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A SYSTEMATIC REVIEW OF CRYPTOCURRENCY SCHOLARSHIP

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Abstract

Purpose – The purpose of this paper was to conduct a systemic review of extant cryptocurrency research in order to identify important features of these studies and to provide directions for future cryptocurrency research. Methodology - The Systematic Quantitative Assessment Technique (SQAT) was used to identify and review relevant peer-reviewed journal articles that investigated various facets of cryptocurrency.

Findings – 54 journal articles were identified from 12 high-quality databases. The findings of the review revealed that most of the studies took place in Europe, North America and Asia, while Africa has been largely ignored. The main focus of cryptocurrency articles has been on a call for regulation of cryptocurrency without much work done on how to mitigate its vulnerability to the financing of terrorism and as a tool for money laundering. Finally, most cryptocurrency articles adopted a single research method – survey. There is a need for future studies to combine a variety of methods so as to gain additional insight into the issues of cryptocurrency's vulnerability, risk identification and mitigation, regulation and acceptability.

Research limitations - The use of limited but high quality academic databases means that some articles were not considered for this review.

Originality/value – This study is one of the few studies to conduct a systematic review on a phenomenon which has the potential to transform the global financial landscape.

Keywords: *Cryptocurrency, Systematic review, Regulation.*

JEL Classification: *G23, G38*

1. Introduction

One of Canada's largest cryptocurrency exchanges, QuadrigaCX, was shut down in January 2019 amid a torrent of uproars arising from huge financial losses suffered by 76,319 clients due to the sudden death of 30-year-old Gerald Cotton, the Founder/Chief Executive Officer of the Exchange in December, 2018. He was the only person who knew the encrypted passwords to gain access to QuadrigaCX's offline cryptocurrency reserves stored in what are called cold wallets and he was gone with the passwords! $214.6million was lost by investors and clients in this incident! (Alexander, 2019; Scotia 2019; Disparte, 2019).

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In the last two decades, cryptocurrency has evolved as a response to the world's search for an alternative to money that would be devoid of central banks' controls, serve as a medium of exchange, store of value, unit of account, have reduced transaction costs, be fast, highly secured and capable of allowing for the creation of self-enforcing smart contracts that do not rely on financial institutions, lawyers or accountants for their execution(Mahmoud et al., 2019; Tredinnick, 2019; Masciandaro, 2018)."Crypto" means "conceal" or "secret", and thus Cryptocurrency is a virtual coinage system that functions much like traditional money, enabling users to provide virtual payment for goods and services (Sele, 2018; Masciandaro, 2018; Zalan, 2018)). It uses strong secret codes to secure financial transactions, control the creation of additional units, and verify the transfer of assets. Validation of transactions is without the need for a trusted third party such as a bank, credit-card company or escrow agent. Its production and transactions ride on Blockchain technology – a system that enables distributed public ledgers to hold immutable data in a secure and encrypted way and makes alteration impossible (Conte de Leon, et al, 2017; Kirkby, 2018; Miseviciute, 2018; Tredinnick, 2019; Zalan, 2018; Pao, et al., 2018).
The first cryptocurrency to go live was Bitcoin in 2009, followed two years later by Namecoin; today, there are hundreds of cryptocurrencies being traded globally, with major examples including Etherum, Ripple and Litecoin (Hileman and Rauchs, 2017; Brauneis, 2018; Hu, 2019). The four key cryptocurrency industry sectors are: (i) Exchange – purchase and sale of cryptocurrency (ii) Wallet - Storage of cryptocurrency (iii) Payments - Facilitating payments using cryptocurrency and (iv) Mining - Securing the global ledger ('blockchain') generally by computing large amounts of hashes to find a valid block that gets added to the blockchain (Hileman and Rauchs, 2017; Shahzad, 2018, Koutmos,2018). As of June 28, 2019, the total market capitalisation of the top 100 cryptocurrencies stood at $336,669,705,557(CoinMarketCap, 2019). This constitutes a significant volume of financial transactions and all indications show that it is on upward trajectory (CoinMarketCap, 2019). However, loss of investment due to anonymity and decentralization of exchange system and other challenges such as high price volatility, lack of wide acceptance, irreversibility of transactions and possibility of serving as a haven for money laundering and other forms of criminality are the contending issues against cryptocurrency (Gkillas and Katsiampa, 2018; Shahzad, et al., 2018; Phillip, et al., 2019).

