

AN OVERVIEW OF BLOCKCHAIN TECHNOLOGY BASED ON A STUDY OF PUBLIC AWARENESS

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ABSTRACT

Blockchain Technology is one of the latest technological advancements and has the potential to benefit many organizations. The focus of this paper is to provide an overview of Blockchain Technology to render a better understanding of what it is and how it operates. Another section of this paper will include a variety of questions that should be asked to determine if Blockchain Technology is the optimal solution for organizations. Within this section, how Blockchain Technology can be beneficial to organizations will also be summarized. Subsequently, there is a discussion showing how different industries are currently learning how to utilize the technology in order to gain an advantage in their sectors. This paper will also examine the results of a study conducted to assess public knowledge of Blockchain Technology.

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KEYWORDS: Blockchain Technology, Bitcoin, Ethereum, R3 Consortium, Hyperledger Fabric, Technology Acceptance, and Awareness

INTRODUCTION

Which new technology has the ability to change the way organizations do business? The answer is Blockchain Technology. Blockchain Technology will be the focus of discussion, including significant milestones in its brief history. Blockchain Technology is an important subject matter since, in early 2016, the Wall Street Journal reported that the financial industry has invested (over \$1 billion) in the financial industry by exploring and developing solutions with Blockchain Technology (Kursh and Gold, 2016). As well, Gartner Inc. predicts that “Blockchain’s business value-add will grow to \$176 billion by 2025” (Lovelock and Furlonger, 2017). Other papers have been written comparing this technology with other technological solutions. The focus of discussion in other papers shows the technology in industry-specific situations. This paper contributes to the current literature in several different ways. It allows readers to comprehend Blockchain Technology by defining the technology while discussing the five core principles. It will also look into how Blockchain Technology advanced when Ethereum and the Hyperledger Fabric was introduced. As well, the paper will examine the questions organizations have to ask to determine if Blockchain Technology is the right solution for their needs; how this technology will improve their processes; and will it address other issues they are facing within their organization. This paper will also look into industry initiatives using Blockchain Technology.

Based on the results of a study, there is a lack of public awareness; this paper was written to help address this situation as well as to share information in order to increase awareness and acceptance. The perspective from others also shows the lack of awareness and that they feel increased knowledge will change the public's perception on Blockchain Technology in a more positive light. Awareness and acceptance are essential to the future of this technology. The remainder of the paper is organized as follows. In the next section a literature review and some background information is provided. The following section discusses the data and methodology used in the paper. The paper continues with a presentation of analysis results. The paper closes with some concluding comments.

LITERATURE REVIEW AND BACKGROUND

Blockchain Technology, what is it? "The Blockchain is a decentralized ledger of all transactions across the peer-to-peer network. Using this technology, participants can confirm transactions without the need for a central certifying authority" (PWC, 2018). For those readers who are unfamiliar with Blockchain Technology, think of it as an enormous database. It records and stores all transactions. These transactions are stored on either a private or a public network. They are linked (and chained) from the beginning of each transaction; each transaction has a connection from the previous one; hence the name, Blockchain. How did Blockchain Technology start? Satoshi Nakamoto introduced it in 2008. Satoshi Nakamoto introduced Bitcoin and Blockchain Technology in a white paper (Satoshi Nakamoto, 2008). From that white paper, Blockchain Technology started to be noticed. The first Bitcoin was mined was on January 4, 2009, and the first payment was made on January 11, 2009. The software for Blockchain Technology (Bitcoin) was then released as open source code on January 15, 2009, allowing anyone with the required technical knowledge to be involved (Evans-Greenwood, Hillard, Harper, and Williams, 2016). In May 2010, the purchase of two pizzas was made with 10,000 Bitcoins (Bitcoin, 2010). This purchase was the first known transaction with Blockchain Technology. It is crucial to remember Bitcoin is not Blockchain Technology; Bitcoin uses the technology.

