

**Title: The decade-long cryptocurrencies and the blockchain rollercoaster: Mapping the intellectual structure and charting future directions.**

by

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**Abstract:**

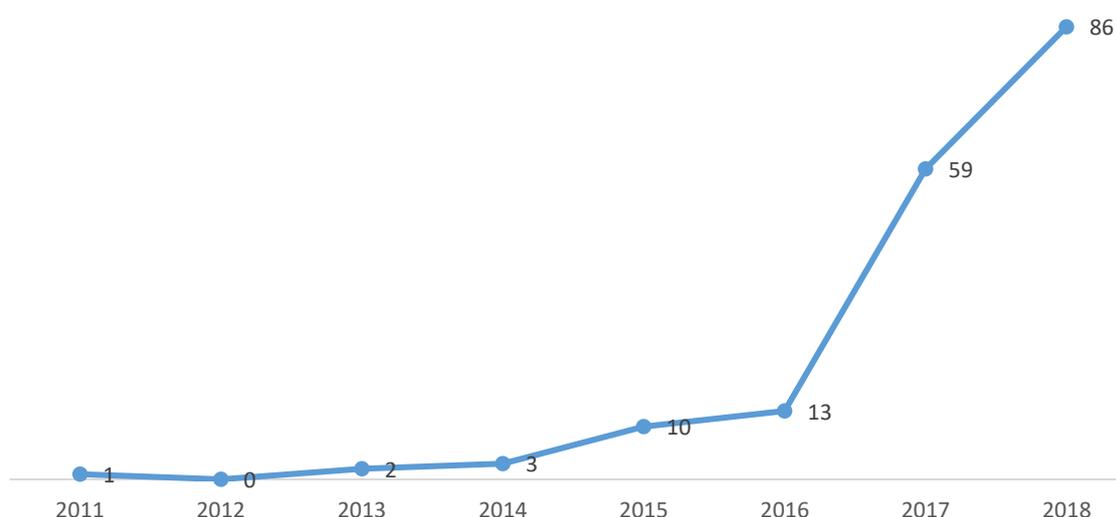
Recent advances in science mapping allowed to analyze the entire intellectual structure of blockchain and cryptocurrencies in business-related disciplines to identify 174 academic articles as well as 1,482 practitioner-oriented articles published since the inception of cryptocurrencies in 2008 to highlight key trends of the published outputs. The results demonstrate academic research done by 389 authors in 296 organizations based in 50 countries that only just initiated the conversation on four major streams of the literature—*Bitcoin and cryptocurrencies; blockchain adoption; cryptocurrency and blockchain environment; and business model innovations*. When comparing academic scholarship to practitioner-oriented literature, the results demonstrate that practitioners discussed investor-related themes, cryptocurrency intrinsic value, political-economic sphere, and the impact of cryptocurrency and blockchain technologies on the wider society in greater detail. As a result, a number of themes are identified and discussed that could align academic and practitioner interests and provide guidance for further research in this important field.

**Keywords:** Bitcoin; cryptocurrency; blockchain; blockchain ecosystem; bibliometrics; science mapping

## 1. Introduction

Marking the ten-year anniversary of the white paper named “Bitcoin: A peer-to-peer electronic cash system” by an individual or an institution operating under the pseudonym of ‘Satoshi Nakamoto’—the creator of the incredibly explosive technology known as the ‘Internet of Money/Value’ and the supporting platform ‘blockchain’, this paper systematically reviews and maps the current state of the cryptocurrency and blockchain (CB) literature.

The research into the emerging CB themes is still at its nascent stage, and it grows at an exponential rate especially from 2016, evident from the total of 59 journal articles in business and surrounding disciplines in 2017 to 86 before the end of the year in 2018, see Figure 1. Nevertheless, there are certain patterns that this research is forming besides the simple division into the value of cryptocurrencies and the inherent proposition of blockchain models. This paper intends to study the current trends of the intellectual structure of CB scholarship, to map the areas of divergence between academics and practitioners and to provide an opinion where the utility of blockchain and its consequent literature is heading.



**Fig 1.** Growth in blockchain and cryptocurrency literature

A number of papers reviewing the scholarship of the technologies have been offered (Corbet et al., 2018; Hawlitschek et al., 2018; Holub and Johnson, 2018; Miao and Yang, 2018; Yli-Huumo et al., 2016) that provide some insights into the state of literature so far. The main potential drawback of the mentioned reviews is in being prone to inherent bias that comes from manual data collection and interpretation of the scholarship data. To overcome these issues, reviews are increasingly systematizing procedures through introduction of statistical methods in reviewing literature (Dotsika and Watkins, 2017; Porter et al., 2002; Zupic and Čater, 2015). It has been shown that statistical and algorithmic data identification and reporting is comparable to or exceeds that of expert judgements (Markoulli et al., 2017; Randhawa et al., 2016; van Eck and Waltman, 2010).

This paper depicts the process of science mapping through bibliometric analysis to provide the most comprehensive systematic review of CB literature so far exploring 192 specific topics spread across four identified major clusters of CB scholarship. I further compare the results of 1,482 practitioner-oriented articles that extracted 167 unique topics to the academic scholarship results to highlight four areas of divergence. Coupled with the academic and practitioner comparison I propose 21 areas where further scholarly research is recommended.

The paper aims to make three major contributions to CB literature. First, I aim to provide the most comprehensive and rigorous analysis of CB literature to date by offering a scientometrically-grounded taxonomy of the field, review the resultant four clusters in CB, and the development of the literature overtime. Second, I compare CB scholarship to practitioner-oriented literature to demonstrate discrepancies in the outlets and propose a number of themes which could align the scholarship with practitioners' discussions to help address the 'research-practice gap'. And finally, I propose a number of provocations stemming from a holistic view of the research provided through this in-depth analysis of the literature. The future research directions provide key challenges and opportunities to enrich and strengthen the literature in this emerging field.

## **2. Prior management-related reviews of blockchain and cryptocurrency and the value added of scientometrics**

Peer-reviewed journal articles are generally considered to be the most reliable and rigorous outputs in the academic domain (Crossan and Apaydin, 2010; Podsakoff et al., 2005). It was my intention to utilize peer-reviewed and published business-related outputs in this systematic review. I briefly outline key contributions of each of the review studies and examine methodologies utilized.

The first published systematic review carried out by Yli-Huumo et al. (2016) on blockchain and Bitcoin collected research from 41 papers, mostly conference papers, symposiums and only one journal article publication. The review, targeted at technical characteristics and the consequent gaps in research, provides little value for business and finance field. The main drawback of the review is its infancy as the majority of research on CB has only been in the last two years (2017-2018), as can be seen from Figure 1. Since then, the field has significantly developed in accounts of both cryptocurrency analysis as well as the blockchain uses.

Hawlitsek et al. (2018) carried out a literature review of trust in the context of blockchain and the sharing economy. The paper concludes that "blockchain technology is to some degree suitable to replace trust in platform providers, and that ... trust-free systems are hardly transferable to sharing economy interactions and will crucially depend on the development of trusted interfaces for blockchain-based sharing economy ecosystems" (p. 50). From the methodological stand point, the review was thorough, however, due to the lack of research on trust and blockchain at the time, the review consisted of 17 articles that depicted trust in blockchain research. Three of seventeen outputs were journal articles, the rest of the review was based on conference papers.

A large part of CB research concerns Bitcoin as it is the first cryptocurrency and the origin of blockchain infrastructure. As such, Holub and Johnson (2018) discussed more narrowly—Bitcoin research across the disciplines. The study took a more rigorous approach in explaining the methodology behind the review. The final sample of 1,206 papers on Bitcoin including book chapters, proceedings papers, unpublished papers, and journal articles garnered six major categories of research. The first, and largest, research area was in technological implications, followed by the economic studies that discussed the monetary value of Bitcoin. When the performance data of Bitcoin was analyzed, finance researchers engaged in calculating the returns and the financial value of Bitcoin. Literature on taxation and regulation of Bitcoin is another major area of research. Finally, the literature discusses institutionalization of cryptocurrencies in the accounting sphere. More recently, a review of Bitcoin research excluding blockchain and its uses has been carried out using the latest scientometric techniques (Mereditz-Solá and Bariviera, 2019). The review is insightful and provides a state-of-the art of Bitcoin only, thus excluding a thorough outlook of research on

blockchain, other cryptocurrencies, the environment and the impact of CB on business models.