Recent scholarship on cryptocurrency has described and tested various significant aspects of the digital currency - For example, scholars have recommended that cryptocurrency should be regulated but the "how" was not addressed (Peters, 2015; Corbet et al., 2018; Phillip et al., 2018; Wei, 2018; Caporale and Zekokh, 2019). Other scholars have recommended the inclusion of cryptocurrencies in the investment portfolio mix because it is considered as a profitable financial asset (Feng et al., 2018; Saksonova and Kuzmina-Merlino, 2018; Platanakis and Urquhart, 2019). In terms of valuation, recommendation was made that the fair value should not be determined without considering the risk elements in cryptocurrency and hedging is regarded as a preferred measure against price movement risk (Conte, 2017; Feng et al., 2018; Zhang et al., 2019). Other scholars are of the opinion that purchasing power parity and social cognition have a role to play in decision making to invest in cryptocurrency (Li and Wang, 2017; Reynolds and Irwin, 2017; Shahzad, 2018)
It is observed that as much as the significance of cryptocurrency as an alternate currency has attracted much attention, so far there is little discussion on how to mitigate the risks posed by cryptocurrencies and the "exact" form of regulation that will make the virtual currency fully integrate into the world financial system as a medium of exchange – should the production and control of cryptocurrencies remain with the non-government entities or should central bank's digital currencies? The reality of digital currency is not what the world can shy away from; however, there is an urgent need for governments to ensure a safe and reliable cryptocurrency that will not be shrouded in anonymity, and devoid of being a haven for criminality (Miseviciute, 2018, Zalan, 2018; van Wegberg, 2018, Kraus 2019). It is in recognition of the importance of cryptocurrency, the riskiness and complexity around it and the need to determine the "perfect fit" type of regulations to make it safe and secure that this study sought to conduct a systematic review of published scholarship dealing with these issues

As this paper sets out to conduct a systematic review of cryptocurrency research, two main objectives were set to be achieved. First, identification of important features of cryptocurrency research (i.e. the number of journal articles published, the time and geographic distribution of these articles, the type of articles (conceptual vs. empirical), the research themes explored by these articles, and the research methods adopted).Second, it attempted to provide

directions for future research on cryptocurrency which will be beneficial to existing digital currency researchers as well as providing a starting point for new researchers who are considering delving into the issue of digital currency. The remaining part of this paper is structured as follows: The next section presents the methodology section, which discusses the method and procedures utilized in conducting this systematic review. This is followed by a section that discusses the findings of the review, and highlights directions for future research based on these findings. Finally, the conclusion is provided with the limitations and additional suggestions for future research based on these limitations.

2. Methodology

I In conducting this systematic review of cryptocurrency research, this study adopted the "systematic quantitative assessment technique" (SQAT) developed by Pickering and Byrne (2013). SQAT is systematic in the way papers are assessed to determine their inclusion or exclusion in the review process, and the focus of this review was on peer-reviewed original journal publications on cryptocurrency in order to maintain a high quality of papers. SQAT enabled the reviewers to identify "important geographic, scalar, theoretical and methodological gaps in the literature" (Pickering and Byrne, 2013, p. 11).

SQAT recommends five important steps in conducting an effective systematic review. Each step and how it was applied in this study is described in Table 1. A total of 54 peer-reviewed English cryptocurrency articles met the selection criteria from 12 academic databases outlined in Table 1.

Table 1: Description and application of SQAT

	Step	Application in current study
1.	Define topic	Cryptocurrency Scholarship
2.	Formulate research questions	Five research questions: 1. What is the time distribution of Cryptocurrency research articles? 2. In which countries were these articles written? 3. What kind of Cryptocurrency articles were published? (Conceptual vs. Empirical) 4. What are the specific themes these articles explored? 5. What research methods were utilized to conduct the research?
3.	Identify key words (not for your study, but for your search terms)	"Cryptocurrency"
4.	Identify and search databases	1. 12 databases utilized: Elsevier; Springer; Wiley; Taylor and Francis; JSTOR; Emerald; Sage; Inderscience; Cambridge Journal; Oxford, MIT, SSRN; 2. "All in title" search using one search term: "cryptocurrency"
5.	Read and assess publications	1. Abstracts of papers found were read to ensure that they were dealing with cryptocurrency 2. Literature reviews book chapters and conference proceedings were

