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ABSTRACT

Purpose: The purpose of this paper is to review the acceptance and future use of blockchain technology. Given the rapid technological changes, this paper focuses on a managerial overview and framework of how the blockchain, including its implementations such as Bitcoin have advanced and how blockchain can be utilized in large-scale, enterprise environments. The paper begins with a technological overview that covers the history of the technology, as well as describing the computational, cryptographic theory that serves as the basis for its notable security features. This paper also covers several key application areas such as finance, accounting, and marketplaces where blockchain technology is seeing major investments from some of the world's largest organizations.

Analysis Methods: Triangulation is utilized for this paper, which combines multiple methodologies, such as qualitative and quantitative methods, as complementary components for improving research study accuracy. The triangulation methods chosen for this paper include a secondary data environment analysis, a text analysis, and financial analysis in order to successfully manage and review the adoption diffusion of innovative technologies like blockchain. The blockchain stands to disrupt many areas of society with the proper application and thus it is important to examine its use with as many viewpoints as possible.

Contributions and Conclusion: The contribution this paper describes the potential drivers and drawbacks of blockchain technology in real world applications and highlights the managerial implications of its use. This paper also expands the theoretical contributions for identifying blockchain technology progress on the diffusion of innovation curve. As it stands, the blockchain is within the innovation

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stage in terms of its application in multi-national enterprises, but with major firms making investments, the blockchain could see growing normalization and acceptance, and at an inflection point akin to the Internet of the 1990s.

KEYWORDS: Blockchain, Diffusion of Innovation, Text Analytics, Bitcoin, Ethereum, Cryptocurrency

BLOCKCHAIN INTRODUCTION

TECHNOLOGY CONCEPTS OVERVIEW

Blockchain can be thought of as an overarching concept that includes many different technologies and applications. Blockchain is a digitized decentralized ledger to allow record keeping of all peer-peer transactions without the need for a centralized authority. The blockchain concept can be compared to the Internet which similarly has a variety of underlying technologies and applications. Continuing this parallel, some experts believe blockchain may have as great a transformation on business as the Internet. Blockchain has the potential to replace central banking platforms and other use cases including business process improvement, trades, health information sharing, automotive ownership, and voting. Cryptocurrency is enabled through blockchain technology. Well-known cryptocurrencies include Bitcoin and Ethereum. A cryptocurrency allows a medium of exchange similar to the US dollar, though is digital and utilized encryption to control new currency creation and verification of funds. (PwC, 2016; Van Doorn, 2017; Capgemini, 2017). Blockchain technology was created and popularized by the cryptocurrency, Bitcoin. Satoshi Nakamoto, the creator of Bitcoin and the subsequent blockchain technology, first mentioned the idea in a 2008 White Paper sent to cryptography enthusiasts (Zohar, 2015). Within the following year, Nakamoto released Bitcoin as open-source software and 'mined' the first Bitcoins, thus successfully implementing blockchain technology (Davis, 2011).

Blockchain technology uses peer-to-peer networking without the need for a centralized server, and instead the blockchain exists across an entire network of computers (Lord, 2016). Using the distributed database system through blockchain, a digital ledger of all transactions across a given network is verifiable by any one computer on said network removing the requirement for a central authority (Hackett, 2016). Any one of these individual computers, also called a 'node' on the network, has access to the entire database and a history of transactions starting from the first block, called the 'genesis block.' As the name suggests, a blockchain

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is a series of 'blocks' chained together with complex computational algorithms. In simple terms, a block is made up of the block header, the hash of the previous block header, and the merkle root (Bitcoin.org, 2016). To create a new block, data containing one or more transactions is collected in the data portion of the block. A copy of this information is made where it is then hashed, paired with another hash, hashed again, paired again, and hashed once more leaving a single hash called the 'merkle root' (Bitcoin.org, 2016). As each new block contains information from the block created before it, the blocks are 'chained' together as there is only one way they will fit together computationally on the blockchain.

MANAGEMENT PROBLEM

Managers are attempting to position their organization by focusing on technology megatrends and new growth areas. PwC and Gartner developed a listing of key technology mega-trends for 2017, the top 5 combined areas include: 1.) Analytics including machine learning and artificial intelligence, 2.) Cloud computing, 3.) Internet of Things and connected systems such as drones, 4.) Virtual and augmented reality, and 5.) Blockchain including distributed ledgers and value exchange transactions. For example IBM has repositioned a large portion of their business on Watson and analytics and artificial intelligence. For companies to compete they must find new areas of focus and reinvest in new growth areas. While managers understand the requirement to refocus on these megatrends, the changes are not always swift or effective. For example, many companies would like to take advantage of the current IoT trend with more than 20 billion devices by 2020. However, companies face challenges how to build these capabilities. In addition to domestic competition, international competition is also having an impact. For example, Amazon faces competition from e-commerce companies in China such as Alibaba and JD.com (Olaf, et al, 2017). More specifically this paper focuses on the mega-trend of blockchain and related distributed ledger capabilities. This area is growing in interest as blockchain technology has the potential to significantly transform many industries. While interest is high, the majority of blockchain implementations are still in alpha or beta stages due to the significant technological challenges (Pancetta, 2016; Olaf, et al., 2017). In addition these capabilities exist in a highly fragmented market, there are over 800 cryptocurrencies though most have limited trading and capitalizations under $1 million (Vlastelica, 2017).

Though blockchain technology has been around since 2009 with the introduction of Bitcoin, it is only recently that other management applications of blockchain networks have come to light, and validation that use of blockchain technology is no longer only for cryptography enthusiasts and cryptocurrency. Early applications proved that Bitcoin could be used as a legitimate currency in a marketplace. In 2016, venture capital investment in blockchain-backed startups have now surpassed

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pure Bitcoin startups totaling over $1.1 billion (Coy and Kharif, 2016). As one example of a management effort to capitalize on blockchain technology a coalition or consortium of financial firms were formed, led by the company R3. The original set of founding participants included IBM, Intel, Microsoft, Goldman Sachs and Barclays, JP Morgan, State Street, UBS, Royal Bank of Scotland, Credit Suisse, BBVA and Commonwealth Bank of Australia. This number of companies has since grown to 45 financial firms in 2015 and 80 firms in 2017. The group of firms intend to research the use of blockchain networks across the financial system (Higgins, 2015; Kelly, 2015; R3, 2017). The goal is to heavily automate and severely cut the operating and infrastructure costs of banks, leading to hundreds of billions in savings for large financial institutions (Lee, 2016a). This technology will be powered in part by Microsoft's Azure cloud services, to improve the trust and credibility in this technology. As a recent development, some founding members such as Goldman Sachs have since left the consortium, and declined to renew their annual membership feeds of $100,000, due in part to terms of fundraising, and Goldman Sachs is investing in other competing blockchain technologies and consortiums (Parker, 2016).

