Current State of Blockchain Technology A Literature Review

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Review

Current State of Blockchain Technology

A Literature Review

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Abstract

Objective: To review the literature on the current state of blockchain**. Method:** A review of academic papers obtained from academic databases, a white paper, a federal report, a memorandum opinion and information from industry sources were used to have (I) an overall sense of the current state of the blockchain technology, (II) potential uses in government and (III), current examples or potential uses of the technology. **Findings:** Most sources say the technology has a groundbreaking nature, having potential in multiples areas government and the private sector. The accounting potential still looks unresolved but accountings

firms like Deloitte have interest in the technology. The technology can reduce cost in multiple areas of the private sector and government, increase transparency and security thanks to an advanced security mechanism. There are technical challenges still to resolve. The law lag must be minimized to keep up with the technology and its implementations. **Conclusion:** The government and the private sector must approach a fail fast and frequently development process with this technology on small scale projects to better understand it and implement it properly. More academic research is needed and there is a lot of space for it since it's a technology still in an early development stage.

Introduction

The blockchain technology is the technology that powers the bitcoin cryptocurrency and other cryptocoins. It is a technology with a lot of potential that could touch a lot of areas of the economy. Brian Behlendorf (2016), executive director at the Hyperledger Project said

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that blockchain today is what the internet was in 1994, a technology in development, still not widely adopted, but with a huge potential to alter the markets. The purpose of this literature review is to have an overall sense of the current state of the blockchain technology, with the aim of identifying potential research areas of investigation within the economics discipline framework, with the end goal of understanding how this technology could improve areas of government, the private sector and therefore the society.

Overview

The blockchain technology is what is behind the cryptocurrency known as Bitcoin. It was created by Satoshi Nakamoto and first published in the seminal white paper *Bitcoin: A Peer-to-Peer Electronic Cash System* (Nakamoto, 2008). The interest in blockchain has grown since its inception in 2008 (Yli-Huumo, 2016). Yli-Huumo (2016) defines the blockchain as a "decentralized transaction and data management technology", a definition that is constant with the definition of other authors. He identifies seven technical challenges and limitations that blockchain technology has. Those challenges are throughput, latency, size and bandwidth, security, wasted resources, usability, versioning hard forks and multiple chains. There is a consensus that the blockchain is a groundbreaking technology that can be as important as the emergence of the internet itself, but surprisingly for a technology with so much potential Yli-Hummo (2016) find out that most of the research is concentrated on the cryptocurrency topic rather than the blockchain technology. Also, according to Yli-Hummo (2016), most publication types come from conferences and workshops while a minority come from book chapters, journals and symposiums.

Although blockchain is talk about like there is only one type of it, three types of blockchain exist, public blockchain, private blockchain and hybrid blockchain (Siba, 2016). Siba (2016) describes the public blockchain as a "digital ledger [that] is completely decentralized and can be accessible to any internet user" (Siba, 2016). A private blockchain differs in the sense that there is a central authority giving permissions of who can write on the blockchain, that being the main difference with the public blockchain. The hybrid blockchain is a combination of the private and public blockchain. No more details are given about that blockchain type. Each type of blockchain can applied with the four features that according to (Siba,2016) the blockchain technology has, those are permissioned network, assets, transactions and consensus. Carlozo (2017) says that according to a 2017 survey 60% big company executives were knowledgeable to some degree about what blockchain is. Companies like IBM and Maersk have been researching it to make real life implementations. Benton (2018) says that in 2018 IBM and Maersk found out during a 18 month study that a shipment from Kenya to Port Rotterdam cointaning just flowers, had more than 200 paper transctions. Those trascations amount almost 20% of the cost of the shipping process.

Popular thinking believe that the technology will be exploited only by business but Manski (2017) makes the case that blockchain technology could be

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of great potential to the cooperative movement. The cooperative movement is "...antagonistic to both corporate capitalism and state socialism" (Manski, 2017) since both systems rely on a central power. He presents six key tendencies off the blockchain technology that lead towards a technological commonwealth and other six that will prevent a technological commonwealth. The six positive key tendencies are disintermediation, trustless exchange, increased user control of information, durable, secure decentralized networks, transparency and immutability, maintenance of high quality, accurate data. The six negative key tendencies are unresolved technical challenges, unsettled regulatory environment, cybersecurity and privacy concerns, challenges to widespread adoption, job loss due to automation, decreased corporate accountability. Woodside (2017) on the other hand does a PEST analysis (Political, Economic, Social and Technical) of the state of the blockchain technology. In the political aspect, Woodside (2017) says that currently in the US, the IRS considers all virtual currencies property, and therefore must pay with the applicable laws to it. (That part of the PEST analysis is concerned with the cryptocurrency side of the topic rather than the blockchain itself). In the economic aspect of the analysis there are some forecasts that says that 30% of the retail banking jobs will be lost due the implementation of blockchain, given the automation of several tasks (Woodside, 2017). The social aspect of the blockchain according the PEST analysis made by Woodside (2017) says that user will have more control and transparency of their information. The price to pay is that once information is uploaded, there

