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BLOCKCHAIN ETHICS IN INFORMATION SYSTEMS: A LITERATURE REVIEW

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Abstract

Blockchain is an open distributed ledger likely to influence future data transactions and human interactions. As blockchain adoption becomes a reality in many industries, an ethical perspective is crucial to guide researchers and stakeholders on this technology's responsible use and implementation. However, current research on blockchain ethics is still at an early stage and is highly fragmented among different disciplines. This timely literature review investigates the current state of blockchain ethics research in the Information Systems (IS) and Information Management (IM) domains and presents a thematic classification as a basis for a critical assessment of blockchain ethics. This study also provides a theoretical grounding for the development of blockchain ethics as a standalone subject and identifies areas within blockchain ethics that would benefit from further development. Overall, results showed that most studies on blockchain ethics are context-specific and perceive this technology as a solution to ethical issues within a specific field. We found that there is a need for a broader conceptualization of blockchain ethics as the implicit and explicit consequences of adopting this technology have not yet been developed.

Keywords: Blockchain ethics, Blockchain, Literature review, Ethical implications, Information systems, Information Management, Technology ethics, Digital ethics

1.0 Introduction

Blockchain technology has promised to influence future data transactions and human interactions since it was created by Satoshi Nakamoto, its anonymous author. In 2008, Nakamoto released a white paper explaining the underlying technology behind Bitcoin, a form of electronic cash that allowed peer-to-peer transactions without the intervention of a financial institution (Nakamoto, 2008). Since then, the use of blockchain has become widespread with large and medium companies swiftly adopting this technology.

The rapid adoption of blockchain in different areas has led to several issues, in terms of legality (Kiviat, 2015), sustainability (Truby, 2018), security (Li et al., 2020), and even morality (Kewell et al., 2017). While there is research on these issues individually and in relation to different disciplines, there is a dearth of scholarly research on *blockchain ethics*. This review of blockchain ethics literature is motivated by Frizzo-Barker et al., (2020), who surveyed works on blockchain from the earliest publications in 2014 to the end of 2018. From 2018 onwards, scholarly research on blockchain and blockchain ethics has grown exponentially and a review of present literature and future research avenues is much needed. This work also expands on Hyrynsalmi et al., (2020) who highlighted blockchain ethics as a pressing area needing more academic attention.

Having an ethical perspective on the blockchain is critical to assess the future implications of this technology and prevent and detect possible misuse. As blockchain ethics is an emerging research topic, it is imperative to understand its current state to advance knowledge on the subject. To do so, we have outlined the following research questions:

RQ1: What is the current state of blockchain ethics in the IS/IM fields?

RQ2: What areas of blockchain ethics could benefit from further development?

The study is structured as follows, after the introduction, we develop a theoretical framework defining the key concepts used in this work. Then, the methodology section details the research protocol for the literature review. This is followed by the findings section and discussion section describing and synthesizing our results, respectively. Finally, we point to future areas of inquiry in the next section and end with the conclusion.

2.0 Theoretical framework

2.1 Blockchain

Blockchain technology is a decentralized immutable system that records and stores data by using timestamps (Tapscott & Tapscott, 2017). These timestamps are stored in a peer-to-peer network forming a chain of blocks that cannot be individually modified without the approval of all the other CPUs in the network (Nakamoto, 2008).

Blockchain’s characteristics like decentralization and anonymity support data and financial transactions without third-parties intervention [Table 1]. Furthermore, blockchain is a peer-to-peer platform, allowing anyone in the network to participate in the record-keeping process (Sharif & Ghodoosi, 2022).

Blockchain features	Definition
Decentralization	Blockchain’s most distinguishing feature. It implies that blockchain doesn’t rely on a central authority to record, store, or update data, instead, it distributes all data among the different devices or nodes in a network.
Transparency	Blockchain’s system of recording and storing data with a timestamp allows for transparent access to data records by any node in the distributed network.
Open source	The initial blockchain was open for everyone to trace and verify data records. Currently, there are many types of blockchains, which can be categorized as public, private, and consortium blockchains (Zheng et al., 2018).
Autonomy	Every transaction in the blockchain is confirmed and recorded in blocks alongside the network following a consensus mechanism that ensures that only one node can add the latest block to the chain.
Immutability	Because of the autonomy of every node in the network, records in the blockchain can’t be deleted or tampered with, unless someone owns 51 percent of the nodes in the network.
Anonymity	Every person in the network has a generated blockchain address instead of their personal information, thus preserving the anonymity of the blockchain users.

