

# **BENEFITS OF LEGISLATING CRYPTOCURRENCIES: PERCEPTION OF NIGERIAN PROFESSIONAL ACCOUNTANTS**

**Mary Kehinde Salawu, University of Johannesburg  
Tankiso Moloi, University of Johannesburg**

## **ABSTRACT**

*This study was undertaken to ascertain the view of Nigerian Professional Accountants towards legislating cryptocurrency in Nigeria. It also examined four of the ostensible benefits which at the same time constitute risks, from the legislation of cryptocurrency. Quantitative data were sourced from the respondents through the administration of a structured questionnaire. The population for the study comprised a stratified group of 1,300 Chartered Accountants among whom were Tax Practitioners, Financial Analysts, Statutory Auditors, Bankers, Accountants, Lawyers, Lecturers and other specialists in the field of Accounting. A sample of 250 Practitioners was conveniently selected for the study. Data were analysed using descriptive statistics. Results revealed that the Professional Accountants in Nigeria are willing to operate in the Cryptocurrency environment provided the Government would legislate its use. The study concluded that the legislation of Cryptocurrency or its modified form by the Federal Government of Nigeria is desirable for the protection of her economy as well as the interest of her citizens. However, government must take holistic view of the economy and scrutinize every relevant factor in the purview of the law to ensure the legislative decision is in the interest of the entire citizens.*

**Keywords:** Bitcoin, Cryptocurrencies, Legislation, Nigeria, Professional Accountants.

## **INTRODUCTION**

The series of terrorist attacks especially that of September, 2001 which came as a global shock did not leave the finance industry the same. According to Bruck and Wickstrom (2004), OECD estimated the direct cost of the attack to be \$27.2 billion. Johnson and Nedelescu (2005) equated it be 25% of the US annual GDP. Apart from over 74% casualty of the workforce, other indirect cost of the event includes the loss of investors' confidence, low asset price, capital flight, increased borrowing costs, fall in demand across major industrial countries, uncertainty and market volatility, significant delays in clearing and settlement system, deepening of economic recession which had only become noticeable during the preceding year (Johnson & Nedelescu, 2005; Roth, 2009; Richter et al., 2015). This event led to the loss of the largest inter-dealer broker and other brokers including several federal funds brokers; destruction of the critical and sensitive financial functions including the Bank of New York and J.P. Morgan Chase, the two main clearing banks and the core of the world's trading infrastructure which were physically located around the World Trade Centre (Lacker, 2004; Johnson & Nedelescu, 2005).

Johnston (2002) claimed that the same event which was reckoned as the height of the terrorist disruption, served as the motivation for creating the sense of urgency in pursuance of accelerated introduction of dispersed, non-physical domain, internet-based clearing and

settlement systems with open standard payment systems which could reduce the place of cash significantly as well as marginalise illegal transactions. The vision for the world of virtual currency had been that of a more extensive planet-wide network of sophisticated transaction system which had been in the pipeline since the last attack only that, it required global financial infrastructure which had slowed down the actualization of the change (Johnson & Nedelescu, 2005). Proponents of this approach had expressed gross discontentment on the embedded risk of monetary rules that promote narrow access and the resultant inequality and social diversity conflict, restriction to discount offer in transactions involving the use of credit card with the unbanked, expensive service charges borne by foreign workers on clearing and settlement systems which characterised the existing transaction system (Johnston, 2002). The introduction of the new virtual currency appeared to be a well-planned remedy to the age-long experience of global financial market disruptive and devastating challenges arising from various terrorist attacks on the market in the last two decades (Johnston, 2002; Johnson & Nedelescu, 2005). Before the emergence of cryptocurrency, currencies the world over had been centrally administered and controlled by the central bank of each country (Mandeng, 2018) but this is not the case with Bitcoin (Nakamoto, 2008; Richter et al., 2015; Hameed & Farooq, 2016).

According to Nakamoto (2008), Bitcoin is a peer-to-peer Electronic Cash System. The peer-to-peer system of Bitcoin is built on blockchain, thus, allowing transactions to take place between users directly, without any intermediary (Hameed & Farooq 2016; Grech, & Camilleri, 2017). It allows anonymous transaction between parties and as such, parties do not know the true identity of each other (Dierksmeier & Seele, 2016). This may be necessary because, the entire details of the transaction of every participant on the Bitcoin blockchain is publicly revealed to other users (Bech & Garratt, 2017). Unlike the traditional currency which is issued at interval determinable by the Central Bank of each country, Bitcoins are mined at a fixed issuance algorithm such that the number of Bitcoins to be mined is halved every year until the maximum limit of 21 million coins are issued. As at the end of January 2018, Mandeng (2018) estimated that only 16.4 million Bitcoins were in existence and the final mining will be accomplished in year 2140.

Although the use of cryptocurrency as a basic money account is aimed at granting all people the right to a verifiable internet identity (Johnston, 2002), there are lots of speculations around its future. First, its lack of central control by any government or administrator raises serious concern to the government in every continent (CPIM, 2015). Recurrent record of illegal transactions (Godlove, 2014), financing of terrorists activities (Johnson & Nedelescu, 2005), the fear of sudden crash of the entire system, the difficulty of clear definition of the coin are some of the reasons why most countries warn their citizens incessantly of the risk of investing in it. At the same time, it presents great and attractive potentials and offers huge returns to the investors.

Despite the risks associated with this currency, the rate of its growth is astonishingly challenging. With its growth, Governments are thrown into dilemma. Literature reveals that there is no consensus either at the national or international level for or against legislating the operation of cryptocurrency, more so that it was not the creation of any government (Hughes & Middlebrook, 2015).

Debates on cryptocurrency constitute a major discourse in modern finance, economic, legal and technology conferences as well as institutional and academic research at the moment with focus on what and how should nations and legislator respond to this new world-shaking technology (Bech & Garratt, 2017). The current study therefore is an attempt to appraise the view of the Nigerian Professional Accountants on the legislation of cryptocurrency in the

Nigerian context. Secondly, it seeks to also examine whether or not the purported benefits of Bitcoin could serve as motivation for Nigeria Government to legislate the use of Bitcoin. For the purpose of this paper, Bitcoin and cryptocurrency shall be used interchangeably.