BLOCKCHAIN TECHNOLOGY ADOPTION ANALYSIS

THEORETICAL FOUNDATIONS

The diffusion of innovation (DOI) theory explains how an idea, product, or service is adopted through a system over time. This adoption of innovation occurs at different rates within people or those within an organization ranging from early innovators to late laggards (Rogers, 1962). There are five major categories of adopters: innovators, early adopters, early majority, late majority, and laggards. These five categories follow a normal distribution, with the first 2.5% as innovators to adopt blockchain technology, the second 13.5% are the early adopters, the third 34% are the early majority, the fourth 34% are the late majority, and finally the fifth 16% are the laggards. The five categories are mutually exclusive. Innovators are adventurous to try new technology, have significant financial backing, and expertise with technology. Innovators willingly accept potential failures and risk when adopting new technology. Early adopters are typically integrated in the local social system, and act as through leaders within the local social system based on previous knowledge. Early adopters can act as change agents to improve technology adoption and diffusion. Early majority will use technology at a point prior to the half-way point of adoption, and typically wait to decide and do not carry a thought-leadership role within the social system. Late majority are more skeptical and cautious of new technology and adopt after the average member within the social system, and typically must be convinced or pressured from others to adopt.

Laggards are the last to adopt new technology, are suspicious of technology and innovators, and focus on past decisions or standards. Many times, by the time a laggard adopts a technology, innovators have already moved on to the next phase of innovation (Rogers, 1962; UO, 2017).

From a managerial and theoretical standpoint, it is difficult to determine the exact location of blockchain technology on the diffusion of innovation adoption curve, as adoption of an innovation can be influenced by a number of factors including network effects, technical complexity, technical compatibility, trialability, perceived needs of relative advantage. In general, the diffusion of innovation, along with the adoption curve, are based on the number of users who have successfully adopted the technology. Blockchain technology, particularly its Bitcoin implementation, is seeing growth both financially as well as in mainstream adoption. Bitcoin data suggests that there are currently ten million Bitcoin Wallets (digital banks to store Bitcoins) and that daily transactions of Bitcoins have increased to more than 200,000, with continued growth (Jackson, 2016). Though this adoption exists globally, the adoption rates vary by country, for example the adoption of blockchain technology has been slower in areas due to risk mitigation and regulatory requirements (Young, 2016). This is contrasted by the major investments being made in countries such as the United Kingdom who has more publically welcomed blockchain and other financial technologies ('fin-techs'). For example, the national government has recently pledged funding to build six brand new research centers aimed at improving the United Kingdom's digital economy as well as lowering taxes on business startups (Imbach, 2016).

Managers are seeking technologies that improve their organizations entry point on the diffusion of innovation adoption curve. Those organizations that are innovators or early adopters may see a competitive advantage over late comers or laggards to the technology. This paper seeks to identify the progress of blockchain on the diffusion of innovation adoption curve and identify the management implications for blockchain technology. Diffusion of innovation theory is utilized based on the flexible application to a variety of areas, prior research has utilized diffusion of innovation within web site adoption, enterprise resource planning (ERP), and electronic data interchange (EDI), among others (Premkumar, 1994; Beatty et al, 2001; Bradford and Florin, 2003). To determine the adoption point of blockchain technology, we adopt a triangulation approach of 1. environment analysis, 2. text analysis, and 3. financial analysis.

1. ENVIRONMENT ANALYSIS

This research study uses a secondary environment analysis for managing the blockchain technology within key areas of Political, Economic, Social, and

Technical (PEST). Political components included governmental intervention, taxation, regulations, and leadership. Economic components include market growth, currency exchange rates, and monetary. Social components include culture, climate, customer behavior, and popularity. Technical components include new technologies and trends. Methods such as PEST can be utilized for conducting strategic analysis and development of a theoretically informed understanding of the business environment in order to develop and deploy managerial strategies. PEST has been utilized in technology applications and research including software as a service (SaaS), e-Government, and e-commerce (Downey, 2007; Lee et al., 2013).

POLITICAL

Public blockchains are viewable by all participants and cannot be altered, allowing trust of transactions without a required regulatory party (Harley, 2016). In terms of blockchain applications such as finance, U.S regulations have not yet considered its use within the industry as compared with other international markets. London, for example, has welcomed fin-tech startups and is actively assisting in exploring their regulatory framework so they could exist within their current standards (Giancarlo, 2016). By contrast the U.S. regulations have been more cautious with the technology, but with enthusiastic investments being made by notable firms, a paradigm shift may be on the way to increase the use and successful regulation of blockchain. Under current law, the IRS considers all virtual currencies, including Bitcoin, as property and thus must follow all general tax principles that apply to property (IRS, 2014). The future of Bitcoin and other virtual currencies is therefore still unpredictable and any number of possibilities could occur for the taxing and regulation of the technology. As a current development, the Securities and Exchange Commission (SEC) recently disapproved of a planned Bitcoin Exchange Traded Fund (ETF). In the decision, the SEC believed that the markets for Bitcoin are unregulated and thereby would be unable to prevent potential fraudulent or manipulative acts and protect users and the public (Shin, 2017).

ECONOMIC

Blockchain technology has the potential to disrupt many industries and automate certain tasks that have traditionally required a large labor force. With the automation of so many tasks, there is the potential of the blockchain phasing out millions of jobs that were once thought to be essential to business. Some forecasts suggest that the implementation of the blockchain in retail banking would result in a 30% loss in banking related jobs over the next decade (Giancarlo, 2016). With this being said, there is also the potential that the blockchain actually creates jobs. In fact, many managers are finding there to be an extreme shortage of blockchain talent and subsequently hiring and training new employees in this technology area (Rizzo, 2016). In addition, blockchain has the ability to significantly increase speed

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of transactions from days to minutes, and lower individual exchange fees through removal of third-party transaction requirements (Harley, 2016).

The pseudo-legitimate nature of Bitcoin cryptocurrency has caused its value to be extremely volatile since its inception in 2009. An exchange rate was quickly established that initially valued one U.S. dollar to be worth approximately 1,309.03 Bitcoins (BTC), taking into account the cost of electricity to generate the Bitcoins. In July 2010, the value jumped tenfold from $0.008/BTC to $0.080/BTC and later that year in November, the total market value of Bitcoin hit $1,000,000, with a value of $0.50/BTC (historyofbitcoin.org, 2016). In February of 2011, the Bitcoin reached parity with the U.S. dollar, then with the Euro in April of that same year. Through late 2011 to 2013, Bitcoin saw a dramatic increase to over $266/BTC and reached a market cap of $1 billion in March of 2013, though in April Bitcoin crashed to a low $130/BTC. Surprisingly, in that same year, Bitcoin soared to over $1200/BTC before again decreasing, as it was known to do. From 2014-2016, the value of the Bitcoin varied wildly from a low point in 2015 of $203/BTC to an astounding $1069/BTC in late 2016, and $2422/BTC in mid-2017 (Coinbase, 2016).