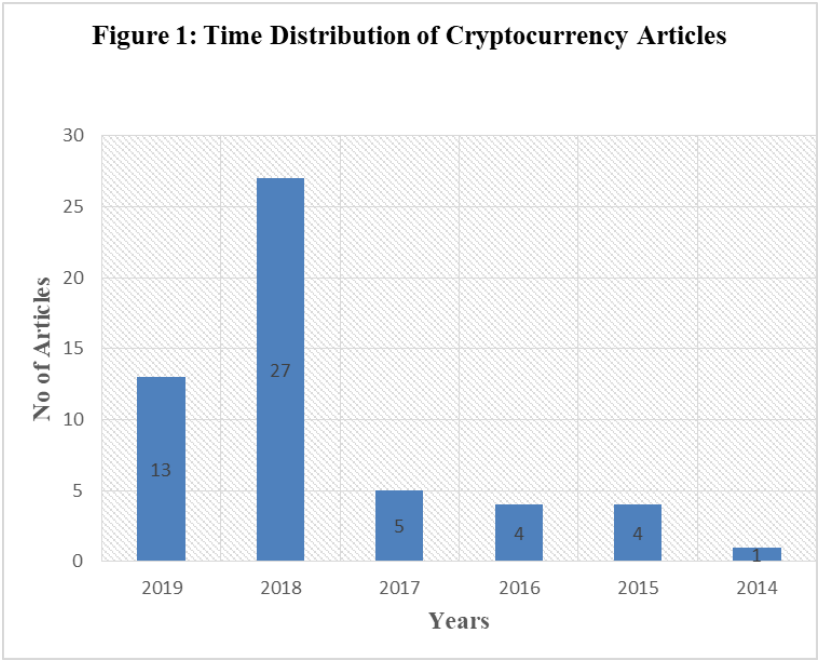
		not included; only peer-reviewed conceptual and empirical articles.

3. Discussion and Findings

3.1. Time Distribution of Articles on Cryptocurrency

Based on this study's sample of 54 articles, the earliest publication dealing with cryptocurrency appeared in 2014 (Dostov and Shust, 2014).During the first 6 years (2009 to 2014) of the 10 years range the study focused on, there were almost no research publications, but interest picked up in 2015 as can be seen in the increase in publications from 2015 as shown Figure 1. A peak was reached in 2018 (27 articles) and half of 2019 has witnessed 13 articles; if the search results for 2019 are extrapolated, it can be expected that a total of 26 Cryptocurrency articles will be published at the end of 2019. Going by the deluge of issues around cryptocurrencies, it is expected that researchers need to do more in the area of publications to address the pressing issues of risk mitigation and what form of regulation will be appropriate for cryptocurrency to make it globally recognised and acceptable.