Table 1. Blockchain’s distinctive features according to Lin and Liao (2017).

Despite initial scholarly enthusiasm, skeptics have also raised concerns regarding blockchain’s decentralized and trustless nature. Zheng et al. (2018) discuss blockchain’s multiple challenges, such as scalability, privacy leakage, and selfish mining or what is known as a ‘51% attack,’ where a node owns the majority of a network and can therefore abuse it. Monrat et al., (2019) add to the potential challenges the amount of energy consumption it takes to mine Bitcoin, which relies on blockchain to perform transactions; the lack of interoperability where networks are isolated and don’t communicate with each other; regulatory issues with countries banning Bitcoin

mining altogether; and fairness and security, also related to selfish mining and unsolved security threats.

Scholars have suggested that some of the challenges when implementing blockchain are due to its complex technical aspects (Swan, 2017). However, previous research showed that 80% of the barriers to blockchain adoption were business and communication-related, while only 20% were technical barriers (Mori, 2016). In this regard, blockchain's potential is not so much in its technical attributes but in its ability to change the structure and organization of entire industries (MacDonald-Korth et al., 2018). Such transformative capability of blockchain requires an ethical perspective that ensures the maximum benefits for its stakeholders while minimizing the risks. However, research has targeted mostly the technical aspects of blockchain and its applications. Only recently, there has been a shift towards the socio-technical dimension of blockchain and how it is bound to transform organizations and society. Taking an Information Systems (IS)/Information Management (IM) approach, we investigate blockchain ethics and its future research avenues as a standalone subject.

2.2 Ethics: a moral issue

Ethics is a complex subject because it needs an ontological definition. We refer to 'ontology' not to the restrictive taxonomic categorization used in IS (see Gruber, 1993). Instead, our focus is on philosophical ontology as the science of all the structures and processes related to reality, i.e., being, becoming, and existence (Smith & Welty, 2001). Within this context, *ethics* is understood as a moral intuition of something being good or bad (Stahl et al., 2012). According to the moral principles we endorse, we will decide what is morally valuable to us (Darwall, 2005). Therefore, ethics is central when making decisions at the individual level, but also at the organizational level. Ethics plays a key role in any decision-making process (Bose, 2012). First, by evaluating the readiness of an organization to implement blockchain. Second, by weighing the risks and benefits of blockchain and detecting potential issues before they arise. Regardless of the type of organization, ethics should be at the forefront of every business-related decision so that both organizations and society can fully benefit from technology's positive impact.

Ethics is largely divided into meta-ethics, which deals with ethics at the ontological level; normative ethics, which is concerned with ethical predicaments and their outcomes (Mingers, 2010); and applied ethics which combines both consequential and non-consequential approaches in specific contexts, such as technology ethics (Ashok et al., 2022). This work is concerned with the moral solution to a practical problem, hence subscribing to applied ethics as it is context-specific, and it allows us to expand on the concrete ethical issues raised by blockchain.

Within the applied ethics realm, we find the computer ethics field, which has been studied as a standalone subject since the early 80s. Moor (1985, p. 266) defined the term as “the analysis of the nature and social impact of computer technology and the corresponding formulation and justification of policies for the ethical use of such technology.” Floridi (1999) goes a step further and claims that computer ethics cannot be fully explained by the traditional ethical theories and needs of its own conceptual foundation. The possible answer to this issue, Floridi continues, is information ethics theory, which argues that every information system holds some basic ethical principles that ought to be considered when implementing these information systems. Therefore, deciding whether or not to implement blockchain will be determined by the ethical standards embedded in blockchain and how implementation aligns with blockchain’s ethical standards.

However, technology is evolving every day and with it the information societies we live in. And so, the ethical standards of blockchain are also evolving as this technology becomes widespread. To cope with this constant change, scholars should *re-ontologize*¹ the term blockchain, that is to redefine the nature of blockchain, its intrinsic moral values, and the potential ethical impact on society. This paper summarizes the attempts to do that.

2.3 Blockchain ethics

Most discussions on the ethics of technology revolved around information technology (Floridi, 1999; Mason, 1986). Currently, efforts have been made to study AI ethics

¹ We borrow the terms ‘information society’ and ‘re-ontologize’ from Floridi, (2010) to explain the importance of defining what an ethical blockchain is and the ethical challenges it presents to businesses and society.

