INTRODUCTION

Over the last few years, blockchain technology has become one of the most talked about topic and it is proving to be the biggest disruption since the internet. Blockchain essentially is a publicly available, immutable distributed ledger of transactions which have been verified by getting consensus from all the participants in its network. It focuses on the issue of trust between parties involved in the transaction. Though started from the area of application in financial services, blockchain since then has been finding its application in governance, e-voting, supply chain, taxation, internet of things and now arguably almost everywhere.

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Smart contract is emerging as one of the most promising areas of blockchain implementation. Smart Contracts are digital auto contracts made between two parties based on pre-defined logic. They are self-enforcing in nature and it is expensive to break the contract. Since Blockchain provides trusted counterparties without a need of trusted third party, it is well suited to corroborate smart contracts. Smart contracts are increasingly being used to automate enforcements of contracts and thus provide a cost –effective, efficient and faster way of handling transactions. They solve almost all the issues associated with a traditional contract. However, since the concept of smart contracts is relatively novel, their legal binding is not clear yet. And even though blockchain provides an intelligent way of enforcing contracts, the arbitration of blockchain disputes itself requires deliberation.

This paper evaluates some of the blockchain supported smart contract platforms. It starts with explaining the evolution, technological details, strength and limitations of five platforms namely Bitcoin, Ethereum, Stratis, Lisk and Neo. Then criteria have been selected based on which comparison of the platforms is performed and then quantitative ratings have been provided to each alternative based on the attributes. Final evaluation of all the platforms is done using Multi-Attribute Decision Making Analysis (MADM) and best alternative has been proposed.

To summarize, the purpose of this research is to answer the following questions:

- i. The pros and cons of using different blockchain smart contracts platforms and identify their strengths and limitations.
- ii. Identify the parameters on which smart contracts can be evaluated and compared.
- iii. Propose the best feasible platform based on current and future perspectives.

METHODOLOGY

In the analysis of this paper, Multi-Attribute Decision Making Analysis is used to evaluate different smart contract platforms on multiple parameters. All the feasible alternatives have been studied in detail, from which different criteria have been selected and quantitative ratings have been provided to each alternative based on the attributes. Finally, quantified results are presented and best alternative is chosen.

FEASIBLE ALTERNATIVES

Here the comparison of Bitcoin, Ethereum, Stratis, Lisk and Neo as smart contracts platform is done and an analysis is presented, clearly showing the choice of platform based on the type of contract requirements.

1. Alternative 1: Bitcoin
2. Alternative 2: Ethereum

3. Alternative 3: Stratis
4. Alternative 4: Lisk
5. Alternative 5: Neo

DEVELOPMENT OF OUTCOMES

1. Bitcoin

- Bitcoin started as a digital currency based on blockchain technology in the year 2009, which offers various benefits like transparency using distributed ledger, low transaction costs, decentralization, and anonymity for the users. In Bitcoin, to make sure that a transaction is confirmed quickly enough by the network, a certain sum of money has to be paid off to the miners.
- Bitcoin is written in C++ programming language.
- Bitcoin does not allow any sidechains along with the primary blockchain.
- Traditionally, Bitcoin blockchain has not been known for its ability to enable smart contracts but only as a virtual currency used for transactions.
- But as the potential of blockchain expanded and Ethereum gained the smart contracts space, the option of incorporating smart contracts with Bitcoin also gained attention. Though it did not get much attention, through the Bithalo project, smart contracts can be created and run on Bitcoin blockchain.
- Smart contract is not as easily programmable and expandable on Bitcoin as it is on Ethereum. Nevertheless, through improvement proposals, some of the smart contract features can be added through Bitcoin scripting.
- Many companies would use the bitcoin blockchain to integrate smarter contract features in the upcoming time.
- The node in the Bitcoin blockchain work on the basis of a consensus algorithm. They use “proof of work” puzzles to decide the method to append a new block of transactions to the previously existing block on the blockchain.

2. Ethereum

- Ethereum unlike Bitcoin wasn't designed to be a payment system or just to provide a virtual currency. Ethereum's is far more robust than Bitcoin.