Blockchain Technology further expanded when Vitalik Buterin released a white paper in December 2013. He proposed that a single foundation layer of Blockchain (known as Ethereum, which uses smart contracts) would be reprogrammed to execute any arbitrarily complex computation and incorporate numerous other projects. "The intent of Ethereum is to merge together and improve upon the concepts of scripting, altcoins, and on-chain meta-protocols, and allow developers to create arbitrary consensus-based applications that have the scalability, standardization, feature-completeness, ease of development and interoperability offered by these different paradigms all at the same time. Ethereum does this by building what is essentially the ultimate abstract foundational layer: a blockchain with a built-in Turing-complete programming language, allowing anyone to write smart contracts and decentralized applications where they can create their own arbitrary rules for ownership, transaction formats, and state transition functions" (Buterin, 2013). From another perspective, Blockchain Technology can be viewed similarly to Microsoft DOS when it first came out. Software companies used Microsoft DOS to start programming and building different applications; by doing so, this allowed developers to write, test and execute their decentralized application. In late July 2014, The Ethereum Project, a decentralized Blockchain based on a platform, which enables smart contracts, launched the sale of Ethereum (Ethereum.org, 2014). NASDAQ announced in May 2015 that it planned to leverage Blockchain Technology as an enterprise-wide initiative. NASDAQ began the Open Assets Protocol, a colored coin innovation built on Blockchain. "Nasdaq will launch blockchain-enabled digital ledger technology that will be used to expand and enhance the equity management capabilities offered by its Nasdaq Private Market platform. Nasdaq's blockchain technology will offer efficient, fully-electronic services that facilitate the issuance, transfer, and management of private company securities" (Recupero and Briganti, 2015).

In September 2015, multiple financial institutions (including Barclays, Credit Suisse, Goldman Sachs, JP Morgan, and RBS) founded the R3 Consortium. The need for the R3 Consortium was due to the shared frustration with banks and other financial institutions having multiple generations of legacy financial technology platforms that struggled to interoperate, which led to inefficiencies; risk; and spiraling costs (R3, 2015). The R3 Consortium was aware of the power that Blockchain Technology could have in the financial markets. In December 2015, The Linux Foundation project launched the Hyperledger Fabric, a Blockchain framework to develop applications. This project was an open-source community to help with the development of the technology and brought leadership into Blockchain. Hyperledger Fabric started with seventeen companies. The companies used this platform to collaborate and advance Blockchain Technology in businesses. Currently, there are over 130 members around the world (Gupta, 2017).

"Hyperledger Fabric is a platform for distributed ledger solutions, underpinned by a modular architecture delivering high degrees of confidentiality, resiliency, flexibility, and scalability. It is designed to support pluggable implementations of different components, and accommodate the complexity and intricacies that exist across the economic ecosystem" (Github, 2018). In February 2017, the Enterprise Ethereum Alliance originated. The Enterprise Ethereum Alliance formed to connect Fortune 500 enterprises, startups, academics, and technology vendors with Ethereum subject matter experts. This Alliance learned from and built upon the only smart contract supporting Blockchain currently running in real-world production. Ethereum defined enterprise-grade software capable of handling the most complex, highly demanding applications at the speed of business (Entethalliance.org, 2017).

How Blockchain Technology Operates

Blockchain Technology has five core principles: 1) Distributed Database 2) Peer-to-Peer Transmission 3) Transparency with Pseudonymity 4) Irreversibly of Records 5) Computational Logic (Iansiti and Lakhani, 2017). Iansiti and Lakhani (2017) explained the five principles by stating: all users have access to the entire distributed database including its history; no one controls any part of data; the transactions can be verified without any issues; all parties can review the documents without a go-between; the communication occurs directly, peer-to-peer transmission instead of a central node. Each node stores and forwards the data to all other nodes. All transactions are transparent with pseudonymity. These transactions show their value and are evident to anybody with access to the system. A unique 30-plus alphanumeric address identifies each node, or user, on the Blockchain. Transactions happen between Blockchain addresses. Users can choose whether or not to make these transactions anonymously. Because all transactions are linked to the one before, none of the transactions that are entered can be changed; this is called irreversibly of records. There are computational algorithms that are deployed to ensure every transaction is permanent, numbered in an orderly manner and available to all others on the network. The Blockchain transactions are tied to computational logic and in essence, programmed.