Corbet et al. (2018) carried out a wider systematic review of cryptocurrency literature. The study made a number of discoveries—first, showing that most of the literature on cryptocurrencies is on Bitcoin analysis. Second, while some regulatory contexts set an outright ban, the others allow certain testing capacity. Further, a call for research into wider benefits that cryptocurrencies may carry besides the financial and economic benefits. Finally, a number of further contributions and directions for future research in cryptocurrencies was proposed. While the study is a valuable contribution to the cryptocurrency research, it does not demonstrate the methodology behind the systematic review apart from the comprehensive analysis of gathered literature.

Cai (2018) carried out a systematic review with components of bibliographic mapping of crowdsourcing and CB. The review attunes to introducing the technology for financial and economic needs for organizations rather than studying the patterns of the scholarship. Most of the literature referred to research carried out on crowdsourcing rather than CB. Further, there is no evidence to suggest that the review carried out by the author is indeed systematic from the methodological perspective of recognized, referenced, methods for data analysis compared to the author's interpretation of results (Robinson and Lowe, 2015; Tranfield et al., 2003).

A previous bibliometric analysis of the field performed by Miao and Yang (2018)—“Bibliometrics-based evaluation of the blockchain research trend: 2008 – March 2017” provided a surface-level analysis of the literature in CB sub-fields. The authors provided a list of top 10 indices including countries, organizations, academic disciplines, journals (which incidentally included magazines), papers, and authors concluding that blockchain literature is growing. A number of methodological issues emerge upon examining the article including indiscriminant use of magazine and other non-academic articles together with academic research without evidence of data cleaning, and dividing the literature into phases which showed little coherence.

Review studies are common in any research discipline, however, not all research review studies are systematic, nor all studies claiming to be systematic are indeed systematic. Going back to the origins of systematic review methodology in social sciences, in this case management research, we ought to revisit Tranfield et al. (2003) that argued for the need of systematic, transparent, and reproducible methodology. It is generally considered that the minimum requirements for a systematic review paper would contain outlines of inclusion criteria, research design, data sources and collection, and analysis (Grant and Booth, 2009; Tranfield et al., 2003).

Traditional/narrative reviews are singular descriptive accounts of research studies in the field based on subjective accounts of reviewers, thus, are prone to type II errors. Instead, a strong methodology that describes the process of data selection, extraction, exclusion criteria, results analysis and discussion are preferably supported by some type of quantitative analysis to support and infer the findings for a more robust and rigorous research output (Grant and Booth, 2009; Porter et al., 2002; Tranfield et al., 2003). Moreover, structural reviews of the field that provide an accurate map of the field and a comprehensive outline require quantification to consider patterns across multiple topic literatures (Markoulli et al., 2017; van Eck and Waltman, 2014). Without a holistic field-level assessment that systematically identifies CB literature and its content, it is not possible to gain an understanding of the current state of the literature, its divisions, and recommend future directions for research.

### 3. Methodology

To carry out a rigorous systematic review of the literature, the three stage procedure of planning, execution, and reporting as described by Tranfield et al. (2003). In the planning stage the objectives of the study and the key data sources were identified. The objectives were deliberately left expansive as to the true nature of systematic reviews. These included an analysis of conceptual, operational, and theoretical convergences and divergences in the literature on blockchain and cryptocurrencies as well as a comparative analysis of the scholarship with practitioner-oriented discussions. Peer-reviewed academic journals were used as they are considered more rigorous and reliable sources with the highest impact in the field (Crossan and Apaydin, 2010; Podsakoff et al., 2005). The ISI Web of Science (WoS) and Scopus databases were selected for a comparison of the chosen field as these are the largest scientific knowledge databases (Vieira and Gomes, 2009). The articles searched were within the timeframe from October 2008 until 2018 (8 November). October 2008 marks the invention of the cryptography blockchain (Nakamoto, 2008), not to be confused with the much earlier chemical research (pre 2008) on ‘block chain’ polymer structures.

#### 3.1. Sample

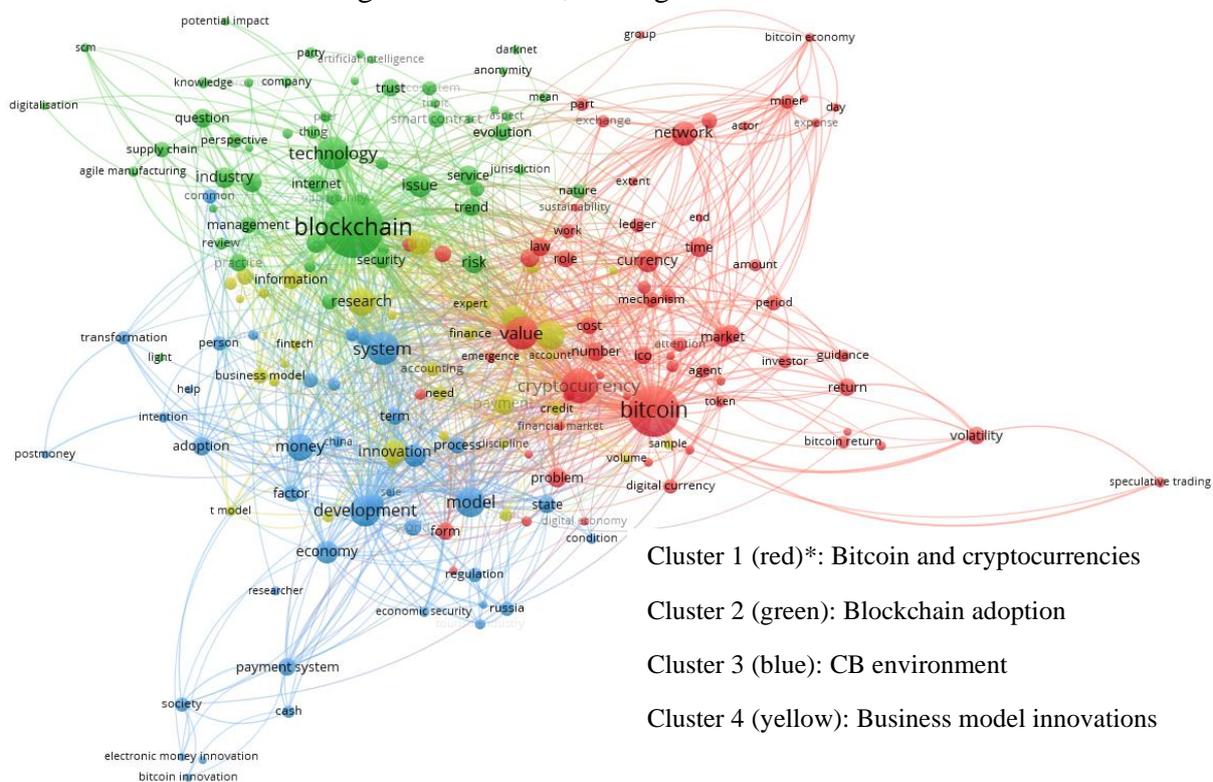
The second stage was divided into two main steps: i) preparing the sample including: selection criteria, setting exclusion criteria, filtering through the results, manual search for suitable automatically excluded articles, manual exclusion of articles that do not fit the criteria, etc.; and ii) analysis of the results using the VOSviewer science mapping software. For the first step I have utilized Web of Science (WoS) and Scopus databases to identify the amount of journal articles that relate to the search "*cryptocurrenc\**" or "*crypto currenc\**" or "*blockchain*" or "*block chain*" or "*Bitcoin\**" or "*altcoin\**". The search for the mentioned string on Scopus returned 4,061 results, of which 410 accounted to Business, Management and Accounting compared to 286 results with the same filters in the WoS database. At this point I followed Scopus as this provided more results of published work for the same period. Scopus is considered a larger source of knowledge (Randhawa et al., 2016) with the majority of overlap with WoS (Vieira and Gomes, 2009). The results were further limited to ‘Article’, ‘Note’, ‘Editorial’, and ‘Review’ resulting in 225 documents. Note, Editorial, and Review Document types were manually searched to include articles which were incidentally excluded from the pool of academic literature such as the highest cited academic publication in the Harvard Business Review—Iansiti, M., Lakhani, K.R. (2017) *The truth about blockchain*, which was listed as a Note. Upon a meticulous inspection of sources of the compiled list of the articles, some publications from non-peer reviewed sources including *The Economist* and *Fortune* were excluded from the academic literature pool ending up with 174 publications as of 08/11/2018.