SOCIAL

With a distributed database system like the blockchain, data is completely transparent to anyone on the network. This allows users to control the entire process of their transactions in an open manner. However, this also creates a drawback in terms of user privacy; as it stands personal information could not be securely stored on a blockchain network (Tennison, 2016). Not to mention, once information is stored, it becomes difficult, or even impossible to remove it. These limitations restrict the possibility of normalizing the blockchain. This being said, IBM has been working to create an open source, privacy-centered blockchain network named Codra. Released by R3, Codra aims to verify users on the blockchain, but keep their personal information encrypted and secure (Leising, 2016). Pushing the bounds of the technology like this might prove that the blockchain could be altered to cater to the secure needs of processing personal information.

It is important to note that blockchain technology is based on software and therefore prone to bugs along with a whole host of malicious activity (Summers, 2016). Though in theory the blockchain itself is extremely difficult to hack, individual nodes that make up the peer-to-peer network are not. The decentralized quality of a blockchain network leads itself to being very open to attacks as individual computers (nodes) on the network cannot be guaranteed to be secure (Summers, 2016). For example, in August of 2016 the Bitcoin exchange platform Bitfinex experienced a massive security breach resulting in the theft of nearly 120,00

Bitcoins (Graham, 2016). With a value of $72.3 million, the stolen Bitcoins represent a major flaw in the Bitcoin technology - confidence. While security flaws plague various nodes on the Bitcoin (blockchain) network, we see the necessity of researching and adjusting how we use and store Bitcoins. Breaches like this hinder the normalizing of Bitcoin and make investors and users alike afraid to invest in the cryptocurrency.

TECHNICAL

In terms of technology, the blockchain is one of the most advanced networking applications ever created. From the complexity and security of the hashing algorithm, to the distributed nature of its sharing and processing, the blockchain is truly innovative. From a hardware standpoint, the blockchain does not really require any extraordinary hardware, but instead relies on software, much of which is open-source and well supported. Going forward, blockchain technology will continue to legitimize and we will see more creative ways that it can be implemented in the technology industry. This will require solving all technology requirements such as speed, processing time, and integration within existing systems and networks (Harley, 2016).

The quality that makes blockchain technology so unique is that each node does not trust any other node on the network. Typical database systems rely on a central server, controlled by some third party, to store the 'truth'. With Blockchain networks, a new transaction (new block) is only added to the blockchain through a complex consensus process where all nodes on the network agree that this new transaction is valid (Harley, 2016; Summers, 2016). This means that fraudulent transactions are impossible to accomplish using a blockchain network and users can trust that previous transactions are valid. As each block contains the hash of the previous block header, blocks are chained together computationally (Bitcoin.org). To alter a single block, both the block before and after would also have to be changed and thus, as more blocks are added to the blockchain, the blockchain becomes more secure. This essentially means that blockchain networks make it impossible to manipulate past transactions. This, coupled with the fact that each node has a full digital ledger of all transactions, makes blockchain networks one of the most secure (Kiviat, 2015).

SUMMARY

The table below displays each of the key environmental factors of political, economic, social, and technical analyzed, with drivers and drawbacks of blockchain technology categorized under the corresponding factor. For example, one drawback of blockchain within the political factor includes uncertainty of regulatory status and approval from governing agencies.

Factor	Drivers	Drawbacks
Political	Transparency: Public blockchains are viewable by all participants and cannot be altered, allowing trust of transactions without a required regulatory party.	Regulatory Status: Currencies have traditionally been regulated by national governments. International adoption rates vary, a recent SEC disapproval of a planned Bitcoin ETF cited unregulated markets.
Economic	Costs: blockchain has the ability to automate a number of existing functions, and lowers transactions costs and improves completion time by removing the need for third-party intermediary transaction fees.	Volatility: currency fluctuations have impacted value of market and susceptible to market shocks.
Social	User Control: ability to monitor transactions in a single location.	Privacy and Security: publicized concerns of transaction privacy and security incidents limit user adoption.
Technical	Quality: decentralized reliability, durability and security, no centralized server or single point of failure, greater protection against fraudulent transactions.	Innovation: resolution of speed, processing time, security and privacy concerns, and integration within existing systems and networks.

Table 1: Blockchain Technology Environment Analysis Summary

2. TEXT ANALYSIS

As a second method to analyze blockchain diffusion of innovation, text analytics is utilized to evaluate the adoption of blockchain. Text analytics is a method used to find and extract useful patterns, directions, trends or rules from unstructured text. Text analytics is a relatively recent term and is an umbrella term which includes information retrieval, information extraction, data mining, and text mining. Estimates are that 85% of data are stored in unstructured text documents, and organizations that that utilizes these sources can improve decision making and measure their innovation and adoption characteristics. Innovators would be expected to make note the developments in their annual reports to shareholders and the securities and exchange commission to promote their ideas. In general, a text

analytics process consists of establishing the corpus, extracting the key terms, and evaluating the results (Sharda and Turban, 2014).

The first step is establishing the corpus or the set of text documents used for discovery. The Fortune 50, or top 50 companies by revenue that were also publically traded were selected (Time, 2017) in order to select companies across a variety of industries and had significant leadership within their respective industries. Annual Summary Report 10-K documents were collected through the Securities and Exchange Commission (SEC) Edgar archives for each of the organizations (SEC, 2017). After collection, all documents were organized into a set of directories and formatted into a standard ASCII text file format. A review of the output was conducted to verify the presence of blockchain technology against annual report text, with excerpts shown in table 2. In order to analyze the adoption status of blockchain technology, the mention of blockchain was compared against the other major mega-trends for 2017, including AI and analytics, cloud computing, Internet of Things and connected systems, and virtual and augmented reality. Keywords for identifying each mega-trend within the annual reports were utilized from the mega-trend summaries (Pancetta, 2016; Olaf, et al., 2017). Each document was verified following text analysis, for example Citigroup uses the term VR to discuss 'viability rating' vs. 'virtual reality'.