(Hagendorff, 2020; Floridi et al., 2018; Taddeo & Floridi, 2018), IoT ethics (Atlam & Wills, 2020; Allhoff & Henschke, 2018), and Big Data ethics (Richardson et al., 2021; Someh et al., 2019). However, literature on blockchain ethics remains scarce [Table 2]. For instance, Tang et al., (2019) conducted a literature review and developed a conceptual framework of blockchain ethics and its ethical impact on various levels of blockchain application. The framework followed a three-by-three assessment matrix classifying blockchain’s ethical issues by level of review (micro, meso, and macro), by application, and by the ethical impact of each blockchain application. Their paper concluded by inviting IS researchers to use their model to confirm and identify new challenges regarding blockchain use by different organizations. Similarly, Dierksmeier & Seele (2019) also proposed a three-axis classification for blockchain technology and its applications according to their morally favorable, unfavorable, and ambivalent dimension.

Hyrnsalmi et al. (2020) conducted a systematic review of blockchain ethics research and collected a sample of 26 primary studies from different scientific areas. The authors concluded that, despite the growing interest in blockchain ethics research, there is a need for concrete tools or guidelines designed for practitioners and scholars to address the ethical concerns raised by blockchain technology. Another relevant study on blockchain ethics is the intentional design framework proposed by Lapointe & Fishbane (2019). The authors examined blockchain’s features, its applications, and their potential social impact and created a practical framework that only targets the design aspect of blockchain. While all these papers make significant contributions to the blockchain ethics field, most of them address the specific contexts where blockchain can have an ethical impact, rather than focusing on the ethical principles of the technology itself. We further examine this point in the discussion section.

Research category	Relevant literature
Emerging technologies	Moor, 1985 Moor, 2005
Information technology	Mason, 1986 Floridi, 1999

Blockchain	Dierksmeier & Seele, 2019
	Tang et al., 2019
	Lapointe & Fishbane, 2019
Internet of Things	Hyrnsalmi et al., 2020
	Allhoff & Henschke, 2018
Big data	Atlam & Wills, 2020
	Someh et al., 2019
Artificial Intelligence	Richardson et al., 2021
	Floridi et al., 2018
	Taddeo & Floridi, 2018
	Hagendorff, 2020

Table 2. Relevant examples of literature on technology ethics.

3.0 Methodology

This study reviews 52 papers on blockchain ethics and provides a thematic classification of past and current research trends from 2016 when the first papers on blockchain ethics emerged to the present. We followed a structured search for our narrative literature review as suggested by Templier & Paré (2015). The authors describe narrative reviews as a bridge between current and future knowledge on a specific subject, oftentimes analyzing studies thematically dissimilar, which is particularly suitable for IS/IM scholars because of their interdisciplinary nature. Despite the structured design of our research, we opted for a narrative or traditional literature review, as it allows us to go beyond the mere description of the literature and make a coherent argument on the importance of blockchain ethics. Narrative reviews summarize and analyze the findings of different studies, rather than listing all literature on the topic available, as happens with systematic literature reviews. Consequently, narrative reviews are the most appropriate method to evaluate the current state of knowledge on blockchain ethics and identify future areas of inquiry.

Prior to formulating the problem, we followed Snyder's (2019) questionnaire to design, conduct and analyze a literature review. We gathered a total number of 52 papers following a structured search described in Figure 1. We read the abstracts of our total population to find the labels for our thematic analysis. Thematic analyses are a widely used technique in qualitative literature reviews to extract similarities and summarize previous research (Templier & Paré, 2015). We take inspiration from Akar & Akar (2020) for our thematic classification. The authors surveyed 334 articles on blockchain

and cryptocurrencies for their literature review and classified the articles by themes to identify future and current research trends. Our research, however, differs from the authors in that it focuses on blockchain and ethics and goes beyond mere description to outline research gaps in current literature. Once we labeled the themes from our thematic analysis, we started the manual classification of articles into the themes as described in the following section.