## REVIEW OF LITERATURE

Currency as a legal tender is accepted as a unit of account, store of value and medium of exchange (Gaudamuz & Marden, 2015; Prasad, 2018). Historically, money originated through public enterprises in the ancient Mesopotamian temples and palaces as standardized weight and also assisted in the development of internal accounting for recognition of credits and debits and as an instrument of taxation (Forstater, 2005; Tcherneva, 2005). According to Davies (2002) and Henry (2004), money predated minting for about 3000 years. Considering the development of money in Egypt, it became clear that the State plays important role in establishing the appropriate measure of value for the purpose of accountability (Henry, 2004). Cowries, Fijian whales' teeth, Yap stones, Wampum, cattle and metallic currencies were the earliest forms of money in existence and thereafter, notes were issued as money but in each instance, the State played important roles such as determining the value of the currency and administrative control (Davies, 2002; Henry, 2004; Tcherneva, 2005).

While certain currencies, like the US Dollar, are said to be backed by commodities such as gold, most other real currencies are fiat (Kien-Meng Ly, 2014; Prasad, 2018). According to Mandeng (2018), Bank notes were introduced by China in the 10<sup>th</sup> Century and in Europe in the 18<sup>th</sup> century, later in 19<sup>th</sup> century, it gained legal tender status. Before the establishment of Central Bank, Private Banks of Issue were involved in rapidly conducting and facilitation of monetary transactions. Each country later established a central bank to regulate bank note issuance, address proliferation and promote stability (Mandeng, 2018).

Similarly, in the history of recording business transactions, the financial industry had always experienced gradual transition from one era to the other. There had been three major phases so far, beginning with pre-paper, paper and electronic. The pre-paper era was the oldest when different materials such as bones of animals, clay, wall, line dates, papyrus, bullae, cuneiform, charcoal sticks, plant stems, feathers and other physical materials served as means of capturing and recording business transactions (Akinyemi et al., 2015). The ancient practice became gradually outdated when paper was invented around 100 BC (Zhangmingwu, 2011).

During the second phase, financial transactions were recorded first in the three main books comprising the journal, the ledger and cashbook with the help of merchants and scribes in the days of Italian Monk, Luca Pacioli, the inventor and father of the double entry system of accounting (Akinyemi et al., 2015; Ovunda, 2015). Since then, paper had been in use until the introduction of computers. Although, paper as the medium for recording accounting information had not been totally eradicated even with the advent of computers, most of the accounting procedure was automated in order to appropriate the host of benefits offered by the use of computers (Nkuah et al., 2015). The use of paper was gradually overtaken by computer spreadsheet and other application software which are still being used. The move from the paper to computer spreadsheet and other application software is seen by many researchers as encompassing third industrial revolution (digitization).

However, the arrival of cryptocurrency which has its root in cryptographic technology with online distributed ledger appears to be introducing the finance industry into another phase (fourth) of development which incredibly is a combination of both the Central Bank function as well as Accounting functions as it produces and manages the supply of virtual currency as well

as producing and managing the record of transactions simultaneously (Zheng et al., 2017). This technology is indeed a pointer to the fact that we have moved to the era of the fourth industrial revolution.

Literature is replete with descriptions that establish the relationship between the concepts of digital currency, virtual currency and cryptocurrency. Digital currency according to CPIM (2015) are assets with zero intrinsic value, whose value is determined by the forces of demand and supply as in other commodity money like gold. They are not a liability of any entity and are not backed by any authority of the State. Their current value is dependent on the future expectation of being exchange for goods, services or a certain amount of sovereign currency (CPIM, 2015). According to Baron et al. (2015), a virtual currency as a digital representation of value is accepted by people as a means of payment, although, it is neither issued by a public authority, nor necessarily attached to a fiat currency. Electronic money was “*a type of unregulated, digital money, which is issued and usually controlled by its developers, and used and accepted among the members of a specific virtual community*” (European Central Bank, 2012). Mandeng (2018) described cryptocurrencies as private, digital, de-nationalised, unreserved, floating rate, convertible monies. Bitcoin, the most popular among other cryptocurrencies has assumed several names among other, the digital currency, digital cash, virtual currency, electronic currency and as cryptocurrency.

Bitcoin was generally believed to be the product of an unknown inventor with pseudonymous name known as Nakamoto. However, before the white paper of Nakamoto was released in 2008, there had been earlier propositions by various writers regarding the efficiency role the market could play in the creation and control of money instead of leaving it in the hand of the government and the Banking system (Rothbard, 2010). Chaum and Naor (1988) elaborated and expanded the work of Chaum (1983), a foremost researcher in Cryptocurrency, identified and addressed the deficiencies relating to anonymity and double spending attack protection, other contributors to the improvement of the template for cryptocurrency include Haber and Stornetta (1997), Back (2002) and (Lansky, 2016) among others.

Miller et al. (2002) had aptly spelt out the plan for cryptocurrency, its desirable attributes and the challenges that would characterise the currency at its introductory stage. The authors further revealed that its features would include, inter alia, efficient global economies and societies on one side; and increased anti-competitive behaviour, exclusion and inequality, economic volatility; criminal activity; and debilitated macroeconomic policy on the other hand. Although, Bitcoin was the first-known coin in the world of cryptocurrency (Nakamoto, 2008), there have been several other virtual currencies including litecoin, namecoin, quackcoin, peercoin, anoncoin, zerocoin among others since the introduction of Bitcoin (Gaudamuz & Marden, 2015; Bhosale & Mavale, 2018). They also operate on technology similar to Bitcoin (Hameed & Farooq 2016).

Raskin and Yermack (2016) noted that Bitcoin was strategically launched by its developer(s) at the climax of global economic meltdown when the Central Bank and the State with all the regular policies, were almost being seen as incapable and investors no longer trust in the ability of the government to sustain the economy (Roth, 2009; Chris et al., 2015). As such, many believed that Nakamoto surfaced to play the role of universal liberator from the scourge of economic crunch and from the monopoly power of the Government (He, 2018). This somewhat indisputable claim was evidenced by the encoded text, “*Chancellor on brink of second bailout for banks*” dated 03/Jan/2009 which accompanied the first brand of the coin mined by the anonymous owner of Bitcoin (Raskin & Yermack, 2016). Hauxley (2018) claimed that Bitcoin is

*“unlike anything we have ever seen, it’ll change the world.”* The world cannot be static and change is inevitable. More so that the internet had turned the world into a global village and being information age, it is not out of context to experience another global-shaking change including the introduction of cryptocurrency.