In evaluating the text analytics results, the occurrence of blockchain keyword results within the annual reports were compared. Blockchain and related keywords were only identified in one annual report from IBM. During evaluation, a more specific blockchain cryptocurrency vendor such as Bitcoin was not identified within any of the annual reports. The absence of or future inclusion of blockchain technology within annual reports provides additional information on the adoption of a technology. In comparing blockchain to other mega-trends, blockchain ranked the lowest in term frequency. By contrast analytics and AI, and cloud computing were identified in 26 and 22 annual reports respectively. Blockchain is sometimes characterized as a blue-sky project, these blue-sky projects are often forward thinking or theoretical projects with no immediate practical application, and discuss potential political and technical risks such as regulatory approvals and technological development. In addition, economic and social risks include the ability to offer competitive prices and accurate communication of benefits to customers (Commonwealth Bank of Australia, 2017).

IBM’s annual report contained the most detail and frequent mention of blockchain including a note of their commitment to blockchain and strategic importance of blockchain along with their portfolio of related technology innovations including artificial intelligence, analytics, internet of things, cloud computing, and quantum

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computing. As described in the annual report: "IBM is committed to blockchain to provide a highly secure method of facilitating multi-step transactions, reducing the number of disputes and points of friction, including its participation in the Hyperledger Project. This cross-industry consortium is working to build the blockchain network in the cloud, doing for trusted transactions what the Internet did for information, and setting industry standards for years to come. Blockchain will enable financial institutions to settle securities in minutes instead of days; manufacturers to reduce product recalls by sharing production logs along their supply chain; and businesses of all types to more closely manage the flow of goods and payments. IBM is working with companies ranging from retailers, banks and shippers to apply this technology to transform their ecosystems through open standards and open platforms (IBM, 2017)."

Of note, Microsoft does not include mention of blockchain or related keywords within their SEC and investor annual report. However several years ago in 2014 Microsoft announced plans to accept the blockchain cryptocurrency Bitcoin in its Windows and Xbox payment services (Gilbert, 2016). More notably, Microsoft is actively working on its "blockchain-as-a-service" (BaaS) and is specifically attempting to create a "certified blockchain marketplace" on the Azure cloud platform (Coy and Kharif, 2016; Microsoft, 2017). One explanation may be that the blockchain marketplace is a sub-component of the Azure platform and therefore not included as a separate component for annual reporting purposes. In reviewing the separate CEO annual letter to shareholders, where transformational opportunities are discussed blockchain is also not included. Other technologies specifically mentioned in the annual letter by Microsoft's CEO Satya Nadella listed in Microsoft's investment for the future include digital intelligence, machine learning, artificial intelligence, and quantum computing, which are included within other mega-trends areas, and includes those with limited adoption implementation currently such as quantum computing (Nadella, 2016).

Mega-Trend	Key Terms	#	Organizations
Analytics and AI	Artificial Intelligence, AI, AI-powered, Machine Learning, Deep Learning, Natural Language Processing, NLP, Neural Networks, Intelligent Apps, VPA, Virtual Personal Assistants, Digital Assistants,	26	Aetna, Alphabet, Anthem, Apple, ATT, Boeing, Cardinal Health, Chevron, Dell, Disney, Express Scripts, Ford, Freddie Mac, GE, Home Depot, Lowes, Intel, IBM, JP Morgan, Kroger, McKesson, Metlife, Microsoft,

	Analytics, Advanced Analytics, Autonomous		Prudential, United Health, Verizon
Cloud Computing	Cloud Computing, Cloud	22	Alphabet, Amazon, Anthem, Apple, ATT, Cardinal Health, Citigroup, Comcast, Costco, Dell, Fannie Mae, Ford, GE, Intel, IBM, McKesson, Microsoft, PepsiCo, United Healthcare, United Technologies, Walmart, Verizon
Internet of Things / Connected Systems	IoT, Internet of Things, Sensors, Monitoring Devices, Robotics, Drones	10	ATT, Alphabet, GE, IBM, Intel, McKesson, Microsoft, Verizon, United Technologies, Boeing
Virtual/Augmented Reality	Virtual Reality, VR, Augmented Reality, AR, Virtual, Virtual World	2	Alphabet, Microsoft
Blockchain	Blockchain, Distributed Ledger, Value Exchange Transactions, Bitcoin, Ethereal, Dash, Monero, Ripple, Token, Cryptocurrency	1	IBM

Table 2: Blockchain Adoption Comparison Text Analysis

3. FINANCIAL ANALYSIS

As a third method to determine the stage of adoption of blockchain technology includes a financial analysis. The analysis components and criteria includes total investments, market value, and vendor adoption. With over $1.4 billion in blockchain startups in 2016 alone (Campbell, 2016) and the big four accounting firms heavily researching and investing in the technology, the blockchain is seeing some major financial growth as well as an acceptance by some of the most trusted firms in the world. In terms of total market value, Bitcoin alone has recently surpassed over $40 billion in total value, with even the second most popular blockchain-based cryptocurrency, Ethereum having a total value of over $21 billion (Coinmarketcap, 2017). For mainstream adoption, Bitcoin has seen some surprising firms accepting the cryptocurrency as a legitimate form of payment. Important

vendors include Microsoft, Subway, Tesla, and Expedia, along with other mainstream vendors accept Bitcoin as a form of payment (Chokun, 2016). Cloud vendors including Alibaba Cloud, Microsoft Azure, RedHat OpenShift have support for Ethereum (Miller, 2017). Ripple lists integration partners such as Accenture and CGI, along with financial institutions such as Bank of America Merrill Lynch, Santander, and UBS (Ripple, 2017). Monero lists a smaller set of exchanges, tools, goods, entertainment where the services are utilized (Monero, 2017). Dash similarly has a smaller set of debit cards, VPN providers, games, casinos and web stores where the services are utilized (Dash, 2017). Though the Bitcoin has seen some relative success and continues to push for normalization as a dominant blockchain cryptocurrency, there have been several other cryptocurrencies that have also been conceived. The second most valuable behind Bitcoin, Ethereum, pushes the limits of the blockchain to include not only a cryptocurrency (ether) but also function as a shared ledger of software that is usable by all, but tamperproof (Coy and Kharif, 2016). Founded in 2015, Ethereum grew rapidly and currently is the second largest cryptocurrency, though it is extremely volatile (Lee, 2016b). Litecoin is another cryptocurrency example that has gained popularity. On a technical level, it is nearly identical to Bitcoin, but Litecoin more specifically aims to decrease the block generation time of transactions (Litecoin, 2017). With a different hash algorithm and an improved GUI, Litecoin has become the one of the top 10 largest cryptocurrencies (Coinmarketcap, 2017).