Determining if Blockchain Technology Is the Optimal Solution

The subsequent information will outline what an organization will need to address to determine how Blockchain Technology can improve their processes and increase efficiency within the organization. How does an organization know if Blockchain Technology is right for them? Each organization has different needs. Organizations have to ask the appropriate questions to determine if Blockchain Technology will help and if it is the correct solution. Detailed answers must be provided before proceeding with a use case. All organizations look for answers either to correct or to improve a process. They also seek answers to gain valuable knowledge, increase revenue, or decrease expenses. They need to see which technological advances will influence their business. Tapscott and Tapscott mention, "The technology most likely to change the next decade of business is not the social web, big data, the cloud, robotics, or even artificial intelligence. It's the blockchain, the technology behind digital currencies like Bitcoin" (Tapscott and Tapscott, 2016). Previous papers have addressed the questions determining whether an organization can benefit from using Blockchain Technology. The two different perspectives below offer their opinions regarding which questions to ask to determine if Blockchain Technology is the right solution. According to Brakeville and Perepa, the organization has to answer the following questions: Is a business network involved? Is consensus used to validate transactions? Is an audit trail, or provenance, required? Must the record of transactions be immutable, or tamper proof? Should dispute resolution be final? (Brakeville and Perepa, 2016) In their article, Brakeville and Perepa declared that if the answer to the first question were "Yes" and at least one other response was "Yes" then a use case would be beneficial.

Gupta asked the following questions: "Does my business network need to manage contractual relationships? Do we need to track transactions that involve more than two parties? Is the current system overly complex or costly, possibly due to the need for intermediaries or a central point of control? Can the network benefit

from the increased trust, transparency, and accountability in recordkeeping? Is the current system prone to errors due to manual processes or duplication of effort? Is the current transaction system vulnerable to fraud, cyber-attack, and human error?" If the answer was "Yes" to any one of these questions, then a use case should be performed to determine if Blockchain Technology would be the right solution (Gupta, 2017). Within both of these papers, the business network was discussed. The question of business network involvement is a non-starter since all organizations should be on a business network; their success depends on it. If they do not have a business network, the other questions are not relevant and should not be a factor in determining if Blockchain Technology will be beneficial. Further to this point, a use case is justified when there is a need for validation of transactions, an audit trail is required, and the record of transactions involves two or more parties. The records need to be tamper proof. A use case would also be utilized in some instances where conflict resolution must be finalized. Another justifiable instance is if the current system is overly complicated or costly. All organizations and industries have the fear that their current transaction systems are vulnerable to fraud, cyber-attack and human error. If the current system were susceptible to errors in manual processes or duplication, then Blockchain Technology would be beneficial to the organization. Many organizations including the Government can benefit from increased trust, transparency and accountability.

Other questions and roadblocks that an organization will need to address are: What are the technological constraints on infrastructure? Is the in-house talent adequate for implementation of this project? What are the costs of the use case and the whole project? Is there a need to be aware of any legal or regulatory requirements? To elaborate: before an organization can start to develop a Blockchain solution, they need to discern if they already have the necessary talent or if outside consultants will be required. The team (or individual) responsible will need to make sure all questions or concerns are addressed and that there is a strategy in place. They will also need to know the limits of the organization. The organization needs to provide detailed information regarding their expectations. A strong use case, prototype, and pilot need to be identified. This project will not be inexpensive, nor quickly implemented. The organization needs to ensure the necessary steps have been performed in order to be ready to proceed. The benefits of using Blockchain Technology for organizations includes the validation of transactions, a decreased risk of fraud and/or cyber-attack and a smaller likelihood for human error. Organizations and Governments can benefit from improved confidence and clarity. More specifically, the benefits of Ethereum, with smart contracts and Hyperledger Fabric support the trusted relationships between two or more parties. Additional benefits are provided below as seen through the industry initiatives.

Industry Initiatives

Blockchain Technology will have a substantial impact on recording private and public information. Financial markets and cryptocurrencies have already met with success by using Blockchain Technology. Now other industries are getting involved. Below are some examples of a few different industries that are exploring if Blockchain Technology is the right technological solution for their sectors.

Automotive: Schade and Pytel with Ginkgo Management Consulting see that Blockchain Technology can have a valuable impact on the automotive industry. It will combine automation with transparency and validate the transaction process. The use of smart contracts will help facilitate this process. They discussed this approach within the automotive industry. It includes manufacturing, design, recycling, maintenance, supply chain and use phases. They discussed this theory in their abstract; they have not been involved in the design process (Schade and Pytel, 2017).