Despite the fact that Bitcoin seems to enjoy wild adoption, the concern is that the Bitcoin technology seemed not to be fully or perfectly developed to maturity before its lunch. Nakamoto (2008) acknowledged the tragic effect of conferring the strategic decision of the custodian and beneficiary of investment gain and transaction control to greedy attacker(s) who by technical expertise could choose to defraud people *“stealing back his payments by undermining the system and be mindless of the validity of his wealth.”* This in-built loophole in the system of coin mining became enough incentive for promoting fraudsters, violating rules at will, invariably populating defiance in the society and defrauding the innocent and inexperienced participants.

At the moment, cryptocurrency technology does not detect any difference between the rightful owner of an account and a successful attacker because crypto private key is accessible to attackers who can conveniently calculate the account address of the rightful owner and gain immediate control (Hameed & Farooq, 2016; Zheng et al., 2017). Worst still, the rightful owners cannot reverse the transactions already executed by crypto attacker, not even with the help of any law court (Lansky, 2018).

Many countries have classified Bitcoin differently based on their evaluation of its characteristics (Godlov, 2014). European Central Bank (2012) described cryptocurrencies as resembling real assets or commodities more than currencies at present, but argued that their role could expand in the future to include functioning as medium of exchange. In the United State of America alone, it has been classified as convertible decentralized virtual currency by US Treasury in 2013; as commodity by the Commodity Futures Trading Commission in 2015; as property by US Internal Revenue Service and as Fund by Supreme Court of the United States in 2018. Classification by other countries include intangible asset by South Africa; money (but not legal currency) by Argentina; means of payment to conventional currency by Canada and Japan (Prasad, 2018); commodity by Kyrgyzstan, United Arab Emirates; virtual commodity by Hong Kong; taxable asset by Israel and Norway and payment tool by Indonesia. Lack of consensus about what Bitcoin really is complicates the decision for its legislation (Bech & Garratt, 2017). Bitcoin possesses certain attributes that may be considered attractive to users for its adoption. At the same times, some of the attributes also pose challenges to users as well as lawmakers. This paper reviews four of such features which are considered as most relevant to the research objectives. They include anonymity; low service charge; international acceptance and lastly, lack of central control.

## **Anonymity**

The concept of anonymity implies that transacting parties do not know the real identity of each other. This feature of anonymity most times are reckoned as strength of the Bitcoin technology. Anonymity complicates the possibility of identifying individuals who engage in illegal transactions and other illicit activities (Zamani & Babatsikos, 2017). However, individuals with a single wallet address for various transactions stand the risk of having their details tracked down by smart attacker who can swiftly identify the user’s alphanumeric keys. It could be said that the participants duly recognize the risks and are willing (by their signature) to totally lose out in the event of sudden attack. In the occasion of death of a crypto account owner, his wealth automatically goes into extinction. Whereas, in the traditional banking system, allowance exists

for next of kin to claim the benefits of the deceased because anonymity implies that no other person except the owner of the crypto account could access and extract his details from the account data. With the knowledge of the risks, the participants who invest heavily and frequently could be suspected to be potential attackers or those who engage in illicit transactions, *ceteris paribus* (Meiklejohn et al., 2016). They invest either to attack or to be attacked. Further research can be carried out on this. Although, the regime of Know Your Customer could help, Carlisle (2017) posits that it weakens anonymity which innocent users might seek to enjoy.

### **Lower Transaction Cost**

Operating cryptocurrency account is believed to be cheap because the services of experts like bankers who act as intermediaries, are not required to verify transactions as in the traditional business (Dierksmeier & Seele, 2016). Although, transactional costs may appear low but in actual fact, the miners are paid substantial amount for the process of mining. Again, it has been argued that the lower cost of transactions may not be sustainable in the future.

### **International Acceptance**

This attribute of Bitcoin stemmed from the fact that Bitcoin could promote a cashless environment and overcome all the limitations posed by the use of cash. Being an online-based transaction which could be easily accessed by anyone, this innovation promises to be less strenuous, allowing any unit of transaction, with no territorial boundary. European Union (2012) viewed a unit of Bitcoin as being divisible to eight decimal places and can be used in any kind of transaction irrespective of the magnitude. This is where Bitcoin differs again from other forms of currencies. These features present cryptocurrency as very attractive to users. However, IMF (2016) refuted the claim that Bitcoin enjoys universal acceptance as a medium of exchange. This is because, certain nations have publicly declared the use of cryptocurrency illegal and would be ready to prosecute anyone that contravenes such policy (The Law Library of Congress, 2018). Other features "*cum benefits*" that could make the use of cryptocurrency attractive includes foreign payments and payments in countries with high inflation rate (He, 2018). Even, though it seems to gain attraction from many users, no country had legislated its use thus far.

### **Lack of Central Authority**

Lack of central authority is an in-built feature of Bitcoin Technology which connotes that there is no single administrator or an entity particularly in charge of the administration of cryptocurrency. All users are independent of one another. Although, the account details of transactions of each participant is within the public domain, yet, there is no responsible authority for the coordination of its activities. Cryptocurrency accounts maintenance contains an inbuilt, self-regulating mechanism that is similar to internal control mechanism found in client-oriented organisations (IPA, 2018). Transactions are chronologically dependent on each other by virtue of the cryptographic hash of the preceding block contained in the subsequent block. It was launched by anonymous developer(s) and patronized by anonymous users. FATF (2016); Meiklejohn et al. (2016) & Zamani and Babatsikos (2017) noted the difficulty of identifying, locating and holding any individual or entity liable by law enforcement agents for investigative purpose since there is no traceable central administrator in charge of the functionality of Bitcoin. This feature of Bitcoin appears very risky for investors in case of any unforeseen contingencies. This accounts

for one of the main reason why no country is eager to legislate its use (Godlov, 2014). The problem of hoarding of currency by the wealthy few for speculative reason could also throw the economy into a serious mess (Gaudamuz & Marden, 2015). This problem can become worse, in a case which is similar to Bitcoin where there is no central authority.