To aid in the financial analysis, the total value of blockchain cryptocurrency in circulation as captured and totaled by the daily average market price across major exchanges is utilized (Blockchain, 2017). While the currencies fluctuate, and have been impacted by various global events, the current prices as of June 2017 are utilized and summarized below. The total US Dollar value of the over 900 cryptocurrencies tracked have a total market cap of $91.073B (Coinmarketcap, 2017). By comparison the total US currency in circulation as of February 2017 is $1.554T (Federal Reserve, 2017). As a percentage of market share cryptocurrencies would be equal to approximately 5.8% of the total currency in circulation. Several significant currency swings have occurred during the first half of 2017. The price of Bitcoin has increased more than 2.5 times within the 2nd quarter of 2017, and Ethereum more than 8 times, with Bitcoin and Ethereum reaching record valuations, though Ethereum also experienced a -20.9% one day flash crash in June, 2017, and one week decrease in June of nearly -40% (Cheng, 2017). The percentage or market share blockchain cryptocurrency is used as a proxy for adoption rate and status based on accessibility of information. Other methods such as transaction rates may be utilized based on company data availability.

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At the current growth rate of the market capitalization of over 900 cryptocurrencies, and to achieve a percentage point beyond innovator category with 2.5% of market share required a market cap of approximately $37.5B based on the 1.5T in current USD circulation vs. a market cap of $91B currently. Of note, the market cap was only $22.3B or 1.5% of total USD circulation a few months earlier in March, 2017. Given the growth rate of blockchain cryptocurrencies, the diffusion of innovation adoption from innovator to the next category of early adopter has occurred, however due to currency volatility significant fluctuations are possible. The dominance of Bitcoin has also decreased with the run-up of other cryptocurrencies falling from 70% to 44% of market share based on market capitalization within the 2nd quarter of 2017. Following the second stage of early adoption, a chasm is often cited, as a point where many of the early innovators and adopters fail to proceed to the next category. Given the number of cryptocurrencies over 900 it is likely many of these will fall out of favor and be consumed by the chasm, as adopter's will lend support to industry leading currencies. The remaining adopter categories would then follow. (Reese, 2016; Coinmarketcap, 2017).

Blockchain Cryptocurrency	Price	Market Value	Vendor Adoption/Support
Bitcoin (BTC)	$2422.36	$39.760B	Microsoft, Subway, Tesla, and Expedia
Ethereum (ETH)	$235.21	$21.835B	Alibaba Cloud, Microsoft Azure, RedHat OpenShift
Ripple (XRP)	$0.26	$9.763B	Individual debit cards, VPN providers, games, casinos and web stores.
Dash (DASH)	$161.95	$1.196B	Accenture and CGI, along with financial institutions such as Bank of America Merrill Lynch, Santander, and UBS
Monero (XMR)	$40.27	$591M	Individual exchanges, tools, goods, entertainment.
Total	-	$91.073 (921 cryptocurrencies)	-

Table 3: Blockchain Technology Financial Analysis

TRIANGULATION METHOD SUMMARY

The table below displays the study results to form triangulation. Triangulation combines multiple methodologies, such as qualitative and quantitative methods, as complementary components for improving research study accuracy (Jick, 1979). The triangulation methods of a secondary environment analysis, text analysis, and financial analysis contained within the study are outlined along with a diffusion of innovation categorization of adoption based on the analysis. In each case the diffusion of innovation category is largely seen as within the innovator category or the first 2.5% of market share with the exception of the financial analysis which due to recent significant fluctuations in pricing of cryptocurrencies has expanded to the early adopter's category, though several of the cryptocurrencies are experiencing significant corrections, which may cause further short-term movement between the innovators and early adopters categories.

Method	DOI Category	Description
Industry Analysis	Innovators	A growing consortium of companies dedicated to blockchain technology is promising to lead to an early adopters category, however several companies have already left the consortium, and competing blockchain technologies are fragmenting the ability to move to the next adoption category. In addition, there is still a large degree of uncertainty around global governmental regulation and taxation requirements. As a result, this is still classified in the innovators category.
Text Analysis	Innovators	Only 1 of the top 50 companies covering various industries and including several technology organizations include blockchain in their annual reports. Further the technology while in practical use for many years is classified as a 'blue-sky' type of technology similar to largely theoretical and less proven technologies. As a result, this is still classified in the innovators category.
Financial Analysis	Innovators <-> Early Adopters	In reviewing market capitalization of blockchain cryptocurrencies such as bitcoin, while growth in the first half of 2017 has been significant, the currency is highly volatile and still makes up only a fraction of the total currency circulation. While the fast rate of market capitalization growth may

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		allow categorizing within early adopter's category, the currency may fluctuate easily. As a result, this is classified in the innovators category with short-term movements to early adoption based on individual cryptocurrency adoptions and pricing.

Table 4: Triangulation Summary Analysis

LIMITATIONS

Study limitations include a secondary data analysis on political, economic, social and technical factors, a convenience sample of the top 50 largest U.S. companies by revenue with annual reports for the text analysis due to public accessibility, and financial analysis based on currency circulation. Future directions include expanding the sample set with non-public companies and internal documents along with transactional currency information, where data is made available by organizations, and conducting longitudinal study across several industries and organizations to measure the diffusion of blockchain innovation over time.

CONCLUSION AND CONTRIBUTIONS

Blockchain technology has the potential to disrupt and innovate several key areas of business. Notably, the accounting industry stands to be massively impacted by the implementation of blockchain technology by automating many of the manual processes that make up most accounting standards. For instance, current financial accounting calls for a double entry system that is meticulously audited for within the public trust. While this system ensures accuracy and verifiability, it comes with a great labor and time cost, and under current methods nearly impossible to automate. With the blockchain, companies could record their transactions directly into a joint register that creates a chain of accounting records. With each transaction verified and a part of the blockchain, altering or falsifying the recorded accounting information would be nearly impossible (Deloitte, 2016). This means that potentially all accounting information could be verified electronically instantly, and permit automated audits with the standardization of the practice. In August of 2016, the 'Big Four' accounting firms, Deloitte, Ernst & Young, KPMG, and PwC met with the American Institute of Certified Public Accountants to discuss this new technology. Specifically, blockchain experts from each organization discussed the feasibility and value that a distributed ledger system such as blockchain would provide, along with possible standards for its use (Del Castillo, 2016). Diehard believers in blockchain technology enthusiastically preach that the blockchain could be implemented in many official capacities beyond those currently in use

such as health records and even voting. Blockchain, with its extreme security and ability to instantly verify information, would seem to benefit both of these areas perfectly, but the current implementation does not bode well for these uses. Adam Ludwin, CEO of Chain, a blockchain company based on banking, claims that while these theoretical uses for the technology are interesting, the purpose of the blockchain is instead to automate much of the financial industry and create money into a completely digital asset (Eadicicco, 2016). Nearly all large-scale investments into the blockchain are currently centered on financial implementations, and have yet to see a viable counter to Ludwin's claim.