#### 3.2. Analysis

Co-citation analysis of a particular area of research has proven to be an effective tool in structuring intellectual foundations across disciplines (Randhawa et al., 2016; Zupic and Čater, 2015). Co-citation analysis involves measuring the affinity and proximity of relationships between topics, researchers, and communities. Previous co-citation analysis on CB carried out by Miao and Yang (2018) demonstrated typical results of a bibliometric co-citation analysis including top publishing countries, institutions, disciplines, outlets, papers, and authors. For a more meaningful and comprehensive analysis the area was further analyzed through the unstructured ontological discovery which relies on the advanced methods of text mining (Randhawa et al., 2016) that allowed synthesizing detailed conceptual insights by shifting the level of analysis using the basic co-citation analysis combined with the content of articles to provide a systematic, unbiased, and content-driven review of the literature. Content analysis occurs when terms are taken from the contexts within which they

appear thus allowing to bootstrap an expanded list of related terms that signify a concept from the search data. This research utilized VOSviewer as a narrative inquiry tool that allows identification of the most frequently utilized concepts and the relationship between these terms. This approach systematically reveals the key concepts within CB paradigm by using terms from available text (thematic analysis), and how they are interconnected dependent on the frequency and co-occurrence of these terms in specific contexts (semantic analysis). This allows a rigorous approach in mapping the scholarship and practitioner-oriented literature. The CB map was created using VOSviewer analysis tool for mapping of science outputs through offering content analysis of titles and abstracts. To prepare the content some full terms were merged with abbreviations (e.g. ‘return on investment’ into ‘ROI’), the terms were further converged by turning British spelling to US English (e.g. ‘organisation’ into ‘organization’, and finally, methodology-related terms were excluded from the analysis (e.g. ‘research methodology limitations’).

It was shown that the key article topics are normally in the form of noun phrases (Justeson and Katz, 1995; van Eck and Waltman, 2014). Thus, VOSviewer utilizes an algorithm to track noun phrases and create networks that are divided into clusters according to co-occurrence based on the text data. To create a reliable map, a threshold of five minimum occurrences of a term was established that allows the removal of non-meaningful or misspelled phrases. The mapping of terms into clusters is dependent on the ratio of co-occurrence between selected terms and the pool of terms from the selected sample (Markoulli et al., 2017; van Eck and Waltman, 2010). Thus, the produced map generated by the software would place terms on a distance that are likely to co-occur with other terms in the same set of articles closer together. To identify clusters, I used the default VOSviewer clustering resolution parameter of 1 and set a minimum cluster size of 30 terms, which identified four distinct clusters in CB research. The terms that appear larger have a higher weightage of occurrences. Some terms are not as obvious on the map which means they are obstructed by other terms that are blocking the clear view, see Figure 2.



\* Note: the Figure is in color when the article is read electronically

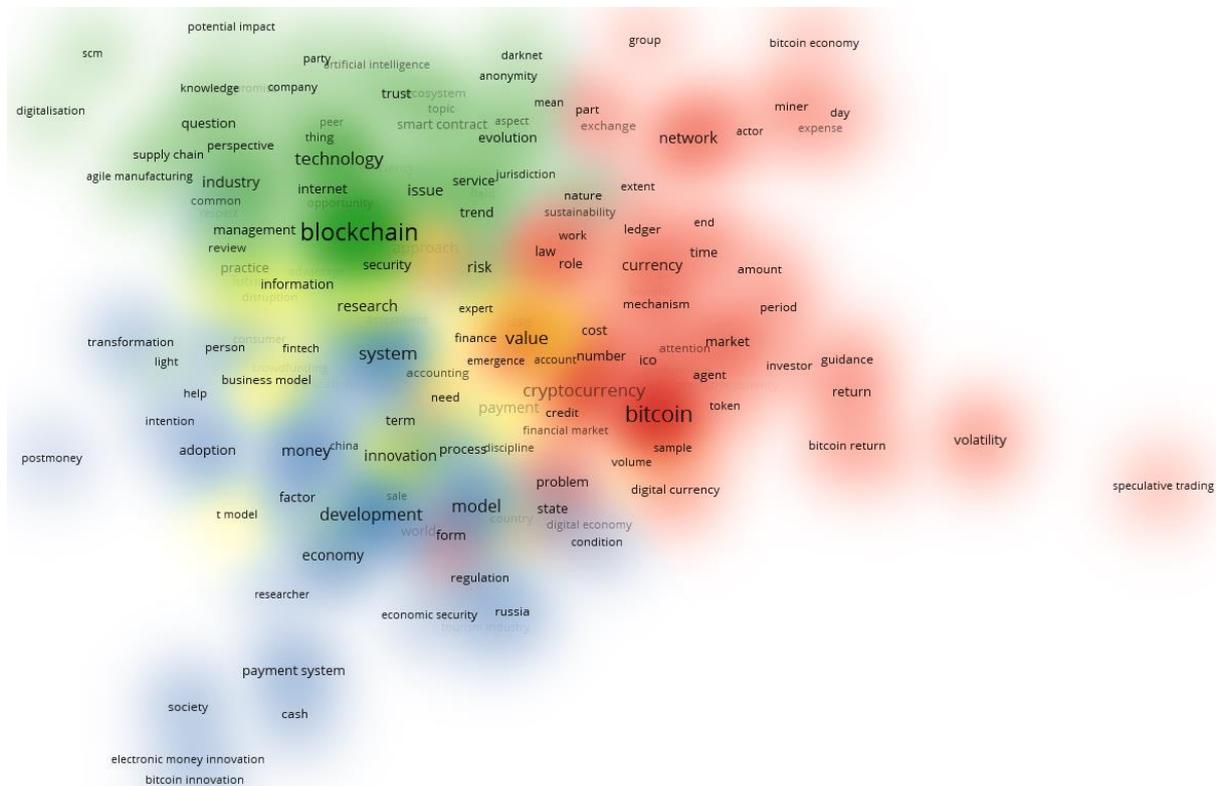
**Figure 2.** The four research areas of cryptocurrencies, blockchain and the associated themes

For a comparative analysis of scholarly research to practitioner-oriented research I compared the results of scholarly research outputs to 1,482 practitioner-oriented articles from *The Economist*; *Fortune*; *Forbes*; *Global Investor*; *The Times*; *Bloomberg Wire Service*; *Business Wire*; *Newsweek*. These sources were chosen as they are few of the leading financial and business audience periodicals and their articles provide abstracts. More details on the operationalization of the comparison is provided in the results section of this paper.

## 4. Results

### 4.1. Cluster reviews

When carrying out research into CB, great divide between the two areas of research became evident. The cluster density map visualization (Figure 3) supported by the document output mapping and the literature review demonstrate that research in the business disciplines clearly divides into two major areas of research—either *cryptocurrencies* or *blockchain*, and their respective underlying values and implications. In fact, *Bitcoin* is a far more prominent research topic if compared individually to *cryptocurrency(ies)*.



**Figure 3.** Density visualization of cryptocurrencies and blockchain research by clusters

The key contribution of the cryptocurrency and the blockchain map is in identifying broad clusters of research as well as specific contents within each cluster. Therefore, the review will systematically outline each of the four broad clusters. Further, articles in all cluster were examined to identify whether each theme was represented by a body of literature. The results aim to present empirically grounded review of the major topics of the CB research. Table 1 presents topics that appear in the highest average normalized citation articles as well as the top trending topics in all four clusters.

**Table 1.** Key topics discussed in the four research areas

	Top article citation impact terms <sup>a</sup>	Top trending terms <sup>b</sup>
<b>Bitcoin and cryptocurrencies</b>	Speculative trading; network effect; trader; record; Bitcoin economy; alternative currency; cryptocurrency market; solution; agent; financial market; value; period; persistence; return; government; demand; correlation; market	Bitcoin economy; miner; token; initial coin offering; prospect; persistence; actor; expense; sustainability; financial market; exchange; Bitcoin return; law; investor; volatility; cryptocurrency market; speculative trading
<b>Blockchain adoption</b>	Promise; digitalization; knowledge; peer; trust; management; recent development; opportunity; ecosystem; service; application; challenge; smart contract	Digitalization; supply chain management; artificial intelligence; agile manufacturing; Darknet; potential impact; ecosystem; smart contract
<b>CB environment</b>	Condition; process; economy; change; system; implementation; transformation; organization; model; business; interest; economic security; development; adoption; consumer; money; society;	Transformation; postmoney; adoption; implementation; tourism industry; organization; intention; regulation; insight; consumer; system; money; change; indicator; economic security
<b>Business model innovations</b>	Triadic business model; limitation; assessment; business model; financial service; discipline; element; approach; innovation; disruption; information; accounting; popularity; principle; transaction; crowdfunding; fintech	Business model; discipline; assessment; fintech; volume; information; future; financial service; element; innovation; transaction; finance; disruption; accounting; crowdfunding; payment; approach

<sup>a</sup> Top impact terms are the terms that appear in the highest average normalized citation articles arranged in descending order.