### **Cryptocurrency in other continents of the world**

While the legislators of most countries are trying not to oppose the new wave of Bitcoin because of its future potentials, the absence of Government control of the supply of this virtual currency raises a question of whether or not it has emerged as a disruption to the world's financial order (CPIM, 2015). The report of illicit transactions, promotion of terrorism financing and other potential uncertainties surrounding the future of cryptocurrency constitute another bone of contention among law makers. Countries like Russia, Nepal, Algeria, Colombia, Bangladesh and Argentina are among those that had declared Bitcoin as illegal and some of these countries would jail anyone using the virtual currency under anti-money laundering laws (Belomyttseva, 2015).

At the moment, no nation across the globe has a clear, leading voice as to how, when and what exactly should be the response to this disruptive surge (Belomyttseva, 2015). Bitcoin, by its unique features is seen to be operating in a legal grey dispositions area (Grinberg, 2011). That is why different countries have demonstrated different disposition and reactions towards legitimizing its usage. The scary threat to legislators across nations is the speed and high propensity with which an increasing number of the current generation of technologically inclined youths and curious adults embrace Bitcoin which is the leading variant in the crypto world and most recognized and traded among others (Benavides & Verme, 2014). Again, there is the realization of the potential for exponential growth and the possibility of increased adoption of Bitcoin by individuals and businesses. CPIM (2015), He (2018) and Prasad (2018) indicated that there is also evidence of the possibility for the technologically advanced countries to leverage on the loopholes of Bitcoins by harnessing resources to correct the defects and to come up with local and superior model that could ensure financial sanctity and offers protection for the citizens.

There had been debate on the attitude of the Government of the United State of America on the issuance of private money that no special action was taken against it and the government did not consider it as breach or unlawful activities (Godlov, 2014). So, it becomes difficult for the USA to oppose the introduction of cryptocurrency (Godlov, 2014). However, Mexico proposed to regulate it by FinTechLaw while the Bank of Jamaica serves as a signal to general framework and Argentina governs Bitcoin by the rules established for the sale of goods under the civil code. New York State Department of Financial Services (2015) enacted “*BitLicense*” regulation in 2015 which expressly prohibited BitLicensees from “*using assets*”, including cryptocurrency on behalf of another person. The regulation further required BitLicensees to continue to maintain records of accounts and transactions for at least five years, after which the property (cryptocurrency) must have been deemed to be abandoned (Hansen & Boehm, 2017). This regulation is reckoned to be the most comprehensive to date.

While many European countries including Austria, Ukraine, Croatia, Hungary, Ukraine, Italy, Czech Republic, Malta Germany accept Bitcoin as legal and some including Slovenia, Finland, Australia and Norway subject Bitcoin to tax (Belomyttseva, 2015), they have not developed any comprehensive framework for its operation within the continent. It is noted that, Belarus, Sweden, France and Luxembourg have all proposed plan for the development of

alternative cryptocurrency (Bech & Garratt, 2017). Spain applies barter law to Bitcoin transactions while United Kingdom has proposed a code of conduct that includes the provision of Anti-Money Laundering and extra security measures (Bech & Garratt, 2017).

Among the Asian countries that endorse the use of Bitcoin are United Arab Emirates with the declaration of Dubai Multi Commodities Centre (DMCC) as the only Free Zone in the Middle East having a government-issued license to trade in crypto-commodities. The Central Bank of the Philippines also regulates cryptocurrency exchanges under Circular 944. Thailand issued a comprehensive edict prohibiting business transaction in Bitcoin in its domestic market (Hughes & Middlebrook, 2015). In some other Asian countries including Saudi Arabia, the use of Bitcoin ATM machines are allowed (Everette, 2017).

Apart from few African countries like Algeria that categorically ban the use of Bitcoin, most other African countries only warn against the risk associated with the it, but do not expressly ban the use of Bitcoin. Zimbabwe endorsed the use of BitMari which is another type of cryptocurrency but skeptical about Bitcoin (FSD, 2017). Morocco has called for a framework for consumer protection (The Law Library of Congress, 2018).

### **Cryptocurrency in Nigeria**

Considering the experience of Nigeria, Ponzi schemes appeared to have gained popularity among the Nigerian citizens prior the introduction of Bitcoin. A Ponzi scheme according to the U.S. SEC (2018) is “*an investment fraud that involves the payment of purported returns to existing investors from funds contributed by new investors*”. Ponzi schemes have been described as financial frauds under the promise of high profits by Bartoletti et al. (2017). Vasek and Moore (2015) conducted an empirical study on Bitcoin-based scams and reported that 21% of 192 cases of Ponzi schemes, mining scams, scam wallets and fraudulent exchanges were associated with Bitcoin addresses. Likewise, Gilbert and Loi (2018) provided the cases of theft involving Bitcoin during years 2013 to 2015 with the names the companies affected and the amount lost. During year 2017, the Federal Government has made official release twice, intimating citizens about its non-readiness to support the use of Bitcoin and warning individuals, corporate bodies and Banks not to get involved in Bitcoin transactions. This warning became imperative because of the devastating effects of the various Ponzi schemes in Nigeria which suddenly collapsed towards the end of year 2016 up to the first quarter of 2017 in which case, many Nigerians lost their fortunes (Bartoletti et al., 2017).

This study was undertaken to ascertain the view of Nigerian Professional Accountants towards legislating cryptocurrency in Nigeria. It also examined the ostensible benefits from the legislation of cryptocurrency. It was hinged on Chartalism theory which states that the origin of money is located outside private markets and rests within the complex web of social (debt) relations where the state has a principal role. This implies that the state both denominates and institutes the role of money (currency) as a unit of account prior its role as a means of payment and a medium of exchange. Only the government has the power to levy taxes and to declare what will be accepted at pay offices for extinguishing debt to the state. Ingham (2000) maintained that the essence of state as the final authority does not lie in the ability to create laws or to print money, but in the ability of the government to create ‘the promise of last resort. With the introduction of cryptocurrency, the Central Bank must still be in place to guarantee monetary stability and political legitimacy with the introduction of the new electronic form of legal tender (cryptocurrency) with regard to the soundness of monetary hierarchy of the issuing institution or state (Miller et al., 2002). In a nutshell, the state determines what to accept and what not to



accept as a medium of exchange. Therefore, the power to either abate or legislate the use of cryptocurrency by citizens of any country resides with the state.