Figure 1: Time Distribution of Cryptocurrency Articles



3.2. Geographical Distribution of Cryptocurrency Articles

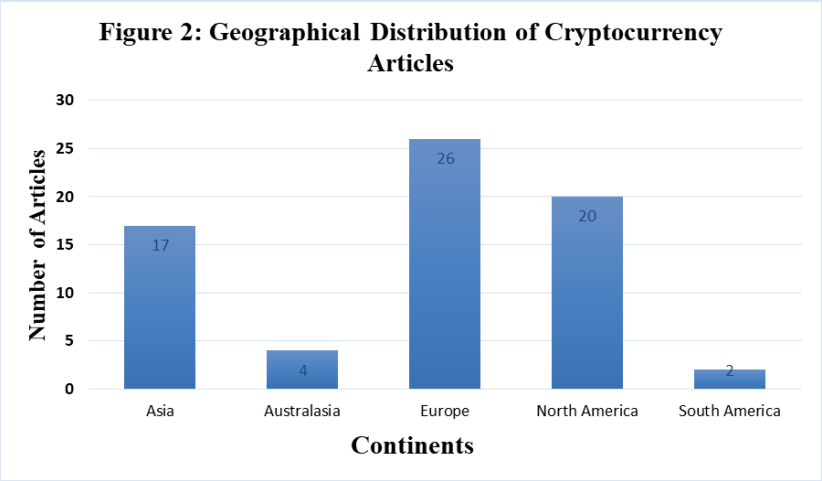
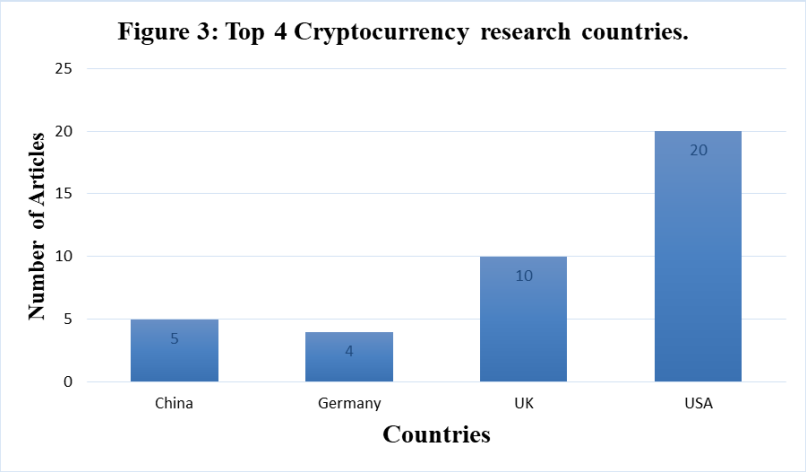


Figure 2 presents the geographical distribution of the 54 cryptocurrency articles reviewed in this study. 5 out of 7 continents have articles published on cryptocurrencies. Europe with 26 out of 70 (spread across 14 countries) led the pack, followed by North America (largely the USA) with 21 articles and Asia with 17 articles spread across 10 countries.

From a country perspective, 70 countries out of 195 countries that make the world as contained in worldatlas.com (World map, 2019) had articles published on cryptocurrency research. Going by 54 articles considered, it can be observed from Figure 3 that the countries with the most publications on cryptocurrency were USA (20), UK (10), China (5) and Germany (4). The countries in Europe, North America and Asia continents account for 90% of global market capitalisation of cryptocurrencies which stood at USD336 billion as at 28 June, 2019 (Coinmarketcap, 2019). This is not a surprise because in the last 10 years that cryptocurrencies emerged, they have become very prevalent in the USA, Europe and Asia continents. Even the Exchanges that have recognized cryptocurrencies so far are only in these continents.

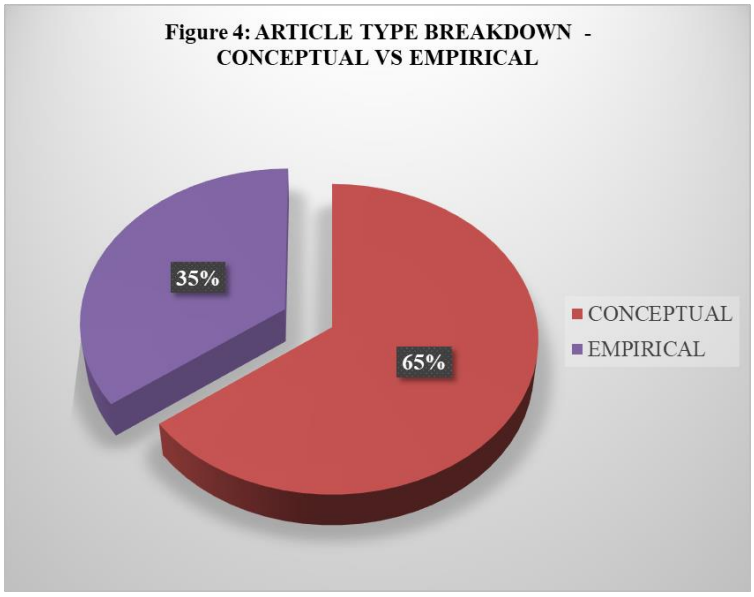


Future research on cryptocurrencies needs to have a special focus on the countries in Africa and nations of other continents that currently have no representation. This is because cryptocurrency is a global phenomenon because it has to do with the world financial system which is interconnected among nations. Thus, it is important that researchers in these countries conduct studies to determine the adoption or not of cryptocurrencies as a form of digital currency and how its benefit can be optimised and its downsides can be minimized.