<sup>b</sup> Top trending terms are the terms that appear in the most recent articles arranged in descending order from the most recent average publication date.

#### 4.1.1. Bitcoin and cryptocurrencies

The most dated research on cryptocurrencies, their inherent values and implications concerns research into Bitcoin (Dumitrescu and Firică, 2014; Eross et al., 2019; Grant et al., 2013; Hughes and Middlebrook, 2014; Jacobs, 2011). While these articles amassed a low normalized citation count of approximately 0.6, the body of research that sprung in 2015 gained traction with normalized citation count of 1.11 according to Scopus citation counts. The notable works on Bitcoin and its return through empirical investigations include Brière et al. (2015) and Polasik et al. (2015) that showed above average returns with the higher risks involved with 4.84 and 3.71 normalized citations respectively. Research has since developed further into studying investment and/or mining returns of Bitcoin (Aysan et al., 2018; Cocco et al., 2017; Corbet et al., 2017; Derks et al., 2018; Hong, 2017; Li and Wang, 2017; Mai et al., 2018; Stavroyiannis, 2018; Zargar and Kumar, 2018) as well as other cryptocurrencies (Adhami et al., 2018; Blau, 2017; Caporale et al., 2018). Several studies provided a critical discussion of the value of Bitcoin and cryptocurrencies as a whole (Alabi, 2017; Hendrickson et al., 2016; Luther, 2018, 2016a). Considering the controversy of cryptocurrencies and their utilization, it is possible for governments to restrict the use of the technology within the boundaries of states through a number of measures (Hendrickson and Luther, 2017). A few other studies provided mostly descriptive studies of Bitcoin, its history and its potentials (Berentsen and Schär, 2018; Holub and Johnson, 2018; Jacobs, 2011; Maddox et al., 2016; Vlasov, 2017). While studying the market patterns of the Bitcoin economy, Tasca et al. (2018) found that we are currently in the third stage progression of the adoption of cryptocurrencies as legitimate forms of market transactions from the prototype and the shadow economy phases. European and North American traders are the main drivers of

Bitcoin trading, and the trading volume is the highest during the morning and day time which is consistent with the other currency markets (Eross et al., 2019). Overall, it is seen that the trend for research into Bitcoin, and increasingly into other cryptocurrencies, continues to grow and attract further research.

#### 4.1.2. Blockchain adoption

Research into blockchain technology was only in its inception for the first seven years. The first real impact (in terms of citations) explored the value of the blockchain proposition as a record keeping technology (Lemieux, 2016), affirming that blockchain is suitable for record keeping in addressing issues related to information integrity considering proper control mechanisms related to security architecture and infrastructure management. The widely referenced paper is that of Iansiti and Lakhani (2017) that provides an outline of the functions, possibilities, adoption scenarios and implications for the practitioners. Subsequent studies on blockchain explored wider uses of the technology starting from storing transaction data in a decentralized, secure, and transparent way, through monitoring logistics and warehousing, to smart contracts (Kim and Laskowski, 2016; Li et al., 2018; Mendling et al., 2018; O'Leary, 2017; Petersen et al., 2016; Rozario and Vasarhelyi, 2018; Tan et al., 2018). As such, Tapscott and Tapscott (2017) provided potential uses of the technology in human resources and procurement, finance and accounting, sales and marketing, legal affairs, and in raising capital for businesses. A real-time, precise, verifiable, and transparent accounting and assurance ecosystems through its inherent characteristics is just one use of the blockchain technology (Dai and Vasarhelyi, 2017). These same capabilities make blockchain an excellent infrastructure system to change how the copyright industry functions and digital content is distributed (Savelyev, 2018). The field stems into legal research in, not only the regulation and control of cryptocurrencies, but also into enforcement (Shermin, 2017) and legal repercussions of smart contracts as there is little experience and institutionalization of the technology due to its disruptive nature (Giancaspro, 2017). Although blockchain can be a catalyst in gaining comparative advantages for firms, Kewell et al. (2017) demonstrate that the technology has a great potential in the NGOs' activities by theorizing the use of distributed ledger technologies (DLTs) in achieving United Nation's current sustainable development goals. Blockchain use in a public sphere is demonstrated by Sullivan and Burger (2017) who showed how the Estonian government uses the technology for e-residency identity management systems. Some authors described a number of radical innovations in which blockchain was mentioned as one of a number of industry developments (e.g. Ivanov et al., 2018).

#### 4.1.3. CB environment

The third literature cluster concerns the ecosystems within which cryptocurrencies and blockchain technologies reside. These include economic security, comparative studies of various payment systems, proposals and development of the institutional systems, country and multilateral systems affected by the disruptive technology, and the impact of this technology on society.

One of the first articles on the proposition of cryptocurrencies, and how it fits in the ecosystem of payment systems can be attributed to Angel and McCabe (2015) (later supported by Dierksmeier and Seele (2018)) who established that, despite major contributions to the monetary systems, there are ethical issues involved in the use of cryptocurrencies due to their relative novelty and intrinsic characteristics. Related to this, Vovchenko et al. (2017) propose a set of actions to minimize money laundering, terrorist financing, and other threats to national security. Barre (2015) showed how Bitcoin innovation is an excellent pedagogical theme that brings attention to issues surrounding the economics and regulation of currency and financial intermediaries as well as its effects on the traditional currency systems. Bitcoin

innovation bypasses traditional systems of institutional intermediation as it is fast and reliable, making it an excellent technology for poverty alleviation in underdeveloped nations (Ammous, 2015). As payment patterns move from cash-based to electronic money systems, cryptocurrency innovation becomes more prominent along with other digital money innovations (Wonglimpiyarat, 2016a, 2016b, 2015). However, the unpreparedness of corporate sector infrastructures coupled with institutional gaps in the use of blockchain technologies creates economic security risks that call for an inclusion of risks decomposition in corporate audits and overall control mechanisms to be established (Umarovich et al., 2017).

#### 4.1.4. Business model innovations

This automatically-generated showcases the features of general technological disruption in financial, accounting, and business model spheres. Cryptocurrencies and the underlying blockchains are the drivers of these changes from closed systems to open/collaborative peer-to-peer systems.

The development of cryptocurrency and its underlying blockchain technology has a potential to create socially-adjusted solidarity-based collaborative organizations and commons-oriented ecosystems in sharing economies (Andreassen et al., 2018; Nowiński and Kozma, 2017; Pazaitis et al., 2017; Scott et al., 2017; Zamani and Giaglis, 2018). The argument for new business models spills over to new types of raising funds, entrepreneurship and development of SMEs (Chen, 2018). The financial services industry as a whole is undergoing vast transformations due to the fast-developing innovations such as blockchain and fintechs (Gomber et al., 2018). Technological advancements including artificial intelligence (AI), robotics, internet of things (IOT), blockchain, among others are transforming retail operations and its education (Grewal et al., 2018). This argument has extended to the context of developing countries as people lacking in financial services access favor the decentralized features offered through blockchain (Larios-Hernández, 2017). Bitcoin is considered to be a disruptive technology trend along with additive manufacturing, big data, cloud technologies, social media, MOOCs, and IoT (Dotsika and Watkins, 2017). As we slowly shift away from maximizing economic gain to openness through such developments as open collaboration, open production networks, offer networks, and the distributed ledger, these technologies become increasingly relevant and are here to stay (Goertzel et al., 2017). Yeoh (2017) finds that minimum regulation on blockchain and cryptocurrency innovation creates greater accessibility and financial inclusiveness thereby resulting in overall economic potential.

Table 2 presents high average citation articles for each of the four research areas. The top peer-reviewed research outlets are provided in Table 3. Finally, Figure 4 demonstrates the distribution of research starting from 2015 in all four research clusters. The vast majority of research remains in the first cluster that talks about Bitcoin and other cryptocurrencies mainly as a form of a value-storing asset, especially in the earlier years of research. The research into the first cluster remains stable in the later years. The blockchain adoption-related cluster has emerged in 2014 and has shown strong growth in the following years which may be due to various applications and potential uses of blockchain infrastructure in business and institutions (Crosby et al., 2016). The CB environment that concerns regulation, ethics, economy, and the society was a prominent cluster in 2015 following a growing recognition of CB in a wider society and security concerns following such events as Mt. Gox security breach and the ensuing collapse (Li and Wang, 2017). Finally, the wider business model innovation theme is the smallest research activity as the prominence and the legitimacy of CB expands. While previous research fused CB innovation with other technological and ideological innovations (Dotsika and Watkins, 2017; Gomber et al., 2018), the theme of

cryptocurrencies as payment systems and the blockchain as a facilitative infrastructure can no longer be ignored.