## METHODOLOGY

This study was conducted to investigate the actual situation as it relates with the expectations of the Nigerians on the legislation of Bitcoin in the country. The population for the study was 1,300 stratified group of Nigerian Chartered Accountants comprising Tax Practitioners, Financial Analysts, Statutory Auditors, Bankers, Accountants, Lawyers, Lecturers and other specialists in the fields of Accounting. The Institute of Chartered Accountants of Nigeria is the most recognized and the Highest Body that Trains and Certifies the Professional Accountants in Nigeria.

The group (population) was physically present at the 42<sup>nd</sup> Annual Accountants' Conference held at the International Conference Center (ICC), Abuja, Nigeria, where members were regularly kept abreast of new development and current trends in the profession. The group was considered appropriate for the study because any strategic decision in term of finance-related legislation would have direct impact on their profession. A sample of 250 of them was purposefully selected for the study. These practitioners were expected to be aware of emergence of cryptocurrency and being well equipped with financial regulations and versatile in financial matters, they were therefore adjudged to be in the best position to provide information on the subject matter. Primary data were sourced from the respondents through the administration of a structured questionnaire which was distributed to the respondents at random. The researchers employed the use of questionnaire for the study because, cryptocurrency and use of Bitcoin in particular was a new development in the history of Nigeria and there was the need to obtain the view of many of the members in order to arrive at a more objective and reliable results. Pilot study was conducted about eight weeks before it was administered to the respondents. About 30 copies were administered to executive members of the Institute during the South-East Zonal Planning Meeting. The completed copies were reviewed and it was discovered that majority of the members were not acquainted with cryptocurrency. Nothing substantial changed as a result of the pilot.

This fact prompted the researchers to target more participants in order to ensure an objective conclusion from the study. The research instrument was therefore used to elicit information about the view of Nigerian Professional Accountants towards legislating cryptocurrency in the country. Four of the major attributes of Bitcoin which were also regarded as its strength or benefits, which at the same time constitute risks comprising anonymity, universal acceptance, lack of central control and low transactional costs were considered in the study to establish whether or not they could serve as motivation for the government to legislate its use or not. Also, information about their view on the possibility of regulating Bitcoins in Nigeria was equally elicited via the instrument. Questions bothering on whether the Accountants were conversant with the current disposition of Nigerian Government on the endorsement of cryptocurrency; whether or not the practitioners expect the Government to ban citizens operating Bitcoin and whether or not the Government should regulate the use of Bitcoin were asked. Out of the 250 copies of the questionnaire distributed to the respondents, only 235 copies representing 94% of the total number were successively retrieved. When sorted, about 15 copies of the questionnaire were returned blank while 5 others were scantily completed by respondents, leaving 215 copies for the study. The study was therefore based on the 215 copies which represents 86%

of the distributed questionnaire. Data were analysed using descriptive statistics like tables and percentages.

Detailed results are interpreted and presented in section IV below.

## **RESULTS AND DISCUSSION**

### **Accountants' View about the Legislation of Bitcoin in Nigeria**

This section presents the results of the views of the Nigerian Accounting Professionals on whether the use of cryptocurrency should be banned or legislated by Nigerian government. The statistical reports including the mean, standard error, standard deviation, the skewness, kurtosis and others, generated from each of the factors were not analysed to avoid spurious result since the raw data were opinions and views of the respondents.

#### **Information about Current Standpoint of the Government**

In analyzing the result, the researchers first made effort to ascertain how conversant the Chartered Accountants in Nigeria were with the current disposition of the Federal Government on legitimizing the use of Bitcoin for the citizens and corporate bodies. Respondents were made to categorically indicate whether or not the Government had already endorsed the use of Bitcoin in the country as at the time of conducting the research. Their response as presented in Appendix Table 1, revealed that more than 65% of the Accountants were conversant with the viewpoint of the government about legislating Bitcoin in Nigeria. At the time of conducting the research, the Federal Government through the Central Bank had issued two circulars to address Bitcoin matters. The first circular basically warned individuals and banks and corporate bodies not to get involved in the use of Bitcoin because of the high risks associated with it. The circular specifically reminded citizens of the unpalatable experience from the various Ponzi schemes which collapsed earlier in the first quarter of the year. The response of the accountants further showed that about 34% of the group under study were not sure of the position of the government. This state of uncertainty could be attributable to the additional clause included in the second circular released by the Central Bank of Nigeria stating that further information should be expected from the government. Only 1% of the accountants were clearly wrong, with the belief that the government had endorsed the use of Bitcoin officially.

#### **Accountants' Opinion on Banning Citizens from Transacting With Bitcoin**

Accounting Practitioners seriously agitated whether or not the government should ban citizens from using Bitcoin. This was evident in their pattern of the response presented in Appendix Table 2. From the analysis, about 40% of the Accounting Practitioners clearly resisted any attempt to ban citizens from trading in cryptocurrency. About 18% of the respondents representing 39 members of the group wanted the Federal Government of Nigeria to ban cryptocurrency transactions in the country while the remaining 40% (90 members) of the Accountants remained irresolute and neutral.

This is an indication that the decision as to whether citizens want to be allowed to transact with Bitcoin is apparently dependent on many factors which are outside the scope of this research. This implication is that the Government would have to take an wholistic approach in

her decision and ensure all the relevant factors within the purview of the law are critically considered so that the final decision would be in the interest of all the citizens.

### **Desire for the Regulation of Cryptocurrency in Nigeria**

Appendix Table 3, showed that 82% of the valid response asked for the regulation of cryptocurrency while only 18% (27 members) of the valid response were opposed to it. About 30% of the respondents were irresolute. The implication of the responses is that since the majority of the members desire to have cryptocurrency legislated, the government needs to get involved to provide a clear structure as to its operation. This is in support of the theory of Chartalism which holds that the origin of money is located outside private markets and rests within the complex web of social (debt) relations where the State has a principal role (Miller et al., 2002).

### **Opinion of Nigerian Accounting Practitioners on the Ostensible Benefits/Risks of Legislating Cryptocurrency by the Government**

This section focuses on the appraisal of four of the important features of cryptocurrency which are supposed to be benefits derivable from the use of cryptocurrency but which at the same time also constitute risks in some respect. The appraised features include low transaction costs, lack of Central Authority, anonymity and international acceptance of Bitcoins. Descriptive statistics was employed with a view to determining whether or not the Nigerian Accounting Practitioners align with the view of some cryptocurrency users on some of these popularly acclaimed benefits of cryptocurrency.