Government: The National Research Council of Canada launched a live trial of public Blockchain Technology in the administration of government contracts. They will be using Ethereum smart contracts. The National Research Council will publish information on original and modified contribution agreements

in real time. They will gauge to see if this has potential and allows for more transparency for better functionality of public programs (Government of Canada, 2017).

Healthcare: In January 2017, IBM and The United States Food and Drug Administration (FDA) signed a two-year agreement to explore potential Blockchain applications for employee health records (EHRs), clinical trials, internet-of-things, genomics and more (Millard, 2017). As mentioned by the chief science officer at IBM Watson Health, “The healthcare industry is undergoing significant changes due to the vast amounts of disparate data being generated, and Blockchain Technology provides a secure decentralized framework for data sharing that will accelerate innovation throughout the industry” (Millard, 2017).

Real Estate: Sweden is creating projects for real estate where they are developing and testing a Blockchain Land Registry. The “testbed-project” was built on private Blockchain that was run by a group of public and private companies. The software application that managed the contracts was controlled and recorded on Blockchain Technology. “The solution provides value by improving processes associated with land registration and real estate transactions” (Kairos Future, 2017).

Software: Oracle Corporation announced that they had launched Enterprise-Grade Blockchain Cloud Service to their customers. “The advanced, enterprise-grade distributed ledger cloud platform helps customers increase business velocity, create new revenue streams, and reduce cost and risk by securely extending ERP, supply chain, and other enterprises SaaS and on-premises applications to drive tamper-resistant transactions on a trusted business network” (Caputo and Reeves, 2017). Blockchain Technology with Enterprise Resource Planning (ERP) systems is forward thinking. It has an opportunity to change the way all transactions are managed particularly within Accounts Payable and Procurement. The number of industries impacted is vast. Different companies, countries, and industries are looking for ways to utilize Blockchain Technology to their best advantage. Blockchain Technology can have a positive impact on organizations if they plan accordingly and execute the plan correctly. Each of these industries is demonstrating different initiatives to verify if Blockchain Technology will work within their sector.

DATA AND METHODOLOGY

If Blockchain Technology is the future, a study was necessary to determine the knowledge that business professionals currently have with regard to it. Are business professionals aware of Blockchain Technology? Based on a particular study there seems to be a lack of awareness. Surprisingly, the response rate was 100 percent; the expectation was to receive 90 percent or higher. According to the results of a study (Appendix A) conducted on November 27, 2017, there is a lack of awareness. The study was distributed to 53 participants, including some Certified Public Accountants (CPAs). All 53 responses were received by November 29, 2017. The study was distributed directly or sent via email to the participants. Participants were asked not to research information on any of these questions by internet searches before answering. As well, they were asked not to disclose their responses to one another. The study included the following questions: Have you ever heard of Bitcoin? Have you ever heard of Ethereum? Is there a future of Blockchain Technology? Is there a future in the distributed ledger? What is Bitcoin? A copy of the study can be viewed in the Appendix section.

RESULTS

Detailed results are discussed below. In Table 1, the first question showed that 70 percent of participants had heard of Bitcoin. The second question was about Ethereum; only four percent of the participants had heard of it. The question asking, “Is there a future of Blockchain Technology?” showed there seems to be a lack of awareness because 83 percent had never heard of it. In addition, 87 percent had never heard of a Distributed Ledger. It was interesting to see that less than six percent of participants felt that there would not be a future for Blockchain Technology. In Table 2 the responses to the multiple-choice question, "What

is a Bitcoin?” Eighty-five percent of the participants did not know that it was mined using mathematics. Approximately eight percent of the participants thought it was stock traded on either the New York Stock Exchange (NYSE) or NASDAQ. To summarize these results, it appears that many people have heard about Bitcoin from a variety of sources including the news, the internet, or social media. The study also revealed the lack of awareness of Blockchain Technology itself.

Table 1: Responses to Study on Familiarity with Blockchain Technology

Question	Yes	No	Never Heard of It
Have you ever heard of Bitcoin?	37	16	n/a
Have you ever heard of Ethereum?	2	51	n/a
Is there a future in Blockchain Technology?	6	3	44
Is there a future in the Distributed Ledger?	4	3	46

This table shows the results of a study distributed to business professionals to assess their knowledge of Blockchain Technology. The numbers in Table 1 were the total responses for each question. The percentages in the body of the paper were rounded to the nearest whole number. Seventy percent of participants had heard of Bitcoin; less than four percent have heard about Ethereum; eighty-three percent had never heard of Blockchain Technology; and eighty-seven percent had never heard of Distributed Ledger.