**Table 2.** Five representative articles in each cluster\***Cluster 1: Top articles— Bitcoin and cryptocurrencies**

- Brière M.; Oosterlinck K.; Szafarz A., 2015, Virtual currency, tangible return: Portfolio diversification with Bitcoin. *Journal of Asset Management*, 16(6), 365-373
- Polasik M.; Piotrowska A.I.; Wisniewski T.P.; Kotkowski R.; Lightfoot G., 2015, Price fluctuations and the use of Bitcoin: An empirical inquiry. *International Journal of Electronic Commerce*, 20(1)
- Blau B.M. 2017/2018. Price dynamics and speculative trading in Bitcoin. *Research in International Business and Finance*
- Li X.; Wang C.A., 2017, The technology and economic determinants of cryptocurrency exchange rates: The case of Bitcoin. *Decision Support Systems*, 95, 49-60
- Jacobs E., 2011, Bitcoin: A bit too far? *Journal of Internet Banking and Commerce*, 16(2)

**Cluster 2: Top articles— Blockchain adoption**

- Iansiti M.; Lakhani K.R., 2017, The truth about blockchain. *Harvard Business Review*
- Lemieux V.L., 2016, Trusting records: Is blockchain technology the answer? *Records Management Journal*, 26(2), 110-139
- Hawlitschek F.; Notheisen B.; Teubner T., 2018, The limits of trust-free systems: A literature review on blockchain technology and trust in the sharing economy. *Electronic Commerce Research and Applications*, 29, 50-63
- Tapscott D.; Tapscott A., 2017, How blockchain will change organizations. *MIT Sloan Management Review*, 58(2), 10-13
- Mendling J.; Weber I.; Van Der Aalst W.; Brocke J.V.; Cabanillas C.; Daniel F.; Debois S.; Di Ciccio C.; Dumas M.; Dustdar S.; Gal A.; García-Bañuelos L.; Governatori G.; Hull R.; La Rosa M.; Leopold H.; Leymann F.; Recker J.; Reichert M.; Reijers H.A.; Rinderlema S.; Solti A.; Rosemann M.; Schulte S.; Singh M.P.; Slaats T.; Staples M.; Weber B.; Weidlich M.; Weske M.; Xu X.; Zhu L., 2018, Blockchains for business process management - challenges and opportunities. *ACM Transactions on Management Information Systems*, 9(1)

**Cluster 3: Top articles— CB environment**

- Dierksmeier C.; Seele P., 2018, Cryptocurrencies and business ethics. *Journal of Business Ethics*, 152(1)
- Angel J.J.; McCabe D. 2015. The ethics of payments: Paper, plastic, or Bitcoin? *Journal of Business Ethics*, 132(3), 603-611
- Umarovich A.A.; Gennadyevna V.N.; Vladimirovna A.O.; Alexandrovich S.R., 2017, Block chain and financial controlling in the system of technological provision of large corporations' economic security. *European Research Studies Journal*, 20(3), 3-12
- Barre T.J., 2015, Bitcoin: A pedagogical guide for the college classroom. *Journal of Education for Business*, 90(6), 335-339
- Vovchenko N.G.; Tishchenko E.N.; Epifanova T.V.; Gontmacher M.B., 2017, Electronic currency: The potential risks to national security and methods to minimize them. *European Research Studies Journal*, 20(1), 36-48

**Cluster 4: Top articles— Business model innovations**

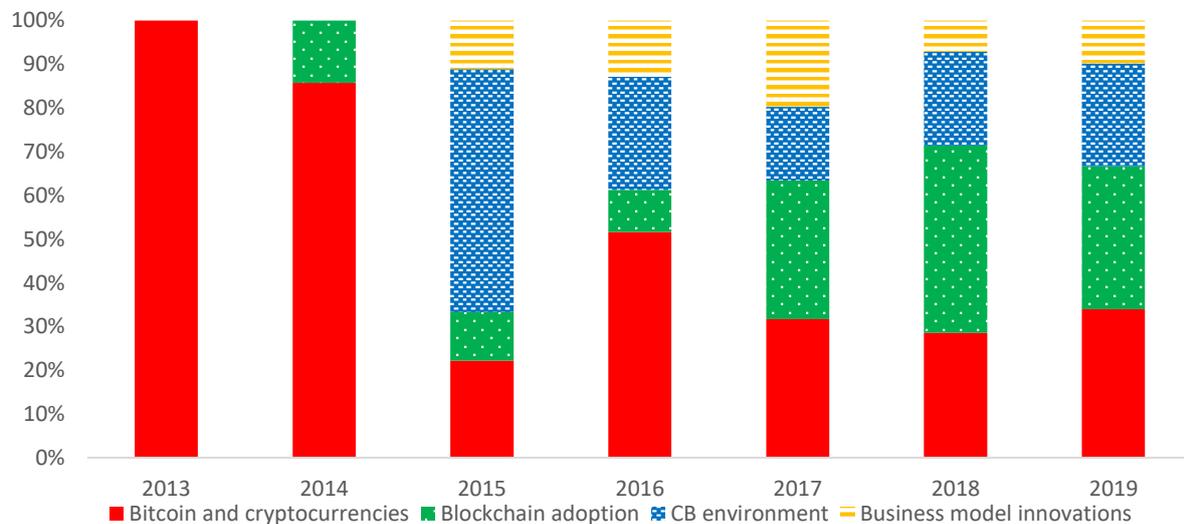
- Larios-Hernández, G. J., 2017, Blockchain entrepreneurship opportunity in the practices of the unbanked. *Business Horizons*, 60(6), 865–874
- Andreassen T.W.; Lervik-Olsen L.; Snyder H.; Van Riel A.C.R.; Sweeney J.C.; Van Vaerenbergh Y., 2018, Business model innovation and value-creation: The triadic way. *Journal of Service Management*
- Pazaitis A.; De Filippi P.; Kostakis V., 2017, Blockchain and value systems in the sharing economy: The illustrative case of backfeed. *Technological Forecasting and Social Change*, 125, 105-115
- Goertzel B.; Goertzel T.; Goertzel Z., 2017, The global brain and the emerging economy of abundance: Mutualism, open collaboration, exchange networks and the automated commons. *Technological Forecasting and Social Change*, 114, 65-73
- Nowiński W.; Kozma M., 2017, How can blockchain technology disrupt the existing business models?. *Entrepreneurial Business and Economics Review*, 5(3), 173-188

\* The articles identified above met the criteria of containing a minimum of two terms in their title/abstract, with at least 70% of terms belonging to a single cluster (i.e. to help ensure reliable cluster assignment).

**Table 3.** Top 15 journal outlets for blockchain and cryptocurrencies\*

Outlet	Cluster	No. of articles	Normalized citations
1. Computer Law and Security Review	Blockchain adoption	12	6.75
2. Strategic Change	Blockchain adoption	11	6.23
3. Research in International Business and Finance	Bitcoin and cryptocurrencies	5	7.48
4. European Research Studies Journal	CB environment	5	4.99
5. MIT Sloan Management Review	Blockchain adoption	5	3.12
6. Quality - Access to Success	Business model innovations	5	0.62
7. Technological Forecasting and Social Change	Business model innovations	4	4.99
8. International Journal of Production Research	Blockchain adoption	4	3.74
9. Journal of Private Enterprise	Bitcoin and cryptocurrencies	4	2.03
10. Journal of Internet Banking and Commerce	CB environment	4	1.20
11. Intelligent Systems in Accounting, Finance and Management	Blockchain adoption	3	11.94
12. Journal of Business Ethics	CB environment	3	6.74
13. Business Horizons	CB environment	3	1.77
14. Espacios	Business model innovations	3	1.04
15. Harvard Business Review	Blockchain adoption	2	11.22

\* Clusters are assigned on the basis of over 50% of the terms in the titles and the abstracts belonging to that cluster

**Figure 4.** Percentage distribution of research by cluster, 2013-27/06/2019

#### 4.2. Comparative topic analysis of blockchain and cryptocurrency fields in academic vs. practitioner-oriented outlets

Blockchain and cryptocurrencies have been developed for individuals and organizations to transact in a new disruptive fashion that is transparent, reliable, decentralized, and immediate. The technology is highly relevant to businesses and individuals alike. Unsurprisingly, practitioner-oriented literature caught on fairly fast to the technology, and the media began its exponential growth from a popular mainstream media business magazine Forbes' May 2011 article named "Crypto currency", and another business outlet, The Economist, June 2011 piece: "Bits and bob: Virtual currency" that explain Bitcoin, its purpose, and implications to

the mainstream reader. A 2013 article by *The Economist*: “JPMorgan jumps in: Bitcoin” that, misleadingly to the title of the article, reports that JPMorgan Chase may possibly be the first large multinational adopter of the blockchain infrastructure for its operations. This can be compared to scholarly research on Bitcoin that began with one short academic article in 2011 (Jacobs, 2011), three years further followed by the second journal article (Dumitrescu and Firică, 2014), finally with a few impactful articles in 2015 (see for example, Brière et al., 2015; Polasik et al., 2015). Blockchain-specific business, IT, and finance scholarly output in journal articles only began in 2016 (Lemieux, 2016; Petersen et al., 2016).