could be privacy issues with it. R3 develops a privacy centered blockchain called Codra. Their website describes it as follows, "Unlike traditional blockchain platforms, Corda minimizes information leakage by only sharing transaction data with participants that require it." (R3, 2018) The technical side of the analysis by Woodside (2017), says that the blockchain is one of the most advanced networks ever created. The main feature of the blockchain is its trustless communication since, every node on the network don't rely on a central server (as in typical databases) to get what is considered the "truth". On top of that, the blockchain get more secure each time a new block is added to chain, since it would be harder to modify it. Nakamoto (2008) in his seminal white paper says, "To modify a past block, an attacker would have to redo the proof-of-work of the block and all blocks after it and then catch up with and surpass the work of the honest nodes." As Halaburda (2018) puts it, the blockchain use cryptography elements. The reason why is almost impossible to hack the blockchain is because is too costly to rewrite history, since that would require a lot of computing power. All that is part of its cryptographic element. Halaburda (2018) clarifies that a distributed ledger, a smart contract and encryption are separate things. People often think all those things are one and the same. They form part of the blockchain, but they don't need each other to work. A smart contract is a type of contract that can take certain action under some criteria. Halaburda (2018) gives the example of a car lease, if the monthly payment is not made, the car locks and the control returns to the lender. A distributed ledger is a subset of distributed databases. The cryptographic element comes from

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the use of SHA-256 (Secure Hashing Algorithm), an algorithm published by National Institute of Standards and Technology as a U.S. Federal Information Processing Standard (FIPS, 2015). These technologies had existed for some time independently. Blockchain proponents say the benefit lies in the disintermediation. Halaburda (2018) says that without a native crypto currency (like Bitcoin), is very hard to have a decentralized blockchain, since the crypto currency is the incentive in the proof of work[1] process (Nakamoto, 2008). A native crypto currency should be integral part of the design process of a blockchain with the end goal of being part of a e-government initiative.

The E-Government and the Hong Kong Case

Governments don't want to miss the lead and the Hong Kong government is putting effort behind the technology. Ko (2017) says that Hong Kong Financial Secretary Paul Chan expressed the following: "For the long-term sustainability of our financial industry, we should also pay attention to the development of the relevant formats, protocol as well as platforms of blockchain". Lam (2016) on the other hand mentions that Hong Kong Monetary Authority is actively behind the development of blockchain, working in proof of concept projects with local banks to gain a better understanding of the technology and materialize pilot programs in those areas.

Voting System

But applications of the technology ca go beyond of those in financial sector. Susskind (2017) gives multiple examples of how a blockchain based voting system can comply with Help America Vote Act (HAVA) and the Voting's Right Act. A blockchain voting system can, with the use of end to end encryption, maintain the anonymity of voters. The system can also be program to prevent errors on the voting process committed by the voter that eventually lead to invalidate the ballot. The system would facilitate the process of voting with people with disabilities since they wouldn't have to leave their homes to vote, something that could raise the low turnover of that population. The votes can also be audited by anyone without revealing the identity of the specific voter, increasing transparency. Such voting system does not need (at least in near future), to be the unique method of voting. Traditional methods can still be used to benefit the people that are not technically proficient or may lack internet service or a device to work with. Susskind (2017) also mentions that "voting centers" with the technology could be also implemented, or public internet be placed in certain areas, so people can get connected and vote. With a good user interface design, voting can be as simple as giving a thumbs up in any current social media application.

Accounting & Auditing

Governments could also benefit from the blockchain technology to improve transparency in its finance. Alboaie (2018) does an analysis of

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[1] The Proof of Work process consist of adding a new block (a transaction) to the chain. The computer must solve a cryptographic problem, like the SHA-256, when solved, the computer is rewarded with a token (like Bitcoin).