Table 2: Responses to the Multiple-choice question, what is a Bitcoin?

Casino Coin From Las Vegas	Mined Using Mathematics	Stock Traded on NYSE or NASDAQ	Same as Gold	None of the Above
0	8	4	3	38

This table shows the results of the multiple-choice question, what is a Bitcoin? The numbers in Table 2 were total responses for the question. The percentages in the body of the paper were rounded to the nearest whole number. Eighty-five percent of the participants did not know that it was mined using mathematics. Approximately seventy-two percent of the participants answered none of the above. No participants thought it was a Casino Coin from Las Vegas. Awareness will be enhanced through education and training which will then lead to greater acceptance of Blockchain Technology among business professionals. To put this in perspective, Folkinshteyn, Lennon, and Reilly researched the comparison between Bitcoin and the World Wide Web (WWW). They analyzed the similarities and differences, for each, based on historical development. They discussed that when the World Wide Web was first introduced, it was new technology and initially had a slow start with a limited number of users and benefits. "Like Netscape, Bitcoin as a particular system/currency may or may not survive for the long term. But like the WWW, blockchain technology upon which Bitcoin is built, with the ability to validate and timestamp events without relying on a central authority, is here to stay. It is a platform for innovation whose history is only beginning" (Folkinshteyn, Lennon, and Reilly, 2015). Many advocates for Blockchain Technology agree that Blockchain Technology will follow the same path as the World Wide Web.

David Huseby (Security Maven for Hyperledger) discussed milestones this year for Blockchain Technology in an interview with JAXenter (a website for developers). He stated, "This is the year when non-technical and generally uninterested people will learn about and begin to understand what a Blockchain is. 2018 is a year of building public awareness and acceptance of this technology" (Motroc, 2018). Bahga and Madisetti also mention, "Blockchain is a nascent technology and is mostly adopted in the financial sector (Bitcoin being the most popular application). Lack of awareness about the Blockchain technology in other sectors is affecting its widespread adoption" (Bahga and Madisetti, 2016).

CONCLUDING COMMENTS

The above information gives an overview of Blockchain Technology. The timeline highlights provide the reader an overall history of the technology, including the inception of Ethereum that led to the different projects: Ethereum Project, R3 Consortium, Linux Foundation Project and the Enterprise Ethereum Alliance. Initiatives within several industries including Automotive, Government, Healthcare, Real Estate, and Software were examined. The importance of appropriate questions and detailed planning were addressed as necessary components in order to determine if Blockchain Technology will work for an organization. This paper reviewed the steps an organization needs to follow before they can develop a Blockchain solution. The five core principles provide insight and valuable knowledge in learning about the basics of Blockchain Technology. This paper was written to provide additional literature to help increase awareness of Blockchain Technology and what it entails. A need for information is evident from the results of a study distributed to fifty-three business professionals in November 2017. Shockingly, the results of the study showed over 83 percent of respondents had never heard of Blockchain Technology. If there is heightened awareness and more education about Blockchain Technology, then the acceptance and approval will follow. Upcoming research will show which industries initiatives achieved the most successful results with Blockchain Technology. Blockchain Technology is the future, and it is exciting!

APPENDIX

Appendix A: Study Questions

I would like to ask you for some assistance with a study that I am doing. I have a few questions to ask. Your answers will help me greatly with my paper.

No.	Question	Answer Options		
1	Have you ever heard of Bitcoin?	YES	NO	
2	Have you ever heard of Ethereum?	YES	NO	
3	Is there a future in Blockchain Technology?	YES	NO	NEVER HEARD OF IT
4	Is there a future in the distributed ledger?	YES	NO	NEVER HEARD OF IT
5	What is a Bitcoin?			
A	A) Casino coin from Las Vegas			
B	B) Mined using Mathematics			
C	C) Stock traded on the NYSE or NASDAQ			
D	D) Same as Gold			
E	E) None of the above			

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BIOGRAPHY

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