While the blockchain has the potential to positively impact many industries, there have been several applications that have called into question the legitimacy of the technology given security and privacy concerns. A well-known example is Bitcoin's place in the creation and flourishing of The Silk Road. The Silk Road was an online marketplace for illegal substances and items that saw success until its closing by authorities in 2013 (Swansea University, 2016). With the possibility of its digital nature, the Bitcoin became the currency of choice on the Internet's first ever "dark market". In some ways, the Bitcoin became synonymous with illegal behavior on the Internet and highlighted a major downfall in the blockchain technology: its ease of use in transactions. Efforts have been made to also address security concerns, one such example is IBM's new blockchain cloud-based services developed for regulated industries that require the highest level of security. Clients of this service are able to build international verification services to transfer valuable goods along the supply chain. Not only does this new service protect against outside, malicious attacks, but also guards against internal threats and was designed to meet all standards of government compliance in multiple industries including finance (Kastelein, 2016).

Several proponents are comparing blockchain to the Internet in the 1990s. At the time, it was unclear how to regulate the Internet, and conflicting regulations existed between various agencies. Today the Internet is a commonplace technology impacting daily life (Boring, 2016). Blockchain is seen to exhibit these same characteristics, and managers who are prepared have greater likelihood of positioning themselves and their organizations for long-term success. This paper contributes to technical and management understanding of blockchain, through an environment analysis, text analysis, and financial analysis to identify the diffusion point and adoption status and strategies of blockchain technology through triangulation. Key takeaways from the analyses, include the adoption status and strategies for management of the technology through addressing the drivers and drawbacks and positioning one's firm for blockchain success as the diffusion of blockchain technology occurs.

ISSN: 1941-6679-On-line Copy

REFERENCES

Beatty, R.C., et al. (2001). Factors Influencing Corporate Web Site Adoption: A Time-based Assessment. *Information & Management*, 38(6), 337-354.

Bitcoin.org. (2016). Developer Guide. Retrieved from https://bitcoin.org/en/developer-guide

Blockchain. (2017). Market Capitalization. Retrieved from https://blockchain.info/charts/market-cap

Boring, P. (2016). What the Internet was for your parents, the blockchain will be for you. Retrieved from http://thehill.com/blogs/congress-blog/technology/271163-what-the-internet-was-for-your-parents-the-blockchain-will-be

Bradford, M. and Florin, J. (2003). Examining the Role of Innovation Diffusion Factors on the Implementation Success of Enterprise Resource Planning Systems. *International Journal of Accounting Information Systems*, 4(3), 205-225.

Campbell, R. (2016). PwC Expert: $1.4 Billion Invested in Blockchain in 2016. CryptoCoinsNews. Retrieved from https://www.cryptocoinsnews.com/pwc-expert-1-4-billion-invested-blockchain-2016/

Capgemini. (2017). A History of Bitcoin. Retrieved from https://www.capgemini.com/beyond-the-buzz/cryptocurrency-blockchain

Cheng, E. (2017). Ethereum is crashing by 20% right now after confidence in bitcoin rival shaken. CNBC. Retrieved from http://www.cnbc.com/2017/06/26/ethereum-drops-more-than-10-percent-even-after-flash-crash-refund.html

Chokun, J. (2016). Who Accepts Bitcoins As Payment? List of Companies. 99 Bitcoins. Retrieved from https://99bitcoins.com/who-accepts-bitcoins-payment-companies-stores-take-bitcoins/

ISSN: 1941-6679-On-line Copy

Coinbase. (2016). Coinbase charts - Bitcoin Money Supply. Bitcoin & Ethereum Wallet - Coinbase. Retrieved from https://www.coinbase.com/charts?locale=en

CoinMarketCap. (2017). CryptoCurrency Market Capitalizations. CoinMarketCap. Retrieved from https://coinmarketcap.com

Commonwealth Bank of Australia. (2016). Online Annual Report. Retrieved from https://www.commbank.com.au/content/dam/commbank/about-us/shareholders/pdfs/annual-reports/2016_Annual_Report_to_Shareholders_15_August_2016.pdf

Coy, P. and Kharif, O. (2016). This Is Your Company on Blockchain. Bloomberg. Retrieved from https://www.bloomberg.com/news/articles/2016-08-25/this-is-your-company-on-blockchain

Dash. (2017). Merchants. Retrieved from https://www.dash.org/merchants/

Davis, J. (2011). The Crypto-Currency. The New Yorker. Retrieved from http://www.newyorker.com/magazine/2011/10/10/the-crypto-currency

Del Castillo, M. (2016). Big Four' Accounting Firms Meet to Consider Blockchain Consortium. CoinDesk. Retrieved from http://www.coindesk.com/big-four-accounting-firms-meet-to-weigh-benefits-of-blockchain-consortium/

Deloitte. (2016). Blockchain Technology A game-changer in accounting? Retrieved from https://www2.deloitte.com/content/dam/Deloitte/de/Documents/Innovation/Blockchain_A%20game-changer%20in%20accounting.pdf

Downey, J. (2007). Strategic Analysis Tools. CIMA Global. Retrieved from http://www.cimaglobal.com/Documents/ImportedDocuments/cid_tg_strategic_analysis_tools_nov07.pdf

Eadicicco, L. (2016). Time. Retrieved from http://time.com/4437388/what-is-blockchain-chain-ceo-2016/

Federal Reserve. (2017). How much U.S. currency is in circulation? Board of Governors of the Federal Reserve System. Retrieved from https://www.federalreserve.gov/faqs/currency_12773.htm

ISSN: 1941-6679-On-line Copy

Gilbert, D. (2016). Microsoft Moving Beyond Bitcoin To Create Blockchain Marketplace On Azure Cloud. International Business Times. Retrieved from http://www.ibtimes.com/microsoft-moving-beyond-bitcoin-create-blockchain-marketplace-azure-cloud-2310462

Giancarlo, J.C. (2016). Do No Harm to the Blockchain—American Jobs Depend on It. Observer. Retrieved from http://observer.com/2016/05/do-no-harm-to-the-blockchain-american-jobs-depend-on-it/

Graham, L. (2016). Bitfinex hack could shake faith in bitcoin. CNBC. Retrieved from http://www.cnbc.com/2016/08/04/bitfinex-hack-could-shake-faith-in-bitcoin.html

Hackett, R. (2016). Blockchain /Blok-Cheyn/ Noun. Fortune.