In this study I propose a comparison of practitioner-oriented and scholarly literature in content to identify potential areas of scholarly gaps due to the nascent nature of this phenomenon. The general knowledge of emergent themes at the current stage is predominantly distributed through practitioner-oriented sources (Schmidt et al., 2013). As a dominant agent of the interpretative system of our modern society, the practitioner-oriented sources serve as a key platform to raise awareness and disseminate information (Schmidt et al., 2013). As such, practitioner-oriented outlets reflect wider trends of ‘what is going on’ (Bednarek, 2006) and convey a strong message to the public about current topics in a field and produce ‘an agenda setting’ effect (McCombs, 2013). In particular, practitioner-oriented sources signal the relevance of an issue to the practitioners and might potentially influence the priority given to it by institutional-building authorities (Schmidt et al., 2013). Thus, a rigorous, systematic analysis of the content of CB scholarship can offer a rich foundation for comparing the current state to what it could evolve to. In particular, for some time, scholars have been raising concerns about discrepancies between the topics considered in CB scholarship and the topic interests of CB-interested practitioners (e.g., Grant et al., 2013; Larios-Hernández, 2017; Yli-Huumo et al., 2016).

To date, there have not been any studies that compared practitioner-oriented literature to academic literature on blockchain and cryptocurrencies. This is necessary to provide future directions for research to help bridge the research-practice divide. By using bibliometric methods it helps to provide the most comprehensive research-practice topic discrepancy analysis. In particular, it allows to: (i) analyze a large sample of practitioner-oriented outlets consistent of 1,482 articles as well as the comprehensive set of Scopus-identified journal articles in the ‘business, management and accounting’ which incidentally includes engineering and technology management, law, political economy, economics, marketing, finance, information systems and related spheres; (ii) use scientometric term identification that allows to deconstruct topic contents of the literature; (iii) perform topic-level discrepancy analysis to identify where the scholarship and the practitioner-oriented literature diverge. The results of topic-level discrepancies between the academic and practitioner-oriented literature will indicate what the potentially underresearched practitioner-oriented themes are. This will help direct further research into this important rapidly developing technology.

For the practitioner-oriented sample proxy I utilized several important business sources which included *The Economist*, *Fortune*, *Forbes*, *Global Investor*, *The Times*, *Bloomberg Wire Service*, *Business Wire*, and *Newsweek*. Having searched through a large number of global business-related sources that matched the criteria of title plus abstract available fields and identified the aforementioned periodicals which returned 1,482 articles. Given that the mentioned periodicals are considered to be the front-liners of business reporting (Jung, 2002). The academic literature relied on the 174 scholarly articles that were extracted from the Scopus database. A three-step process was utilized to compare the topics in both streams. First, VOSviewer term identification was applied to extract most commonly appearing noun-phrases from the titles and abstracts of both streams (van Eck and Waltman, 2010). Second, I

calculated the proportion of the scholarship and business periodicals that referenced each term in the abstracts and titles. And finally, the discrepancy was measured by the proportion of topic mentions in the academic proxy from the proportion of the practitioner-oriented proxy. Through this process I selected the top 50 terms emphasized in both literature corpuses, their emphasis discrepancies, and emphasis ratios, see Table 4.

**Table 4.** Top 50 terms<sup>a</sup> emphasized in practitioner-oriented outlets compared to academic research, excluding top methodology-related terms

Terms	Practitioner-oriented	Academic research	Emphasis discrepancy <sup>b</sup>	Emphasis ratio <sup>c</sup>
1. Blockchain	134	270	146.13	0.06
2. Bitcoin	305	191	89.19	0.19
3. Technology	52	80	42.47	0.08
4. Value	54	80	42.33	0.08
5. Cryptocurrency	167	88	39.31	0.22
6. Transaction	44	62	32.66	0.08
7. Money	74	54	26.04	0.16
8. Business	53	39	18.84	0.16
9. Currency	62	39	18.23	0.19
10. Time	45	30	14.20	0.18
11. Industry	55	31	14.10	0.21
12. Risk	55	31	14.10	0.21
13. Number	46	26	11.84	0.21
14. ICO	47	24	10.62	0.23
15. Future	40	20	8.80	0.23
16. Market	135	30	8.13	0.53
17. Security	50	20	8.12	0.29
18. World	80	21	6.67	0.45
19. Digital currency	47	16	6.02	0.34
20. Country	52	12	3.39	0.51
21. Growth	36	10	3.32	0.42
22. Person	82	15	3.09	0.64
23. Emerging country	44	10	2.78	0.52
24. Trader	45	6	0.41	0.88
25. Day	58	7	0.11	0.97
26. Group	51	6	0.01	1.00
<b>27. Investor</b>	<b>128</b>	<b>13</b>	<b>-1.17</b>	<b>1.16</b>
<b>28. Firm</b>	<b>107</b>	<b>9</b>	<b>-2.05</b>	<b>1.40</b>
<b>29. Inequality</b>	<b>35</b>	<b>0</b>	<b>-2.36</b>	<b>N/A</b>
<b>30. Gold</b>	<b>37</b>	<b>0</b>	<b>-2.50</b>	<b>N/A</b>
<b>31. Report</b>	<b>37</b>	<b>0</b>	<b>-2.50</b>	<b>N/A</b>
<b>32. Poverty</b>	<b>41</b>	<b>0</b>	<b>-2.77</b>	<b>N/A</b>
<b>33. CEO</b>	<b>42</b>	<b>0</b>	<b>-2.83</b>	<b>N/A</b>
<b>34. Central Bank</b>	<b>43</b>	<b>0</b>	<b>-2.90</b>	<b>N/A</b>
<b>35. Head</b>	<b>43</b>	<b>0</b>	<b>-2.90</b>	<b>N/A</b>
<b>36. Startup</b>	<b>43</b>	<b>0</b>	<b>-2.90</b>	<b>N/A</b>
<b>37. Year</b>	<b>123</b>	<b>9</b>	<b>-3.13</b>	<b>1.60</b>
<b>38. Month</b>	<b>47</b>	<b>0</b>	<b>-3.17</b>	<b>N/A</b>
<b>39. Contract</b>	<b>48</b>	<b>0</b>	<b>-3.24</b>	<b>N/A</b>
<b>40. Asset</b>	<b>49</b>	<b>0</b>	<b>-3.31</b>	<b>N/A</b>
<b>41. Platform</b>	<b>53</b>	<b>0</b>	<b>-3.58</b>	<b>N/A</b>
<b>42. Exchange</b>	<b>157</b>	<b>12</b>	<b>-3.70</b>	<b>1.54</b>
<b>43. Trading</b>	<b>61</b>	<b>0</b>	<b>-4.12</b>	<b>N/A</b>
<b>44. Plan</b>	<b>63</b>	<b>0</b>	<b>-4.25</b>	<b>N/A</b>
<b>45. Fund</b>	<b>71</b>	<b>0</b>	<b>-4.79</b>	<b>N/A</b>
<b>46. Company</b>	<b>150</b>	<b>9</b>	<b>-4.95</b>	<b>1.96</b>
<b>47. Regulator</b>	<b>75</b>	<b>0</b>	<b>-5.06</b>	<b>N/A</b>
<b>48. Week</b>	<b>76</b>	<b>0</b>	<b>-5.13</b>	<b>N/A</b>
<b>49. Price</b>	<b>82</b>	<b>0</b>	<b>-5.53</b>	<b>N/A</b>
<b>50. Bank</b>	<b>90</b>	<b>0</b>	<b>-6.07</b>	<b>N/A</b>

<sup>a</sup> Practitioner-oriented article sample: n = 1,482 articles. Academic article sample: n = 174 articles.