3.3. Article Type

The 54 articles reviewed were divided into two categories: conceptual and empirical. Conceptual articles were defined as those that provided a theoretical discussion on Cryptocurrency, whilst empirical articles were those which collected data qualitatively or quantitatively in order to test a particular hypothesis in the real world (Saksonova and Kuzmina-Merlino, 2018). Figure 4 presents the breakdown of the 54 articles based on this categorization.

It can be seen from Figure 4 that the majority of articles reviewed (65%, 35 out of 54) are conceptual in nature, whereby the authors offered recommendations (Brown, 2016; Guadamuz and Marsden, 2016; Hayes, 2017; Gkillas and Katsiampa, 2018) and theoretical models on how cryptocurrencies are mined as better alternatives to regular currency (Moore and Stephen, 2016; Li and Wang, 2017; Hacker and Thomale, 2018;Gregoriou, 2018; Milunovich, 2018; Corbet et al., 2018).The remaining35% of the articles were empirical in nature (Avdeychik and Capozzi, 2018; Shahzad, 2018, Van et al., 2018). This imbalance represents an obvious gap in cryptocurrency research which future researchers should address. As commendable as it is that cryptocurrency researchers are thinking and putting strategies in place, about ways to minimize the risks cryptocurrrency poses and make it acceptable as a virtual currency, empirical research will determine how effective these strategies are in achieving their important objectives.

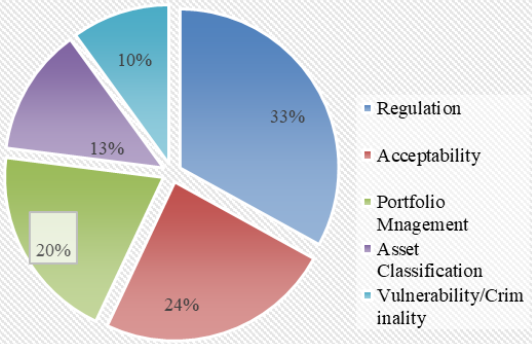


3.4. Cryptocurrency Research Themes

Figure 5 reveals that five cryptocurrency themes were explored by the 54 articles reviewed in this study. 18 articles which constitute one third articles (33%) dealt with regulation of cryptocurrencies (c.f. Dostov and Shust, 2014;

Marian, 2015). Typically the authors in this category were of the view that conceptually, cryptocurrency is not a legal tender in any nation yet, but they recognised cryptocurrency/blockchain as a disruptive technology that is capable of altering the financial system, aiding money laundering and terrorism financing because of the anonymous and decentralised nature of its transactions (Peters, 2015; Brown, 2016). They recognised the efforts of some countries towards regulation of cryptocurrencies (Guadamuz and Marsden, 2016; Luther, 2016). They also recommended that regulation is required across board to legitimise or outlaw cryptocurrencies because it poses to become "2nd life" in another decade (Reynolds, 2017; Yeoh, 2017). They would then conclude by making recommendation that if legitimised, guidelines, policies, and framework are needed for the activities of the operators and transactions to contain the risks and also to protect the investors (Miseviciute, 2018; Catania et al., 2019).

Figure 5: Cryptocurrency Themes



The second biggest theme after regulation was Cryptocurrency Acceptability (24%) i.e. 13 out of 54. The articles in this cateogry made an observation that cryptocurrencies are unlikely to generate widespread acceptance in the absence of government support (Conte de Leon, 2017; Avdeychik and Capozzi, 2018). Governments of many nations agreed that cryptocurrencies as virtual currency have come to stay but are indecisive whether to give it a government legal backing or not and if they are to do, how? (Brown, 2018; Zalan, 2018) Sympathetic citizens' intention to use cryptocurrencies as a mode of exchange is high, but government has to come out with clear policy statements regarding the legal recognition and usage of cryptocurrencies (Geiregat, 2018; Kirby, 2018; Koutmos, 2018).