Harley, A. (2016). Israel: A Hotspot for Blockchain Innovation. Deloitte. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/il/Documents/financial-services/israel_a_hotspot_for_blockchain_innovation_feb2016_1.1.pdf

Higgins, S. (2015). Inside R3CEV's Plot to Bring Distributed Ledgers to Wall Street. CoinDesk. Retrieved from http://www.coindesk.com/r3cev-distributed-ledger-wall-street/

HistoryofBitCoin.org. (2016). Bitcoin History: The Complete History of Bitcoin [Timeline]. Retrieved from http://historyofbitcoin.org

IBM. (2017). 2016 IBM Annual Report. Retrieved from https://www.ibm.com/annualreport/2016/images/downloads/IBM-Annual-Report-2016.pdf

Imbach, P. (2016). 10 reasons London is becoming the Fintech capital of the world. KPMG. Retrieved from http://www.kpmgtechgrowth.co.uk/fintechcapital/

IRS. (2014). IRS Virtual Currency Guidance: Virtual Currency Is Treated as Property for U.S. Federal Tax Purposes; General Rules for Property Transactions Apply. Retrieved from https://www.irs.gov/uac/newsroom/irs-virtual-currency-guidance

ISSN: 1941-6679-On-line Copy

Jackson, M. (2016). Bitcoin's Big Challenge in 2016: Reaching 100 Million Users. CoinDesk. Retrieved from http://www.coindesk.com/2016-bitcoin-challenge-100-million-users/

Jick, T. D. (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly*, pp. 602-611.

Kastelein, R. (2016). IBM to Roll Out Blockchain as a Service in the Cloud. Blockchain News. Retrieved from http://www.the-blockchain.com/2016/07/15/ibm-roll-blockchain-service-cloud/

Kelly, J. (2015). Nine of world's biggest banks join to form blockchain partnership. Technology News. Retrieved from http://www.reuters.com/article/us-banks-blockchain-idUSKCN0RF24M20150915

Kiviat, T.I. (2015). Beyond Bitcoin: Issues In Regulating Blockchain Transactions. *Duke Law Journal*, pp 569-608.

Lee, S., Chae, S. H., and Cho, K. M. (2013). Drivers and inhibitors of SaaS adoption in Korea. *International Journal of Information Management*, pp 429-440.

Lee, P. (2016). Banks Take Over the Blockchain. *Euromoney*, pp 92-99.

Lee, T.B. (2016). Ethereum, explained: why Bitcoin's stranger cousin is now worth $1 billion. Vox. Retrieved from http://www.vox.com/2016/5/24/11718436/ethereum-the-dao-bitcoin

Leising, M. (2016). Blythe Masters Unveils Fix for Blockchain Privacy Concerns. Bloomberg. Retrieved from https://www.bloomberg.com/news/articles/2016-12-07/blythe-masters-unveils-fix-for-blockchain-privacy-concerns

Litecoin. (2017). Litecoin - Open source P2P digital currency. Litecoin - Open source P2P digital currency. Retrieved from https://litecoin.org

Lord, S. (2016). Bankchain & Itbit: Settling On The Blockchain. *Modern Trader*, pp 16-21.

  ISSN: 1941-6679-On-line Copy

Microsoft. (2017). Blockchain-as-a-Service. Retrieved from https://azure.microsoft.com/en-us/solutions/blockchain/

Miller, J. (2017). When Ethereum Will Go From IT to Enterprise. CoinDesk. Retrieved from http://www.coindesk.com/2017-ethereum-will-go-enterprise/

Monero. (2017). Merchants and Services Directory. Retrieved from https://getmonero.org/getting-started/merchants

Nadella, S. (2016). Annual Report 2016 - Shareholder Letter. Microsoft. Retrieved from https://www.microsoft.com/investor/reports/ar16/index.html

Olaf, A., Hagen, H., Hajj, J. (2017). 2017 Technology Trends. PwC. Retrieved from https://www.strategyand.pwc.com/trend/2017-technology-trends

Pancetta, K. (2016). Gartner's Top 10 Strategic Technology Trends for 2017. Gartner. Retrieved from http://www.gartner.com/smarterwithgartner/gartners-top-10-technology-trends-2017/

Parker, L. (2016). Shakeup at R3 CEV blockchain consortium as banks leave. Brave NewCoin. Retrieved from https://bravenewcoin.com/news/shakeup-at-r3-cev-blockchain-consortium-as-banks-leave/

PwC. (2016). Making sense of bitcoin, cryptocurrency, and blockchain. Retrieved from https://www.pwc.com/us/en/financial-services/fintech/bitcoin-blockchain-cryptocurrency.html

Premkumar, G., et al. (1994). Implementation of Electronic Data Interchange: An Innovation Diffusion Perspective. *Journal of Management Information Systems*, 11(2), 157-186.

R3. (2017). About R3. Retrieved from http://www.r3cev.com/about

Reese, F. (2016). Not Just Bitcoin: The Top 7 Cryptocurrencies All Gained in 2016. CoinDesk. Retrieved from http://www.coindesk.com/not-just-bitcoin-the-top-7-cryptocurrencies-all-gained-in-2016/

ISSN: 1941-6679-On-line Copy

Ripple. (2017). Network. Retrieved from https://ripple.com/network/system-integrators/

Rizzo, P. (2016). Consulting Firms Face Talent Shortage As Blockchain Offerings Grow. CoinDesk. Retrieved from http://www.coindesk.com/consulting-firms-hiring-blockchain-talent/

Rogers, E.M. (1962). Diffusion of innovations. New York: Free Press.

Shin, L. (2017). SEC Rejects Winklevoss Bitcoin ETF, Sending Price Tumbling. Forbes. Retrieved from https://www.forbes.com/sites/laurashin/2017/03/10/sec-rejects-winklevoss-bitcoin-etf-sending-price-tumbling/#48a40522643c

SEC. (2017). Aetna 2017-02-17 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1122304/000112230417000014/form10-k.htm

SEC. (2017). Alphabet 2017-02-03 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1652044/000165204417000008/goog10-kq42016.htm

SEC. (2017). Amazon 2017-02-10 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1018724/000101872417000011/amzn-20161231x10k.htm

SEC. (2017). AmerisourceBergen 2016-11-22 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1140859/000114085916000022/abc10-kxseptember302016.htm

SEC. (2017). Anthem 2017-02-22 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1156039/000115603917000002/antm-2016123110k.htm

SEC. (2017). Apple 2016-10-26 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/320193/000162828016020309/a201610-k9242016.htm

SEC. (2017). Archer Daniels Midland 2017-02-17 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/7084/000000708417000008/adm-20161231x10k.htm

SEC. (2017). AT&T 2017-02-17 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/732717/000073271717000021/ye16_10k.htm