#### **Low Transaction Costs**

Contrary to the general belief that cost of transactions involved in the use of Bitcoin is low (Dierksmeier & Seele, 2016), the result in Table 4, Appendix 1 revealed that Nigeria Accountants, representing about 82% of the respondents, did not believe that the cost of transacting with Bitcoin was low. The reasons for this response could be the consideration of the other associated indirect costs in form of waiting time, limited supply of Bitcoin and the 51% risk of theft by attackers (Kumar et al., 2017). More importantly, the response is consistent with the theory of Chartalism which posits that the benefits from using a particular commodity as medium of exchange can be recognized only after that commodity has already been in use. *“Coins, for example, must be minted and circulated before the benefits of reduced transaction cost are recognized. Thus, the argument that private agents and by extension, the users of cryptocurrency collectively and spontaneously chose a certain commodity (Bitcoin) for exchange because it reduces costs is, at a minimum, tenuous”* (Bech & Garratt, 2017).

#### **Lack of Central Authority**

As shown in Appendix Table 5, accountants in Nigeria did not consider the lack of central authority for the administration of cryptocurrency as an advantage for its use. From the ethical point of view, these practitioners considered the matter of finance as the life wire of any economy and would not consent to the belief that government should be sidetracked in the core decision of performing oversight role of determining the flow of money in the economy (Carlisle, 2017). This is an evidence that the Nigerian Accounting professionals place high value

on standard setting by government in the management of both public and private businesses. This result also establishes the theory of chartalism that argued that the value of any currency is derived from the Authority of a recognized State that issues it. In the case of cryptocurrency, lack of central authority for its administration poses more threats than benefits because, in case of any crisis, there is no identifiable entity that could be held responsible by law because, different individual customers have the same account details in different jurisdiction. This also conflicts with the value of accountability upheld by professional Accountants. Again, lack of central authority poses serious disadvantage to, and likely exclusion of the illiterate citizens, whose interest would ordinarily be protected by the special provision of financial instrument of the nation in case of any loss or damage. This result is consistent with the findings of Godlov (2014) and Carlisle (2017). Nigeria Accountants could appreciate the issue of official cryptocurrency as an option to ensure necessary control by the Federal Government (Prasad, 2018).

### **Anonymity**

Considering the present state of the acclaimed anonymity of Bitcoin as appraised and presented in Appendix Table 6, less than 15% of the respondents saw it as an advantage, more than 85% of Nigerian Accountants do not believe that there is anonymity in reality in transactions involving cryptocurrency. The reasons for this response could be partly due to the use of distributed ledger which displays the transaction details of each participant in the public domain. More so, the internet protocol addresses of individuals can be identified by attackers. Until a technology that can mask the IP addresses of users is enabled, the acclaimed Bitcoin anonymity is unimpressive to lay users (Baron et al., 2015). The recent fall of Ponzi Scheme in Nigeria which also bear much resemblance with cryptocurrency with respect to anonymity could serve as a strong reason why Nigerians would not rely on the anonymity feature of Bitcoin as having any benefit. This finding is consistent with those of Meiklejohn et al. (2016) & Zamani and Babatsikos (2017).

### **International Acceptance**

The result in Appendix Table 7, showed that, majority of the Accountants, that is, more than 67% refused the claim that international acceptance is an attribute to consider for the legislation of Bitcoin by the government. Factors that may inhibit its acceptance by the Accountants could include high level of risk, security challenges and lack of infrastructures for smooth operation as described by Joseph and Richard (2015). However, in the opinion of the Accountants, other factors which they identified and may be considered for legislation of cryptocurrency include investment opportunity, lack of restriction in procurement, convenience, quick appreciation of the currency while uniformity with other countries of the world in the use of cryptocurrency was considered of less importance by Nigerian Accountants.

## **CONCLUSION, POLICY IMPLICATION AND RECOMMENDATIONS**

Although several suggestions have emerged from research with respect to Government's response to legislating cryptocurrency ranging from monitoring, creation of state-owned cryptocurrency to banning or derecognizing cryptocurrency, the danger of most of these recommendations would be future strive for dominance and superiority among nations resulting from divergent views and approaches toward its legislation. Considering this fact, the cost of

ignoring the usability of cryptocurrency, outweighs the perceived risks of not legislating it in the future especially by developing countries like Nigeria. It is highly imperative therefore that the Government either reviews her regulatory framework for the purpose of legislating the use of cryptocurrency, which must specify the terms and conditions with respect to privacy law in the interest of the state and citizens, anti-laundry and loss recovery in case of illicit transactions and possible attacks on users, insurance of crypto-assets in the interest of investors, necessary disclosure of transaction details on jurisdiction basis for the purpose of tax returns to the government. These would serve as protection of the interest of investors, general users and the government as well. Alternatively, the government could harness resources to develop her local cryptocurrency with the welfare of the citizen and the confidence of investors in mind. The major and peculiar challenge that the nation would likely encounter considering this option would include lack of infrastructures and electricity problem. It could be therefore concluded that the legislation of cryptocurrency or its modified form by the Federal Government of Nigeria is desirable for the protection of her economy, safeguard of the interest of the citizens and for the efficiency of her human capital in particular.

### APPENDIX

		<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Valid	Yes	2	0.9	1.0	1.0
	No	131	61.2	65.2	66.2
	Not Sure	68	31.8	33.8	100.0
	Total	201	93.9	100.0	
Missing	System	13	6.1		
<b>Total</b>		<b>214</b>	<b>100.0</b>		

Source: Field Survey, 2018.

		<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Valid	No	85	39.7	68.5	68.5
	Yes	39	18.2	31.5	100.0
	Total	124	57.9	100.0	
Missing	System	90	42.1		
<b>Total</b>		<b>214</b>	<b>100.0</b>		

Source: Field Survey, 2018.

		<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Valid	No	27	12.6	18.1	18.1
	Yes	122	57.0	81.9	100.0
	Total	149	69.6	100.0	
Missing	System	65	30.4		
<b>Total</b>		<b>214</b>	<b>100.0</b>		

Source: Field Survey, 2018.