<sup>b</sup> The Emphasis Discrepancy is calculated by subtracting the proportion of scholarly articles referencing a term from the proportion of practitioner-oriented articles referencing that term.

<sup>c</sup> The Emphasis Ratio is the division of the proportion of practitioner-oriented articles referencing each term by the proportion of scholarly articles referencing that term.

From the outset it is obvious that there is a much greater emphasis in the academic literature on the definitive terms including the subject terms—*blockchain*, *cryptocurrency*, *Bitcoin*, *market*, *value*, *technology*, etc. What received considerably less attention in the scholarship are the investor-related themes identified through such terms as *price*, *week/month/year*, *fund*, *trading*, *asset*, *gold*, *investor*, *report* and others. For example, a practitioner-oriented comparative analysis of gold vs. Bitcoin are summarized in “Investing - The gold bears emerge: What explains bullion’s change in trend?” (Buttonwood, 2013). A number of articles in the mainstream media on cryptocurrency adoption, cycles and its intrinsic value, such as “Swiss bank to launch Bitcoin futures to allow betting against cryptocurrency” (Ball, 2017), is somewhat deficient in the analysis contained in the scholarship.

Further, it may seem that such themes as the political economy and economics are relatively unexplored in the current academic literature which is manifested through no major occurrences of terms as *bank*, *central bank*, *exchange*, *regulator*, etc. For example, articles including “What the world’s central banks are saying about cryptocurrencies” (Lam, 2018) that explains views of various countries’ central banks, the regulations impending, and implications for the cryptocurrencies.

Finally, it is imperative to carry out meaningful research into how the latest technological developments may contribute to dealing with global issues concerning growth of less developed countries, combating poverty and inequality, emerging markets’ growth and its people. Blockchain has immense potentials for competitiveness and catch-up of developing nations, as explored in mainstream media such as “Emerging markets to “leapfrog” with new technology” (Chender, 2018) but is sparse in the academic literature.

To summarize, practitioner-oriented outputs devoted greater attention to investor-related themes, cryptocurrency intrinsic value, political-economic sphere, and the impact of CB technologies on the wider society. To align CB scholarship with practitioner-oriented themes it is recommended that researchers heed the 50 most common terms and the resultant divergences as provided in Table 4.

## 5. Discussion and directions for future research

Bibliometric co-citation analysis coupled with the text mining results identified four major areas of research in CB literature—*Bitcoin and cryptocurrencies*; *blockchain adoption*; *CB environment*; and *business model innovations*. While the research into *Bitcoin and cryptocurrencies* as financial instruments exhibited the fastest growth in 2016, as seen from Figure 4, *blockchain adoption* literature confidently overtook and continues to dominate most recently in business and management-related disciplines. This comes as no surprise as cryptocurrencies exhibit traits of bubble-related instabilities and regulatory uncertainty while blockchain technologies are gaining legitimacy in business model innovations and operationalization.

*CB environment* literature had a strong start as compared to other clusters in 2015.

Researchers aimed at understanding and predicting institutionalization of cryptocurrencies and its inherent technologies given the disruptive nature of the technology and its potential implications. As decision-makers and the environment adjust to the adoption of the technology, the research remains stable in the most recent years. There are abundant avenues of research in the political, economic, societal, and regulatory spheres as the technology slowly but surely disseminates and settles in the ecosystem of business and finance.

*Business model innovation* is the smallest cluster of research wedged between *blockchain adoption* and *CB environment*. This stream of research is about reconfiguration of business models considering such technologies as blockchain solutions and cryptocurrency payment systems. While *blockchain adoption* cluster is specific to the use of blockchain for business purposes, *business model innovation* is a wider discussion of the impact of these technologies

on business. This research stream shows a decrease in the most recent years as the novelty factor decreases.

The majority of research on CB is confined to select journals in business and management-related disciplines mostly in finance, law and operations management, thereby exerting limited influence on other fields. Nevertheless, the research in this highly important field is growing exponentially as seen in Figure 1.

### 5.1. Future research directions

Upon reflection of the results described earlier in the paper, there are a number of interesting implications that CB scholars ought to consider. In particular, this research discusses the intellectual content and structure of CB literature to reveal the current state of the scholarship. This paper also considers what is underresearched when comparing the scholarship with practitioner-oriented results. The directions for future research proposed below stem from three sources of analysis. First, the breadth of the output offered in practitioner-oriented sources that can guide the academic scholarship, see section 4.2. Second, a thorough investigation of the academic scholarship and appeals for future research in previous articles. And finally, from the holistic scientometric analysis that reveals four disparate interrelated areas of research and themes depicting the clusters. I, thus, offer a number of future research directions as summarized in Table 5.

#### 5.1.1. Bitcoin and cryptocurrencies

This field is more established and developed compared to the following clusters.

Nevertheless, research remains scant on a number of themes:

1. With much research on investment returns of Bitcoin, there is little knowledge on the true ‘intrinsic value’ of Bitcoin and/or other cryptocurrencies (Luther, 2018). For example, does the Lightning Network that allows for greatly increased transaction speed with a reduction in cost and its implementation reflect on the value and price of cryptocurrencies (Mendling et al., 2018)? Other fundamentals include decentralized nature; the ability to send monetary value over the internet (Internet of Value); potential to be more stable and acceptable than fiat currencies; transparency and security against fraud because of blockchain; investment tool (some consider it as a security); public ledger; and other related value propositions.
2. Related to the above—do cryptocurrencies have an intrinsic value at all (Berentsen and Schär, 2018)? What are the arguments for long-term viability and outlook for cryptocurrencies, and what are the arguments for inevitable failure of cryptocurrencies?
3. Are the cryptocurrencies destined for a bumpy ride through pricing bubbles and turbulence, or will the price be dictated by the so-called ‘fundamentals’ (Corbet et al., 2018)?
4. Considering close to ten years of Bitcoin existence, what are the traditional trading patterns of securities that can predict the price of cryptocurrencies (Brière et al., 2015; Hong, 2017)? Do cryptocurrencies actually follow their own pattern of value behavior or these can be analyzed as other securities? This area needs a thorough investigation as practitioners tend to emphasize comparisons to gold, silver, shares, and other stores of value, this research is still in its nascent stage.
5. From the exploratory thematic and semantic analyses carried out through text-mining, we can clearly see that the only cryptocurrency mentioned systematically is Bitcoin. With a reduction in the stringency of filter parameters, Ethereum, Ripple, XRP, Litecoin, and a small number of others are also part of the field. Leading to the conclusion that other cryptocurrencies are severely underresearched despite

amounting to almost half of the entire market capitalization of all cryptocurrencies. For example, XRP cryptocurrency market capitalization being third after Ethereum as of July 2019 (CoinMarketCap, 2019), yet receiving no considerable attention in the literature.

6. Further from above, there is little research comparing the influences and consequent dynamics of various cryptocurrencies (Bartoletti and Pompianu, 2017). Cryptocurrencies have diverse programming chains, for example, while Bitcoin blockchain stores information related to past transactions since the start, Ethereum is built on Ether which on top of storing information on accounts and transactions is also able to execute smart contracts through stored programming logic (Chen, 2018). Various crypto coins are generally not considered as competitors to each other, rather they share co-existence and various capabilities that allow for the use of blockchains (Adhami et al., 2018). Thus, research into the fundamentals of these coins and how they are reflected in the long-term performance of the value of these cryptocurrencies is needed to inform and educate of various propositions for businesses.

### 5.1.2. Blockchain adoption

The stream of research in this field is growing rapidly as evidenced in Figure 4, especially in the various potentials and uses of blockchains in business purposes. The research needs further discussion in the following directions:

7. From those organizations that have adopted the technology, what are the returns on investment? As organizations have adopted these technologies, there is need for empirical research into what benefits have these investments eventuate. Can these technologies render comparative or competitive advantages for firms (Nowiński and Kozma, 2017)?
8. From the above, will blockchain eventually become a mainstream technology similar to other technologies including modern accounting software, credit card payment systems, intranets, etc. (Iansiti and Lakhani, 2017)?
9. Is there scope for SMEs to utilize this technology (Chen, 2018; Nowiński and Kozma, 2017)? The likes of IBM, Microsoft, large investment banks as well as technology startups including Lemonade insurance company, Omnichain supply chain solutions, and BABB microeconomy banking, among thousands more companies are successfully utilizing blockchains for their operations. There is a divide between organizations that invest large amounts of money to introduce technologies into their systems and small firms that are built on the premises of the functions that the technology offers. Will general SMEs that already have systems in place adopt the technology as mainstream in the future?
10. Current research mainly focuses on what this technology offers for organizations. A clear understanding of which industries and sectors (e.g. services based on technology) are the primary utilizers of blockchain should be established (Beck et al., 2017). Further, there should be research aimed at discussing what this technology is not capable of doing. As such, which organizations/industries do not require such technology (Peck, 2017)?
11. It is worth exploring how this technology can assist institutions beyond businesses, for example how blockchain assists governments and decision-makers (Goertzel et al., 2017), one such paper is on Estonian government use for e-residency purposes (Sullivan and Burger, 2017). How can this assist governments or other institutions in efficiency and/or competitiveness?