SEC. (2017). Bank of America 2017-02-23 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/70858/000070858l7000013/bac-1231201610xk.htm

SEC. (2017). Berkshire Hathaway 2017-02-27 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1067983/000119312517056969/d303001d10k.htm

SEC. (2017). Boeing 2017-02-08 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/12927/000001292717000006/a201612dec3110k.htm

SEC. (2017). Cardinal Health 2016-08-12 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/721371/000072137116000277/a16q4_10kx63016xform10-k.htm

SEC. (2017). Chevron 2017-02-23 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/93410/000009341017000013/cvx-123116x10kdoc.htm

SEC. (2017). Citigroup 2017-02-24 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/831001/000083100117000038/c-12312016x10k.htm

SEC. (2017). Comcast 2017-02-03 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/902739/000119312517030512/d290430d10k.htm

SEC. (2017). Costco 2016-10-11 10-K. https://www.sec.gov/Archives/edgar/data/909832/000090983216000032/cost10k82816.htm

SEC. (2017). CVS 2017-02-09 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/64803/000006480317000006/cvs-20161231x10k.htm

SEC. (2017). Dell 2017-03-12 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/826083/000082608313000005/dellfy1310k.htm

SEC. (2017). Disney 2016-11-23 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1001039/000100103916000516/fy2016_q4x10k.htm

SEC. (2017). Express Scripts 2017-02-14 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1532063/000153206317000004/esrx-12312016x10k.htm

SEC. (2017). Exxon Mobile 2017-02-22 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/34088/000003408817000017/xom10k2016.htm

SEC. (2017). Fannie Mae 2017-02-17 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/310522/000031052217000096/fanniemae201610k.htm

SEC. (2017). Ford Motor Company 2017-02-10 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/37996/000003799617000013/f1231201610-k.htm

SEC. (2017). Freddie Mac 2017-02-16 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1026214/000102621417000018/a201610k.htm

SEC. (2017). General Electric 2017-02-24 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/40545/000004054517000010/ge10k2016.htm

SEC. (2017). General Motors 2017-02-07 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1467858/000146785817000028/gm201610k.htm

SEC. (2017). Home Depot 2017-03-23 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/354950/000035495017000005/hd-01292017x10xk.htm

SEC. (2017). IBM 2017-02-28 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/51143/000104746917001061/a2230222z10-k.htm

SEC. (2017). Intel 2017-02-17 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/50863/000005086317000012/a10kdocument12312016q4.htm

SEC. (2017). Johnson and Johnson 2017-02-27 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/200406/000020040617000006/form10-k20170101.htm

SEC. (2017). JP Morgan 2017-02-28 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/19617/000001961717000314/corp10k2016.htm

SEC. (2017). Kroger 2017-03-28 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/56873/000155837017002198/kr-20170128x10k.htm

SEC. (2017). Lowes 2017-04-04 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/60667/000006066717000076/lowesform10k.htm

SEC. (2017). Marathon Oil 2017-02-24 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/101778/000010177817000046/mro-20161231x10k.htm

SEC. (2017). McKesson 2017-05-22 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/927653/000092765317000007/mck_10kx3312017.htm

SEC. (2017). MetLife 2017-03-01 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1099219/000093783417000003/met-12312016x10k.htm

SEC. (2017). Microsoft 2016-07-28 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/789019/000119312516662209/d187868d10k.htm

ISSN: 1941-6679-On-line Copy

SEC. (2017). PepsiCo 2017-02-15 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/77476/000077476170000010/pepsico201610-k.htm

SEC. (2017). Phillips 2017-02-17 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1534701/000153470117000051/psx-20161231_10k.htm

SEC. (2017). Proctor and Gamble 2016-08-09 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/80424/000080424160002l2/fy151610-kreport.htm

SEC. (2017). Prudential Financial 2017-02-17 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1137774/000113777417000084/form10-kx4q2016.htm

SEC. (2017). Target 2017-03-08 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/27419/000002741917000008/tgt-20170128x10k.htm

SEC. (2017). United Health 2017-02-28 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/731766/000073176617000009/unh2016123110-k.htm

SEC. (2017). United Technologies 2017-02-09 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/101829/000010182917000007/a2016-12x31form10xk.htm

SEC. (2017). UPS 2017-02-21 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1090727/000109072717000011/ups-12312016x10k.htm

SEC. (2017). Valero 2017-02-23 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/1035002/000103500217000009/vloform10-kx12312016.htm

SEC. (2017). Verizon 2017-02-21 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/732712/000119312517050292/d296602d10k.htm

SEC. (2017). Walgreens Boots Alliance 2016-10-20 10-K. https://www.sec.gov/Archives/edgar/data/1618921/000114036116083198/form10k.htm

SEC. (2017). Walmart 2017-03-31 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/104169/000010416917000021/wmtform10-kx1312017.htm

SEC. (2017). Wells Fargo 2017-03-01 10-K. Retrieved from https://www.sec.gov/Archives/edgar/data/72971/000007297117000278/wfc-12312016x10k.htm

Sharda, R., Delen, D., Turban, E. (2014). Business Intelligence A Managerial Perspective on Analytics. Upper Saddle River, NJ: Pearson.

Summers, T.C. (2016). Hacking The Blockchain. Modern Trader.

Swansea University. (2016). Silkroad and Bitcoin. Retrieved from https://www.swansea.ac.uk/media/GDPO%20Situation%20Analysis%20silk%20rd%20and%20bitcoin.pdf

Tennison, J. (2016). What is the impact of blockchains on privacy? Open Data Institute. Retrieved from https://theodi.org/blog/impact-of-blockchains-on-privacy

Time, Inc. (2017). Fortune 500. http://beta.fortune.com/fortune500/list/

UO. (2017). Diffusion of Innovation Theory. University of Oklahoma. Retrieved from http://www.ou.edu/deptcomm/dodjcc/groups/99A2/theories.htm

Van Doorn, M. (2017). The Evolution of Crypto-currency. Capgemini.

Vlastelica, R. (2017). With bitcoin surge, cryptocurrencies top $100 billion in market capitalization. http://www.marketwatch.com/story/with-bitcoin-surge-cryptocurrencies-top-100-billion-in-market-capitalization-2017-06-06

Young, J. (2016). Without unified, federal regulations for digital currencies, the U.S. Risks falling behind. Bitcoin Magazine. Retrieved from https://bitcoinmagazine.com/articles/without-unified-federal-regulations-for-digital-currencies-the-u-s-risks-falling-behind-1470086728/

ISSN: 1941-6679-On-line Copy

Zohar, A. (2015). Bitcoin: Under The Hood. *Communications of The ACM*, pp104-113.