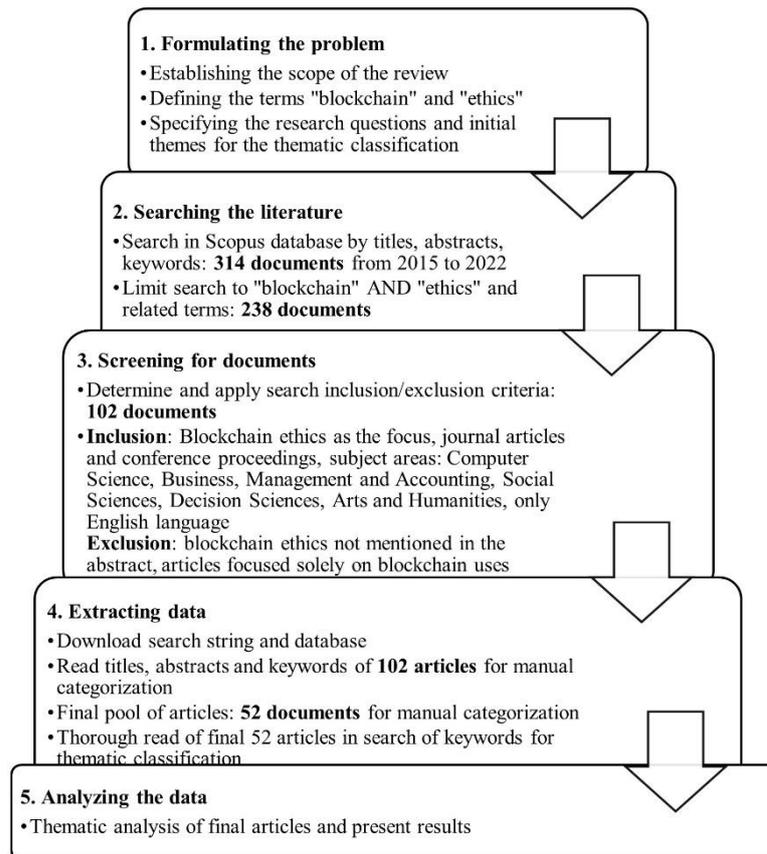


Figure 1. Design for research methodology adapted from Templier & Paré (2015).

4.0 Findings

We found six themes regarding the topics discussed in our final database. We found no studies on blockchain ethics before 2016, which represents the year when blockchain related to cryptocurrencies became a trend (Akar & Akar, 2020). The themes are labeled as follows: blockchain (BC) in organizations; BC ontology; BC ethical implementation; BC benefits and challenges; BC intentional use and BC technical use [Table 3].

Theme	Description	Articles
BC in organizations	Articles exploring blockchain implementation in different fields to achieve an ethical purpose	Babich & Hilary, 2020; Balzarova et al., 2022; Erik Boetto et al., 2021; Bux et al., 2022; Calvaresi et al., 2019; Cascini et al., 2022a; Daskal et al., 2019; Jung & Pfister, 2020; Khezr & Mohan, 2022; Klerkx et al., 2019; Kshetri, 2022; Mishra, 2022; Racine, 2021; Ronaghi & Mosakhani, 2022; Schinckus, 2022; Sherif & Mohsin, 2021; Zhou et al., 2022
BC ontology	Articles focusing on the nature of blockchain and the moral principles underlying this technology	Bocean & Vărzaru, 2022; Heckler & Kim, 2022; Marković, 2020; Reijers & Coeckelbergh, 2018; Sharif & Ghodoosi, 2022; Srivastava et al., 2021; Tang et al., 2019; Teng, 2021; Thiebes et al., 2021
BC ethical implementation	Articles analyzing ethical implications of blockchain implementation in different fields	Akar & Akar, 2020; Cao et al., 2021; Castell, 2018; Chang et al., 2020; Dierksmeier & Seele, 2016; Kher et al., 2021; Mendling et al., 2018; Saheb et al., 2022; Senbekov et al., 2020
BC benefits and challenges	Articles outlining the benefits and challenges of blockchain and its features	Ishmaev, 2020, 2021; Koroma et al., 2022; Liu et al., 2022; Madianou, 2019; Malherbe et al., 2019; Upadhyay et al., 2021; Wahlstrom et al., 2020
BC intentional use	Articles examining the ethical aspects of the application of blockchain's features	Ballandies, 2022; Bertino et al., 2019; Carlson, 2019; Marchang & Di Nuovo, 2022; Porsdam Mann et al., 2021; Seele, 2018
BC technical use	Articles studying the technical infrastructure and design of blockchain applied for ethical purposes	Arulprakash & Jebakumar, 2021; Baharmand et al., 2021; Bautista et al., 2022; Nalin et al., 2019

Table 3. Themes categories on blockchain ethics and relevant literature for each theme.