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multiple dimensions that affect the blockchain. The topological dimensions state the three types of networks possible, centralized, decentralized & distributed. Also, as mentioned before, there are three types of blockchain, public blockchains like Bitcoin and Ethereum (both cryptocurrencies), private blockchains, like Hyperledger (An open source project from the Linux Foundation), and hybrid Blockchains. With something like Hyperledger, being an open source platform, government could jump in and try the technology in a more rapid manner. Alboaie (2018) point the possible benefit of monitoring in almost real time the transactions in the network. This could be of special use to have data that is current, (with the corresponding software development), in the same day. That data could be of a huge potential for the accounting purposes of the government. Coyne (2017) in his paper concludes that the blockchain solves what is known as Byzantine Generals Problem[2]. The problem and the solution are poorly associated with financial reporting problems. Although some parts of it still work for accounting purposes. But Coyne (2017) also mentions that one the Big 4 accounting firms states that the blockchain will reduce back office costs. Coyne (2017) points out that interesting future research should look at how to find better ways to take the advantages of the public blockchain and the private blockchain. Murray (2018) states that in his experience as a CPA, one the main problems is to reconcile records at the end

of the year. Overemployment must be incurred to work this problem. With Blockchain all that is needed is to download a copy of the transaction history, where all records are already correct, again improving transparency and efficiency reporting financial records to the public (in the case of the government).

Another use according to Murray (2018) is the flexibility to work with government records. Due to the government being a large centralized entity, is hard to obtain its information because of red tape, and the time-consuming process of doing it. Blockchain could serve a portable version of those records, that everyone would carry with itself.

Copyright

Copyright could also be benefit by blockchain implementation. Ensing (2018) mentions the potential capability of attaching a smart contract to a piece of work (in its digital form) and make it work as a form of digital watermark. With this it could be proven that a piece of work is a counterfeit copy or not. That would could be of great use by the music and film industries to help their battle against piracy. Still, blockchain does does not prevent the need to comply with law, Ensing (2018) said …"in the United States it is still necessary to register a creative work with the U. S. Copyright Office in order to seek certain remedies in litigation". This is an example of what

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[2]"A reliable computer system must be able to cope with the failure of one or more of its components. A failed component may exhibit a type of behavior that is often overlooked--namely, sending conflicting information to different parts of the

system. The problem of coping with this type of failure is expressed abstractly as the Byzantine Generals Problem." (LAMPORT, 1982)

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Reyes (2018) called law lag, how the law can't keep up with rapid change.

Delaware Law Case

In the same manner that the internet has been submitted to different types of regulations since its inception, blockchain is no different. Reyes (2018) states that the state of Delaware and its then governor, Jack Markell, created the Delaware Blockchain Initiative. The purpose of that initiative has multiple applications, one of them being to "…enable[ ] companies to authorize and distribute their shares directly to investors via the internet" (Strassman, 2017). Reyes (2018) mentions a case where after a conflict in a merger of two corporations, it was necessary to see who owned shares to give the corresponding award of the settlement. The problem was to pinpoint the specific owners of the shares, and the DTC (Depository Trust Company, a company that "…was created to reduce costs and provide clearing and settlement efficiencies by immobilizing securities and making "book-entry" changes to ownership of the securities." (DTCC, 2018)) could not point the actual ownership of the current shares. "…investors filed roughly 49 million facially valid claims to Dole shares, but there were only about 37 million shares outstanding at the time of settlement" (Strassman, 2017). The judge and vice chancellor of the Delaware Chancery Court said in a memorandum opinion regarding that case, that the "Distributed ledger technology offers a potential technological solution by maintaining multiple, current copies of a single and comprehensive stock ownership ledger." (Laster, 2017). Reyes (2018) concludes that the changes made to the Delaware General Corporation Law

serve as a store showcase for other corporations to take example of it and let the blockchain continue its path towards a more mainstream adoption.

Conclusion

There is potential in multiple areas for government to invest in the technology and don't fall behind in comparison to the private sector, and certainly Delaware and Hong Kong offer examples that governments are keeping an eye on it. As the internet, there are still gray areas that will be resolved to some degree during time. One of those areas is the accounting and auditing purpose it could serve in the government to increase transparency. More developments on those areas are needed. What companies like Deloitte and KPMG do in reference to the blockchain will certainly have big impact on how things are done in that field. But it is certain that there is a consensus that the technology is more safe than current alternatives, it has groundbreaking potential and the law must keep up with its velocity. As the literature review shows, there are multiple types and ways to use the blockchain, meaning that is up to the entity behind a certain blockchain how decide how to implement their blockchain, how they want to give the incentive for people to join their network.

Acknowledgment

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