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Statement of integrity: By typing the names of all group members in the text box below, you confirm that the assignment submitted is original work produced by the group (*excluding any non-contributing members identified with an "X" above*).

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Introduction

With the progression of blockchain technology, smart contracts are implemented that would benefit not just one sector of the government and economy. In this work, we presented what smart contracts are, its functionality, advantages and disadvantages and an example of use case of smart contract deployment.

1. Smart Contracts

In 1994, Nick Szabo envisioned the functionality of computer code as recording contracts which is now called smart contracts which is executed automatically upon satisfying certain conditions which would be needed by financial sectors such as the bank. Transaction or smart contracts are self-activated fully executed by computers in a known trusted network. Therefore, a smart contract is an deal or transaction in the form of computer code between two parties. They are stored on public database and cannot be altered because they are run on blockchain platform. Transactions that occurred in smart contract are processed by blockchain technology; meaning can be sent automatically without third party. However, the transactions only happen when the conditions in the agreement are met like no third part and no issues with trust. With the aid of blockchain technology, smart contracts can be decentralized.

Smart contracts can be used for any transaction besides financial operations. Because of its endless possibilities, smart contracts can be used for financial trades and services, insurance company, credit authorization, legal processes, and crowd funding agreements.

Benefits of smart contracts
Accuracy - smart contracts are based on "if/then" relationships written in the code and is executed when all necessary conditions are met. There is no chance for human to do subjective interpretation.

Speed – smart contracts can quickly be processed, and their automated and digital nature allows for incredible fast data input and modification. This is an incredible advantage in any smart competition to equalize time.

Cost-effectiveness – with the mind that smart contracts can eliminate employment intermediates, using agreement of this type is less costly for companies. Trust is built in mechanism for recording and executing the terms of the agreement.

Trust – smart contracts technology is used between parties trusting the code. Through encryption of slices of records of legal relationships and financial transactions are provided to all blockchain participants to that will warranty no malicious changes or damage.

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Security – Stored data in a blockchain related to the contract are fragmented, encrypted and distributed across the network. Therefore, to change any piece of information the entire chain would need alteration through a validation consensus.

Risks of smart contracts
There are risk issues preventing the universal adoption of smart contracts since mid-nineties.

Reliance on the code – An imperfect human can yield imperfect code which makes some parties preventing them to use smart contracts. This imperfection can cause manipulation to gain unauthorized access.

Regulation – smart contracts and blockchain technology are still young and waiting to mature so that it can handle transactions from various sectors considering taxation and other forms of regulations.

2. Smart Contracts and its functionality

Smart contract is a programming code executed on blockchain such as the Ethereum blockchain. It involves collecting of code and data stored in the blockchain platform which can perform balance and . Smart contracts are Ethereum account that can perform and send transactions over to the network. These contracts are not operated by user, but they are deployed to a given network and executed as programmed. User accounts follows the conditions in the smart contracts in order to interact with the contracts through a transaction process to execute a function defined on the smart contracts. Ethereum network is a globally open-source platform used for decentralized applications and is among the leading programmable blockchain used to build application like cryptocurrency wallets, financial applications, and decentralized markets, and others. Ethereum has a native cryptocurrency know as Ether.

3. Advantages compared to traditional trading solutions

In any blockchain, smart contracts play the role of the heart in order to make the blockchain useful.   The following are the advantages and disadvantages.

Advantages:
-Immutability
One of smart contract's major advantage is its code immutability. The code once deployed onto the blockchain cannot be modified in any way when it is functioning.

-Accuracy
Since the contracts are coded, they are extremely accurate and there is little to no scope for any manual errors. Once coded, the smart contract works strictly according to its own specified terms and conditions. Manually written contracts are error prone.

-Transparency
The terms and conditions with which the smart contracts are coded are visibly available to everyone using them. This helps in complete transparency to all parties involved in the transaction process.

-Speed
Manually written contracts cannot be duplicated across several parties and hence this is an area wherein the smart contracts excel written contracts. Due to this the speed of transactions executed using a single coded contract is extremely high.

-No middlemen
Perhaps the most advantageous of all, smart contracts help us eliminate the middlemen involved in any transaction that would have happened manually. The contract is hard coded and hence the same contract with the same terms and conditions can be scaled to include any number of parties.