Cryptocurrency Portfolio Management (21%) i.e. 11 out of 54, were the third most common theme amongst the articles reviewed. The articles in this category emphasized the recognition of cryptocurrency as financial assets with unique mechanisms for determining the price and high price volatility, behaviour of returns on cryptocurrencies (Gkillas and Katsiampa, 2018; Saksonova and Kuzmina-Merlino, 2018). These studies further advocated for cryptocurrencies to be considered as part of portfolio of financial assets of individuals and government, because in their view, it offers a window of investment diversification to investors (Dierksmeir, 2018; Caporale and Zekokh, 2019).

The next group of articles (13%) i.e. 7 out of 54, were on Asset Classification. They established a dynamic relationship between cryptocurrencies and other financial assets. The puzzle here was "Is cryptocurrency a currency or financial product? (Koblitz and Menezes, 2016; Ammous, 2016). These studies revealed that some countries viewed cryptocurrencies as securities, some viewed them as virtual currency and some, as commodity (Moore and Stephen, 2016; Baur, 2018). Some studies in this category opined that cryptocurrencies can serve as a medium of

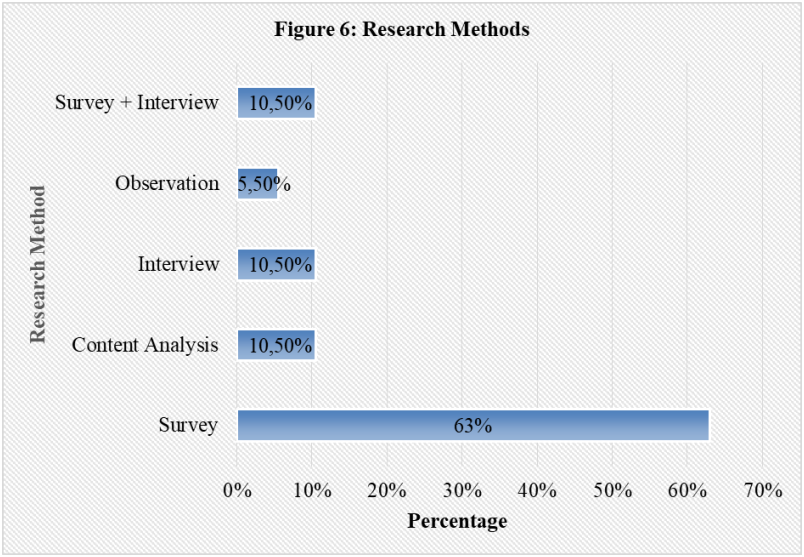
exchange but are too unstable to be used as unit of account as they do not possess all features of money (Brauneis and Mestel, 2018; Corbet et al., 2018; Milne, 2018).It is up to the government of every nation to take a clear position on cryptocurrencies and decide whether to accept it a legal tender or simply a financial product which can serve as an investment tool (Corbet et al., 2018; Milne, 2018)
Finally, the last and fifth most common themes were Vulnerability and Criminality (9%), i.e. 5 out of 54. The submission here was that cryptocurrency's two distinct features – decentralisation and anonymity made it a safe haven for money laundering and terrorism financing; as such it constitutes a substantial danger in terms of criminal enterprise (Brenig, 2015; Feng et al., 2018).Criminal justice professionals, law enforcement officers, financial regulators should be aware and take more drastic steps in regulating the usage of cryptocurrencies (Teichmann, 2018; van Wegberg, 2018; Foley et al., 2019)

Based on the cryptocurrency themes identified in this review, it is observed that a vast majority of researchers focused on the potentially negative aspects of cryptocurrencies and recommended that there is a need to regulate their usage in order to minimize the level of criminality it is prone to and not to cause an upset to the global financial system, but there is none that prescribed the exact type of regulation – should it be regulation of the exchanges, the current miners or the trading activities? Should central banks be the only agencies authorized to produce cryptocurrency? Should it be outlawed outright? It is thus incumbent for future cryptocurrency research to focus on these unanswered questions.
Another area that calls for further research is the ethical issues (criminality) surrounding cryptocurrency. For both defenders and detractors, cryptocurrencies beckon a revolution of global finance as we know it. The detractors condemn cryptocurrencies as downright evil because they can facilitate nefarious commerce (e.g., weapons, drugs, and sex) and they often escape public scrutiny or regulation while the defenders hail cryptocurrencies as a solution to some of the most pressing societal ailments (e.g., poverty, debt crises, and hyperinflation) of the current economic system, then, where is the balance? (Brenig, 2015; Dierksmeier 2018).With only 5 out of 54 papers dealing with this issue. Future researchers should thus explore this area and find a way to optimise the benefits of cryptocurrency while mitigating the risks.