- Ethereum represents a decentralized platform capable of running smart contracts on blockchain stored applications for negotiation and execution and has the feature of and the Ethereum Virtual Machine.
- Ethereum's smart contracts provide greater security than traditional contracts and bring down the transactional costs to a huge extent. Ethereum's protocol also allows and promote flexibility.
- The average block time for Ethereum is around 12 seconds, due to its Ethereum's GHOST protocol.
- Though the confirmations are quicker, they also have chances of orphaned blocks, which are left dead outside of the blockchain network.
- Ethereum has been written in 'Turing-complete' and uses solidity coding language and allows developers to write more flexible programs in which there is more space for governance and automation.
- It allows seven different programming languages.
- As of now, Ethereum also works on the proof-of-work protocol. The miners are rewarded for executing smart contracts and for the efforts required for processing transactions, which create blocks.
- But it is in the process of adopting the proof-of-stake protocol. Neither proof-of-work protocol encourages collaboration nor does it provide any consequence for any bad behaviour.
- In a proof-of-stake model there will validators and not miners. Validators will be required to validate a block by putting their own ethers. So in case of any malicious behaviour, the validator will lose their ethers.
- Thus, the proof-of-stake protocol will be minimizing the downfalls associated with the existing system and thus allow smoother contract execution.
- The state of all contracts are stored in a single blockchain which is conceptually convenient and simple.
- Due to a single blockchain concept, Ethereum is not scalable, which is a major drawback.
- Ethereum targets both Enterprises and one-off developers.
- Ethereum already has a big application ecosystem with thousands of developers working on the platform.

3. Stratis

- Stratis is developed in C# under Microsoft's .Net framework attracting developers who already have experience of writing in C#.
- Stratis is built as a Proof-of-Stake algorithm. Thus it has already adopted a good reward model.
- Stratis allows for complete sidechains and thus is much more scalable.
- Validators hold Strat coins into their software wallet and are rewarded by more Strat as they stake the existing coins by validating blocks.
- Stratis is mainly targeted towards Enterprises.

4. Lisk

- Smart contracts in Lisk have “rules” that the developers have to follow otherwise there is a risk of breaking the consensus.
- Lisk allows for sidechains, which eliminates the problem associated with most blockchains, that is scalability. Sidechains remove clutter from the primary blockchain but it also has additional issues of auditing and low centralized oversight.
- Lisk supports executing smart contracts which are totally Turing-complete.
- Lisk's smart contract language is 100% based on JavaScript. Since JS is highly used worldwide, Lisk has great potential for its adoption.
- Lisk has its own currency with a proof-of-stake consensus mechanism.
- Being relatively new in the market, currently it lacks developers and applications in number.

5. NEO

- NEO has the backing of the Chinese government, WINGS, Alibaba, and other big tech companies.
- Delegated Byzantine Fault Tolerant (dBFT) consensus mechanism is used in NEO. This goes even a step further of the proof-of-stake protocol.
- dBFT is said to be more energy efficient than proof-of-work and is less expensive.

- NEO’s smart contracts can be programmed in C# and Java. It will also allow Python and Go in the future. This will hugely reduce the entry barrier for developers into blockchain ecosystem.
- Due to its Chinese roots, not much information is available about NEO for the general English-reading audience.
- NEO has a special crypto asset called NeoGAS which is used for NEO’s blockchain.
- NEO can process almost 10,000 transactions in a second, which is its biggest advantage.
- NEO is likely to be the most secure platform among all as it is quantum computer-proof. Quantum computers have the ability to solve cryptographic problems at superfast speed, even before a consensus is reached by multiple individual miners. And thus quantum computers can break blockchain principle. NEO has introduced an anti-quantum cryptography mechanism, NeoQSm that solves this problem.

SELECTION OF CRITERIA

- In order to select the best alternative, Multi-Attribute Decision Making Analysis has been conducted. The qualitative analysis of the feasible alternatives is assessed against the best attributes identified to find the best blockchain-based smart contracts platform.