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	176	81.9	82.2	82.2
	Yes	38	17.7	17.8	100.0
	Total	214	99.5	100.0	
Missing	System	1	0.5		
<b>Total</b>		<b>215</b>	<b>100.0</b>		

Source: Field Survey, 2018.

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	200	93.0	93.5	93.5
	Yes	14	6.5	6.5	100.0
	Total	214	99.5	100.0	
Missing	System	1	0.5		
<b>Total</b>		<b>215</b>	<b>100.0</b>		

Source: Field Survey, 2018.

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	183	85.1	85.5	85.5
	Yes	31	14.4	14.5	100.0
	Total	214	99.5	100.0	
Missing	System	1	0.5		
<b>Total</b>		<b>215</b>	<b>100.0</b>		

Source: Field Survey, 2018.

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	144	67.0	67.3	67.3
	Yes	70	32.6	32.7	100.0
	Total	214	99.5	100.0	
Missing	System	1	0.5		
<b>Total</b>		<b>215</b>	<b>100.0</b>		

Source: Field Survey, 2018.

## ACKNOWLEDGEMENTS

Authors would like to acknowledge the Institute of Chartered Accountants of Nigeria (ICAN) for facilitating the questionnaires, Dr. Michael Adelowotan for reviewing this work, the University of Johannesburg for providing the enabling environment and anonymous reviewers for their useful inputs. Authors certify that no funding was acquired to carry out this work.

## REFERENCES

- Akinyemi, B., Okoye, A.E., & Izedonmi, F. (2015). History and development of accounting in perspective. *International Journal of Sustainable Development Research*, 1(2), 14-20.
- Back, A. (2002). *Hashcash-A denial of service counter-measure*. Retrieved from <http://www.hashcash.org/papers/hashcash.pdf>

- Baron, J., O'Mahony, A., Manheim, D., & Dion-Schwarz, C. (2015). National security implications of virtual currency examining the potential for non-state actor deployment. *Library of Congress Cataloging-in-Publication Data*.
- Bartoletti, M., Carta, S., Cimoli, T., & Saia, R. (2017). *Dissecting Ponzi schemes on Ethereum: Identification, analysis, and impact*. Retrieved from: <https://arxiv.org>
- Bech, M., & Garratt, R. (2017). Central bank Cryptocurrencies. *BIS Quarterly Review*, 55-70.
- Belomyttseva, O.S. (2015). Conceptual framework for the definition and regulation of virtual currencies. *International and Russian Practices*, 61(5), 32-39.
- Benavides, & Verme. (2014). Virtual currencies, micropayments and monetary policy: Where are we coming from and where does the industry stand? *Journal of Virtual Worlds Research*, 7(3).
- Bhosale, J., & Mavale, S. (2018). Volatility of select crypto-currencies: A comparison of Bitcoin, Ethereum and Litecoin. *Annual Research Journal of Symbiosis Centre for Management Studies*, 6, 132-141.
- Bruck, T., & Wickstrom, B. (2004). The economic consequences of Terror: Guest editor's introduction. *The European Journal of Political Economy*, 20, 293-300.
- Carlisle, D. (2017). Virtual currencies and financial crime challenges and opportunities. *RUSI Occasional Paper*.
- Chaum, D. (1983). Blind signatures for untraceable payments. *Advances in Cryptology. Proceedings of Crypto 82*(3), 199-203.
- Chaum, D., Fiat, A., & Naor, M., (1988). Untraceable electronic cash. *CRYPTO 88 Proceedings on Advances in Cryptology*, 319-327.
- Chris, R., Sascha, K., & Ricarda, B. (2015). Virtual currencies like Bitcoin as a paradigm shift in the field of transactions. *International Business & Economics Research Journal*, 14(4).
- Committee on Payments and Market Infrastructures (CPMI) (2015). Digital currencies. *Bank for International Settlements*.
- Conti, M., Kumar, S.E., Lal, C., & Ruj, S. (2017). A survey on security and privacy issues of Bitcoin. *IEEE Communications Surveys & Tutorials*, 20(4), 3416-3452.
- Davies, G. (2002). *A history of money from ancient times to the present day*, (Third Edition). University Of Wales Press Cardiff.
- Dierksmeier, C., & Seele, P. (2016). Cryptocurrencies and business ethics. *Journal of Business Ethics*, 1-14.
- European Central Bank (2012, October). *Virtual currency schemes*. Retrieved from <http://www.ecb.int/pub/pdf/other/virtualcurrencyschemes201210en.pdf>
- Everette, J. (2017). Risks and vulnerabilities of virtual currency: Cryptocurrency as a payment method. *Public-Private Analytic Exchange Program*.
- Financial Action Task Force (FATF) (2016). *Virtual currencies: Key definitions and potential AML/CFT Risks*'.
- Carlisle, D (2017). Virtual currencies and financial crime challenges and opportunities. *RUSI Occasional Paper*.
- Financial Sector Deepening Africa Report (2017). *Reducing costs and scaling up service provision for remittance flows from the UK to Africa*.
- Forstater, M. (2005). Taxation and primitive accumulation: The case of colonial Africa. In Tcherneva, P.R. (eds), *The Nature, Origins, and Role of Money: Broad and Specific Propositions and Their Implications for Policy*. Working Paper No. 46.
- Gaudamuz, A., & Marden, C. (2015). Blockchains and Bitcoin: Regulatory responses to Cryptocurrencies. *First Monday*, 20(2).
- Gilbert, S., & Loi, H. (2018). Digital currency risk. *International Journal of Economics and Finance*, 10(2), 108-123.
- Godlove, J.D.N. (2014). Regulatory overview of virtual currency. *Oklahoma Journal of Law and Technology*, 10(1), 1-67.
- Grech, A., & Camilleri, A.F. (2017). Blockchain in education. *Inamorato dos Santos, A. (ed.). EUR 28778*.
- Haber, S., & Stornetta, W.S. (1997). Secure names for Bitstrings. *Proceedings of the 4th ACM Conference on Computer and Communication Security*.
- Hameed, S., & Farooq, S. (2016). The art of crypto currencies: A comprehensive analysis of popular Crypto Currencies. *International Journal of Advanced Computer Science and Applications*, 7(12), 426-435.
- Hansen, J.D., & Boehm, J.L. (2017). *Treatment of Bitcoin under U.S. property law*. Perkins Coie LLP. Retrieved from [https://www.virtualcurrencyreport.com/wp-content/uploads/sites/13/2017/03/2016\\_ALL\\_Property-Law-Bitcoin\\_onesheet.pdf](https://www.virtualcurrencyreport.com/wp-content/uploads/sites/13/2017/03/2016_ALL_Property-Law-Bitcoin_onesheet.pdf)
- Hauxley, R. (2018). A short history of crypto euphoria finance & development: An eminent economist's taxonomy of bubbles is applied to the latest financial fad. *A Quarterly Publication of the International Monetary Fund*. 55(2), 20-21.