Another gap that has been identified is lack of standards for classification of cryptocurrency. Large percentage of people believe it is a digital currency while some believe that it is a digital asset like stock or any other commodity.? There needs to be distinct empirical studies that actually address this. Only 7 out of 54 papers addressed this issue. It is time to move beyond the theoretical assumptions of "what it seems to be" to "what it is".

3.5. Research Methods

The objective here was to identify the primary research method used in each of the 54 cryptocurency articles reviewed in this study. Figure 6 provides a summary of the findings.



As shown in Figure 6, more than half of the studies reviewed, precisely 63% adopted a survey as their primary research method (c.f. Brown, 2016; Guadamuz and Marsden, 2016; Moore and Stephen, 2016; Hayes, 2017). These surveys were largely used to gather data so as to help in unravelling each component of the cryptocurrency's major themes – regulation, acceptability, portfolio management, asset classification and criminality and identify key issues in them (Li and Wang, 2017; Baur, 2018; Corbet et al., 2018; Gkillas and Katsiampa, 2018; Gregoriou, 2018). This was followed by Content Analysis (c.f. Jaag and Bach, 2017; Teichmann, 2018). Next was the interview of various stakeholders in cryptocurrency (c.f. Avdeychik and Capozzi, 2018; Shahzad, 2018,). In addition, there was a mix of surveys and interviews in some cases (c.f Seele, 2018; Foley et al., 2019). This accounts for 10.5% of the data gathering method andit was lastly followed by observations which accounted for 5.5% (c.f. Van et al., 2018)

Two opportunities for future Cryptocurrency research have been identified in terms of research methods. From Figure 6, it can be seen that a lot of prior studies have adopted the use of surveys. While this method is valuable for data gathering in order to understand cryptocurrency perceptions, there is a need for future studies to explore more of content analysis, case studies, questionnaire and observation for deeper insights on this research area. The second opportunity for future research lies in the fact that most of the studies reviewed adopted a single research method. Future research can combine two or more research methods so as to attain greater insight as to the different perspectives of the cryptocurrency as it pertains to regulation, acceptability and vulnerability controls.

4. Conclusion

This paper reviewed 54 peer-reviewed journal articles dealing with cryptocurrency. The articles were examined along five key categories, including the time distribution of the articles, geographical distribution of the article, article type, research themes and research methods. The results of the review were discussed and directions for future research were provided. Whilst a reasonable number of cryptocurrency studies have been conducted, there is still significant room for more empirical research in this area, particularly considering the crucial importance that cryptocurrency has set out to play as a digital currency; capable of being a major disruption in the world financial system. This is even more pertinent for countries that are deemed to be sitting on the fence regarding regulation of this global phenomenon.

Some limitations exist in this study, which serve as additional gaps which future reviews of cryptocurrency scholarship can explore. The main limitation concerns the method used to gather studies for review, which was the use of a title search in twelve databases. Whilst the databases contained high quality, peer-reviewed articles, they

definitely do not contain all peer-reviewed cryptocurrency articles. Future systematic reviews can widen the scope of databases to gain further insight in cryptocurrency research.

Another limitation is the fact that only journal articles were included in the review, while excluding book chapters and conference proceedings. This was done in accordance with the SQAT methodology to maintain the high quality of articles reviewed. However, there is potentially very useful insight in book chapters and conference proceedings, which future research would do well to include.
A further limitation is the fact that a title word search was utilized rather than a key word search. A title word search provides a more precise search of articles that are dealing with cryptocurrency. However a key word search would have produced a greater number of articles for the review. Some of the papers might not have been directly addressing cryptocurrency, but might have provided additional insight.
However, despite these limitations, this systematic review was important as it provided a clear picture on the current state of cryptocurrency research and gave clear directions on the areas that future research needs to address in order to make cryptocurrency a near risk free digital currency and widely accepted.

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