-Security
Since smart contracts are hard coded into the core blockchain Ethereum Virtual Machine (EVM), it is impossible to tamper with it for personal gains.

One of the important applications of smart contracts is its ability to replace traditional trading systems. Here we outline some of the advantages and disadvantages in doing so.

-Currently trading equities on exchanges daily requires a T+2 days for settlement. This means that if a stock has been purchased on a Wednesday, the settlement of the asset into the buyer's account will take 2 additional days to be processed. The reason for this mechanism can be attributed to the various parties involved such as clearing houses, brokers, and exchanges. With smart contracts, the dependence of settlements on third parties can be removed and can be done in real time compared to the T+2 days it would take to do so.

-Reduction in charges. Automating the process of trading would lead to reduction in the traditional costs that are usually incurred for settlement purposes. A lot of overhead can be reduced, and investors and issuers of securities will benefit from the cheap costs.

-Low to no margin for errors since it is all coded for automation

4. Disadvantages compared to traditional trading solutions

Although smart contracts serve many purposes and are advantageous in several ways, it is worthy to take stock of their disadvantages too before using them for various applications. Some of them are:

Bugs in code
As with any code, bugs may exist which may not be immediately identified by the developers before it is deployed into the blockchain environment. However, unlike any software product, owing to its immutability, it is extremely difficult to fix these code bugs. If it is possible to do so, it will prove to extremely expensive and resource intensive. This proved to be the case during the infamous DAO hack of 2016.

Complexity limitations
Any smart contract needs to have as low as a complexity as possible to reduce the transaction fees. 'Gas' is charged according to the computation steps of the smart contract involved. Hence a complex smart contract written with a higher degree of complexity will charge heavy transaction costs for the parties involved. As there is a cap on gas usage, the smart contract will stop executing if the computation done by the code so far has used up the maximum gap limit.

Dependence on third party
Although they eliminate third party dependence, the initial terms and conditions of the smart contract need to coded by the developers by consulting the third parties. For instance, a smart contact for lawyers needs to be drafted by involving lawyers and going through every possible scenario. Hence any smart contract would be heavily dependent on the third parties for the initial contract formulation.

Scalability issues
The current blockchain technology is not yet fit to offer the same throughput as offered by traditional trading systems. Hence the smart contracts developed here would still be insufficient to handle the day-to-day trading operations of equities and digital securities.

Immutability
Immutability of smart contracts may prove to be huge hindrance as many a times securities like futures and options are traded on margin money. The amount of margin needed varies across traditional brokerages. Moreover, brokerages may change the rules governing the margin money for trading as and when they notice a shift of volatility in the markets. Owing to the nature of smart contracts, these changes cannot be quickly adapted thereby rendering them useless.

5. An example of Use-Case of Smart Contracts

<u>Banking and Financial Services</u>

Smart contracts deployed for banking and financial services to manage standard loans is already common and one of the useful cases of it making the services effective and efficient. In can also assist in syndicated loans where multiple lenders and/or multiple borrowers are involved on the same loan terms. With the use of smart contracts, underwriting and servicing process would be faster. Through smart contracts, establishing identity, relationships and security are simplified using on/off chain information.

Smart contracts through permissioned ledger can minimize any possible delays in processing due to documentation, both parties' confirmation and agreement, and (Know Your Customer) KYC, (Anti Money Laundering) AML and Foreign Account Tax Compliance Act (FATCA) checks. It is estimated that the processing time will take only 6-10 workings which will make the leveraged loan market more liquid. Moreover, through smart contracts automation, the total mortgage processing fees can be reduced by 11% to 22%. The US and European Union's total outstanding mortgage loans is estimated to be $20.98 trillion in 2014. With smart contracts, it is estimated that it could have save $3 -$11 billion.

Summary

In this work, we have presented the smart contract's functionality, advantages, disadvantages, and use-case in blockchain technology. Though it has many benefits and advantages over traditional trading solutions, the trading solutions migration of industries and technology are painstaking in which customized smart contracts are required for proper deployment. While the process of migration to smart contracts, a hybrid text and code contracts are implemented by other industries. With proper progression of smart contracts and adoption of industry, we envision faster and cheaper transactions that can improve the economy through smart contracts in blockchain trading solutions.

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