- He, D. (2018). Monetary policy in the digital age: Crypto assets may one day reduce demand for central bank money. *A Quarterly Publication of the International Monetary Fund*, 55(2), 20-21.
- Henry, J.F. (2004). The social origins of money: The case of Egypt. *European Journal of Political Economy*, 14, 407-432.
- Hughes, S.J., & Middlebrook, S.T. (2015). Advancing a framework for regulating Cryptocurrency payments intermediaries. *Yale Journal on Regulation*, 32(2), 495-559.
- Ingham, G. (2000). Babylonian madness: On the historical and sociological origins of money. *What is Money*, 1, 16-41.
- International Monetary Fund (2016). Monetary and financial statistics manual and compilation guide. Washington, D.C. *International Monetary Fund*.
- International Public Accountants (IPA) (2018). *Classifying cryptocurrencies*. Retrieved from: <http://www.pubacct.org.au/blog/classifying>
- Johnson, R.B., & Nedelescu, O.M. (2005). The impact of terrorism on financial markets. International Monetary Fund, WP/05/60. Retrieved from <https://www.imf.org/external/pubs/ft/wp/2005/wp0560.pdf>
- Johnston, D.J. (2002). The future of money. *Organisation for Economic Co-Operation and Development*. OECD Publication. Retrieved from <https://www.imf.org/external/pubs/ft/wp/2005/wp0560.pdf>
- Joseph, O., & Richard, I. (2015). Electronic payment system in Nigeria: Its economic benefits and challenges. *Journal of Education and Practice*, 6(16), 56-62.
- Kien-Meng Ly, M. (2014). Coining Bitcoin's "Legal-Bits": Examining the Regulatory Framework for Bitcoin and Virtual Currencies. *Harvard Journal of Law & Technology*, 27(2), 587-608.
- Lacker, J.M. (2004). Payment system disruptions and the Federal Reserve following September 11, 2001. *Journal of Monetary Economics*, 51(5), 935-965.
- Lansky, J. (2016). Analysis of Cryptocurrencies price development. *Acta Informatica Pragensia*, 5(2), 118-137.
- Lansky, J. (2018). Possible state approaches to Cryptocurrencies. *Journal of Systems Integration*, 9(1), 19-31.
- Mandeng, O.J. (2018). Cryptocurrencies, monetary stability and regulation: Germany's nineteenth century private banks of issue. *Ousmène Jacques Mandeng Lse Institute of Global Affairs*.
- Meiklejohn, S., Pomarole, M., Jordan, G., Levchenko, K., McCoy, D., Voelker, G.M., & Savage, S. (2016). A fistful of Bitcoins: Characterizing payments among men with no names. *Communications of the ACM*, 59(4), 86-93.
- Miller, R. Michalski, W., & Stevens, B. (2002). The future of money. *Organisation for Economic Co-Operation and Development*. OECD Publication.
- Nakamoto, S. (2008). *Bitcoin: A Peer-to-Peer electronic cash system*. Retrieved from <http://bitcoin.org/bitcoin>
- Nkuah, J.K., Frederick, A.K., & Asamoah, K. (2015). The correlation between accounting systems of small and micro enterprises and tax revenue assessment in Ghana. *Journal of Education and e-Learning Research*, 2(1), 1-12.
- Ovunda, A.S. (2015). Luca Pacioli's double-entry system of accounting: A critique. *Research Journal of Finance and Accounting*, 6(18), 132-139.
- Prasad, E. (2018). Central banking in a digital age: Stock-taking and preliminary thoughts. *Hutchins Center on Fiscal & Monetary Policy at Brookings*. Retrieved from: <https://www.brookings.edu/research/how-will-fintech-and-digital-currencies-transform-central-banking>
- Raskin, M., & Yermack, D. (2016). *Digital currencies, decentralized ledgers, and the future of central banking*. NBER Working Paper No. 22238.
- Reserve Bank of New Zealand (2018). *Bulletin 81*(3).
- Richter, C., Kraus, S., & Bouncken, R.B. (2015). Virtual currencies like Bitcoin as a paradigm shift in the field of transactions. *International Business & Economics Research Journal*, 14(4), 575-586.
- Roth, F. (2009). The effects of the financial crisis on systemic trust. *Intereconomics*, 44, 203-208.
- Rothbard, M.N. (2010). What has government done to our money? Auburn, AL: Ludwig von Mises Institute.
- Security and Exchange Commission (2014). Retrieved from [www.sec.gov/spotlight/enf-actions-ponzi](http://www.sec.gov/spotlight/enf-actions-ponzi)
- Tcherneva, P.R. (2005). The nature, origins, and role of money: Broad and specific propositions and their implications for policy. *Working Paper No. 46*
- The Law Library of Congress, (2018). Regulation of cryptocurrency around the world. *Global Legal Research Center*.
- United States Securities and Exchange Commission (2018). *SEC Shuts Down \$102 Million Ponzi Scheme*. Retrieved from <https://www.sec.gov/news/press-release/2018-110>
- Vasek, M., & Moore T. (2015). There's no free lunch, even using Bitcoin: Tracking the popularity and profits of virtual currency scams. *International Conference on Financial Cryptography and Data Security*. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.671.1283&rep=rep1&type=pdf>



- Zamani, E.D., & Babatsikos, I. (2017). The use of Bitcoins in light of the financial crisis: The case of Greece. *The 11th Mediterranean Conference on Information Systems (MCIS)*, Genoa, Italy.
- Zhangmingwu, P.J. (2011). Review on the debate of paper history during recent 30 Years in China. *Journal of the International Association of Paper Historians*, 15(2).
- Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2017). An overview of blockchain technology: Architecture, consensus, and future trends. *IEEE 6th International Congress on Big Data*, 557-564.