### 5.1.3. CB environment

As mentioned earlier, most of the CB literature tends to relate to either economic value of cryptocurrencies, mostly Bitcoin, and the application of blockchain in organizations. The research on political, economic, societal, implications still needs further exploration in the following directions.

12. The impact of cryptocurrencies and/or blockchains on the wider society. Blockchain technologies have the potential to bring numerous advantages to the society including increasing entrepreneurship in least-developed countries or the unbanked (Larios-Hernández, 2017). While the general-public periodicals and practitioner-oriented literature realizes the benefits the blockchain can bring to the world's poor (e.g. Kuznetsov (2017); Gramm and Soto (2018); Szal (2018)), the academic literature offers little input into this highly important topic. The negative implications of the technology are yet to be researched as well, including the excessive purported use of energy to mine cryptocurrencies; various unsafe companies; Initial Coin Offerings (ICOs), etc.; use of cryptocurrencies for illegal activities; and other drawbacks.
13. Considering the above, what are the safeguards to protect the public from economic risk and fraud that is accompanied with businesses operating and offering blockchain uses and products (Dierksmeier and Seele, 2018; Yeoh, 2017)? How to prevent further speculative bubbles, the hype trading and the consequent inadvertent or purposive economic and societal harm? Should regulations and normative instruments be involved in governing this rapidly developing technology? Further to this, what role should regulations and government play—should the market be liberalized or heavily sanctioned? What role should taxation play in the use of cryptocurrencies?
14. The fundamental proposition of cryptocurrencies is the decentralized nature of the coins that protects the users from the middle-men and controlling parties. However, with the boom in ICOs in this unregulated market, many peer-to-peer coins may or may not be highly concentrated in the hands of a few major players. Thus, naturally the question is how truly decentralized are the various cryptocurrencies (Gervais et al., 2014)? Considering that large-scale 'miners' get hold of a large share of the coins, what role do the miners play? Most of the alternative coins offered contain a low-relative value as compared to the top coins, hence are potentially subject to concentration of the value in one or a few holders (Bradbury, 2013). Since there is little regulation in the market, there is scope for manipulation.
15. Since cryptocurrency mining is dependent on hash rates (Li and Wang, 2017) that dictate the difficulty and energy use in obtaining cryptocurrencies through computing power, there is a theoretical probability that, as it becomes more costly to mine cryptocurrencies, the less mining will occur, combined with a number of other influences (e.g. regulatory issues, market manipulation, speculative trading, increasing power consumption, and skepticism from both the public and the world's established financial industry) could potentially lead to a 'death spiral' (Bianchi, 2019). Thus, is there a potential for some type of withdrawal of some or all cryptocurrencies due to the above-mentioned or other reasons?
16. Cryptocurrencies have gained some legitimacy in society and with some institutional investors (Hong, 2017). However, leading institutional investors and the established financial industry have expressed skepticism, and sometimes, an outright disapproval of cryptocurrencies (Yermack, 2013). The legitimization and wide-scale adoption has not taken place as yet, how can regulatory/normative/cultural-cognitive institutions aid or curb the legitimacy of cryptocurrencies?

#### 5.1.4. Business model innovations

By far, the least researched field as it is wedged between the larger clusters and has a smaller niche in revolutionary/disruptive technology that changes the way businesses operate especially from the accounting and finance perspectives. Also, this field touches upon business models that are based on blockchain service offerings.

17. Further empirical research needs to be conducted into use of cryptocurrencies as payments for goods and services. This field is virtually unexplored (Bartoletti and Pompianu, 2017). Research shows uses of blockchain technologies including Ripple and Ethereum that allow payments to occur (Nowiński and Kozma, 2017), however, the actual use of cryptocurrencies is underresearched.
18. Related to the above, research should aim to investigate adoption and legitimization of cryptocurrencies in day-to-day operations by traditional brick-and-mortar businesses (Luther, 2016b). How far are we from wide-scale use of cryptocurrencies as a legitimate way of payment system? Extending this argument, how far are we from a large scale adoption of cryptocurrencies as a standard on the same scale as cash and cards?
19. What value can emerging markets and/or least developed nations gain from cryptocurrencies and blockchains (Carrick, 2016)? This is somewhat related to Blockchain adoption cluster, dependent on the angle of the argument, this research would either belong in this cluster or the blockchain cluster.
20. Some suggest that we have entered into the new era of ‘internet of value’ (Giancaspro, 2017; Tapscott and Tapscott, 2017; Zamani and Giaglis, 2018). Does this actually hold true in that sending monetary value over the means of internet without involving banks is the new disruption, or is this just an upgrade to the current payment systems? What implications might it have for businesses and society?
21. Finally, some might argue that this technology is truly disruptive and will eventually change the course of the way we do business and transact. If this is true, should the educational system adopt CB curricula (Kursh and Gold, 2016)? For example, should universities offer courses on blockchain or should finance courses offer diversification of portfolios to include cryptocurrencies? Some universities already introduced these into their programs, should this be the norm?

The research gaps and further research recommendations are summarized in Table 5.

**Table 5.** Research gaps and further research recommendations

<b>Bitcoin and cryptocurrencies</b>	<b>Blockchain adoption</b>	<b>CB environment</b>	<b>Business model innovations</b>
The research is primarily on Bitcoin and some on Ethereum, other altcoins are underresearched.	What are returns on investment of blockchain integration?	Is there a potential for a “death spiral” or some type of withdrawal that could eliminate some or all cryptocurrencies?	Empirical research into use of cryptocurrencies as payments.
No research comparing dynamics and their influencers of Bitcoin vs. other cryptocurrencies or in-between cryptocurrencies.	Is there scope for SMEs in the use of this technology?	Impacts of cryptocurrencies and/or blockchain on the wider society.	How can emerging markets benefit from blockchain and/or cryptocurrencies?
What are the fundamentals and how it is reflected on the value of the currencies?	Which industries/types of organizations are the primary users of technology? Which industries/types of companies do not need the technology?	Is cryptocurrency truly decentralized? How are third-party coin providers regulated? Is there scope for manipulation? What role do the miners play in the industry?	How far are we from a large scale adoption of cryptocurrencies in everyday life?
Are we to experience further pricing bubbles or the price will largely be driven by the ‘fundamentals’?			
What cryptocurrencies actually have intrinsic value and will remain in the long-term, and which ones will inevitably fail?	Blockchain on the national level—do governments and agencies need blockchain and how it might create benefit for national competitiveness?	Regulations and/or normative instruments that govern the industry. Is taxation of cryptocurrencies inevitable?	Educating about CB? Do future degrees require education of CB?
Do cryptocurrencies follow traditional investment/ trading patterns? Do traditional finance theories explain cryptocurrency movements/value?	Will blockchain eventually be mainstream among organizations e.g. similar to the use of intranets?	What are the required institutions that will play a part in legitimization of large-scale investments i.e. attracting mainstream institutional investors?	‘Internet of value’—sending monetary value over the internet is the new era in technology?

## 6. Conclusion

The unstructured ontological discovery coupled with co-citation analysis provided interesting insights into the field of CB. The exploratory analysis done through thematic followed by semantic analysis into the exponentially developing literature provided a ‘big picture’ understanding of where we are now and where the research is lacking. The analysis of entire peer-reviewed business-related published literature on CB provided a map that divided research into four inter-related clusters with the largest streams in researching the value of cryptocurrencies vs. the proposition of blockchain for business uses. I believe that this overview of CB scholarship combined with diverse insights and perspectives of scholars can yield ground-breaking research that will strengthen and diversify the field.

When comparing scholarly output to that of practitioner-oriented and main stream interests, there are wide discrepancies in alignment of the two streams. The comparison provides avenues to contribute to the literature as well as enrich CB scholarship by taking stock and exploring diverse and complex realities of CB discussed by the professionals and practitioners.

Last but not least, a detailed section on the future directions of research provides the key provocations that ought to be tackled in order to offer a greater understanding of CB. This research aims to encourage research into key growth opportunities in each of the four streams of CB.

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