Programming Language	
Most widely used	5
Highly Used	4
Moderately used	3
Low use	2
Specifically used only for the platform	1

Speed	
Very High	5
High	4
Medium	3
Low	2
Very Low	1

Scalability	
Very High	5
High	4
Medium	3
Low	2
Very Low	1

Future orientation	
Very High	5
High	4
Medium	3
Low	2
Very Low	1

Risk	
Very Low	5
Low	4
Moderate	3
High	2
Very High	1

Figure 1: Quantitative analysis of the alternatives evaluated regarding their interests

ATTRIBUTES	Bitcoin	Ethereum	Stratis	Lisk	NEO
Programming language	4	2	3	4	5
Speed	1	2	3	3	5
Scalability	2	3	5	5	5
Extent of Adoption	5	4	2	2	3
Risk	2	2	3	3	4
Total	14	13	16	17	22

FINDINGS

If we look at Figure 1, the best alternative seems to be the second one, followed by the third one and the first one. To improve that conclusion and go deeper in our analysis, we can produce a MADM ratio scale.

Figure 2 – Quantitative analysis of the alternatives evaluated their interests in ratio scale

ATTRIBUTES	Bitcoin	Ethereum	Stratis	Lisk	NEO
Programming language	0.8	0.4	0.6	0.8	1
Speed	0.2	0.4	0.6	0.6	1
Scalability	0.4	0.6	1	1	1
Extent of Adoption	1	0.8	0.4	0.4	0.6
Risk	0.4	0.4	0.6	0.6	0.8
Total	2.8	2.6	3.2	3.4	4.4

SELECTION OF THE PREFERRED ALTERNATIVE

Based on the Multi-Attribute Decision Making Analysis in ratio scale done above it can be proposed that Neo is the best alternative. It scores 30% higher than both Stratis and Lisk, its nearest competitors. It multi folds faster than other platforms and has the best scalability which is one of the biggest limitation of blockchains. It is foolproof as it is quantum computer-proof which none of the other platforms is. Its speed is unmatched as per the current numbers. Neo offers the biggest range of programming language all of which are extensively used across the world. It supports side chains which is absent in the two most used platforms viz. Bitcoin and Ethereum. The next best option is Lisk which is slightly better than Stratis that is just because Stratis is in C# .Net, a technology whose adoption is decreasing due to the use of more scripting based technologies like JavaScript. Both of these platforms offer more features than Bitcoin and Ethereum.

Post-evaluation of results

After the entire analysis, the best alternative found is the last one: Neo. Obviously, other alternatives are possible and in particular Lisk and Stratis can definitely be used. The good part is that if the chosen smart contract platform is not suitable for the business requirement, then another one can be easily adopted. Also, as time progresses, Bitcoin and Ethereum are going to have big technological changes in order to adapt to the competition. Since these are already very famous, they should get fast upgrades and thus provide the user with more options. It is recommended that the user keeps track of upgrades and chooses the best alternatives accordingly.

CONCLUSION

The original purpose of this research was to answer the following questions:

- i. The pros and cons of using different blockchain smart contract platforms and identify their strengths and limitations.
- ii. Identify the parameters on which smart contracts can be evaluated and compared.
- iii. Propose the best feasible platform based on current and future perspectives

As a result of this analysis, it was concluded that even though Bitcoin and Ethereum are the two most used platforms and have gained extremely high attention due to their first mover advantage in blockchain, and smart contract space respectively, they lack some essential features which other newly introduced platforms offer. Bitcoin lacks speed and more importantly scalability. And even though Ethereum was the first to bring the smart contracts concept, it is still not as scalable as Stratis, Lisk or Neo. Its programming, Solidity, is not as easy and widely recognized as JavaScript or Python which is why even though it currently has more developers, other platforms are going to catch up very fast given they boast widely used languages and the support they have been receiving from governments or other giant tech players. Programming language, speed, scalability and risk are other extremely important factors which in the future are going to prove to be game changers as business and users realize. The analysis resulted in the fact that the Chinese blockchain platform Neo is currently the best platform in the market. The only limitation is that its penetration in English speaking and reading world is limited which hopefully is going to be sorted out as it expands and reaches other markets.

FOLLOW ON RESEARCH

As new platforms emerge and new factors come into the play, the blockchain landscape is going to change sharply. The arbitration of smart contracts themselves is going to be an area which requires a lot of focus as the adoption of smart contracts goes up. Thus a new field of work would be to evaluate how smart contracts are managed and supervised and in case of disputes, what's the best method to ensure speedy fair resolution.

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