4.1 Blockchain ethics research by themes

The analysis shows the classification of articles by themes [Figure 2&3], ranging from most to least popular among researchers. The main theme is blockchain in organizations with 33% of total entries. Studies within this theme explore the potential value of implementing blockchain at the organizational level. Additionally, these studies explore how blockchain could be used as a tool to achieve an ethical goal (Balzarova et al., 2022; Cascini et al., 2022). The second most popular theme is blockchain ontology (17%). Articles on this theme discuss the nature of blockchain technology from a philosophical standpoint and consider the ethical implications of digital

technologies (Markovič, 2020; Tang et al., 2019). The next most popular themes are blockchain ethical implementation with 15% of results and blockchain’s benefits and challenges (15%). The former discusses the ethical issues raised by blockchain at the implementation level (Kher et al., 2021; Chang et al., 2020), and the latter involves descriptive articles emphasizing the risks and benefits of blockchain and its features (Babich & Hilary, 2020; Ishmaev, 2020). Similar to the previous theme, but with a specific focus is blockchain intentional use (12%). Studies on this theme pay attention exclusively to the ethical aspects of blockchain features (Bertino et al., 2019; Carlson, 2019). Finally, there is the blockchain technical use theme (8%), which targets the technical design and the infrastructure behind blockchain which could be used to achieve an ethical goal (Baharmand et al., 2021; Arulprakash & Jebakumar, 2021).

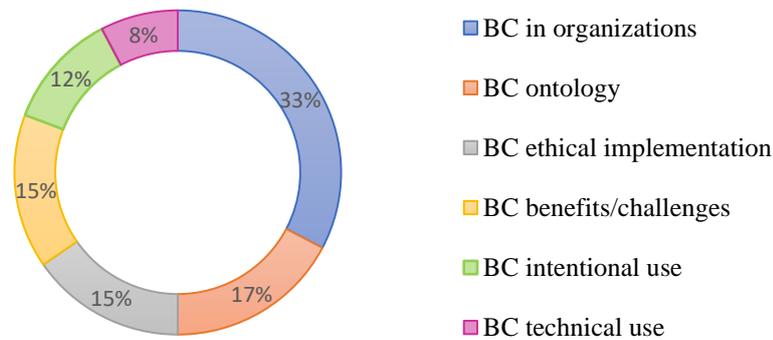


Figure 2. Percentages of articles in blockchain ethics emerging from our review organized by themes.

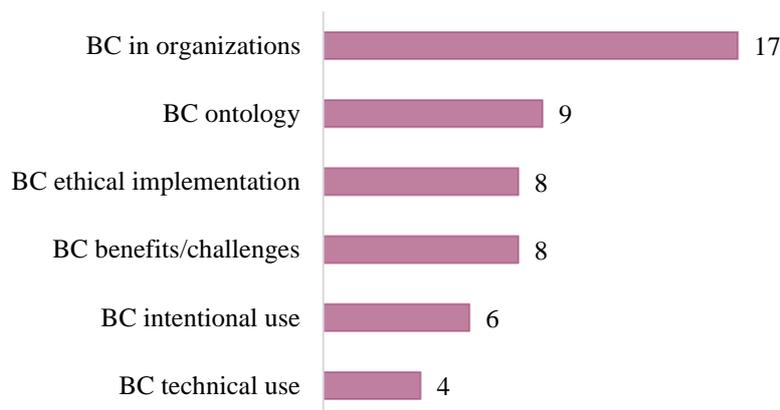


Figure 3. Main themes extracted from our review on blockchain ethics organized by number of articles.

4.2 Blockchain ethics methodological approaches

We analyzed the papers from our database according to the relative proportion of qualitative, quantitative, and mixed methods articles [Figure 4]. Qualitative articles develop theories, analyze risks and benefits, and theorize about how blockchain is impacting different industries. Quantitative articles focus on empirical data and focus on measurable variables of blockchain. Mixed methods papers use a combination of these two approaches and develop theories or frameworks on blockchain ethics.

Overall, we found that 77% of our total population followed a qualitative methodology, while 19% chose a quantitative approach, and only 4% opted for a mixed methods approach. Qualitative studies focus on blockchain's definition and applications (Reijers & Coeckelbergh, 2018), hypothesizing this technology (Liu et al., 2022), and analyzing its risks and benefits (Chang et al., 2020). Once blockchain and its features are described in detail, empirical studies appear to measure the viability of blockchain (Frizzo-Barker et al., 2020). Quantitative works tackle blockchain and its features as a tool and ethics as an outcome of the proper use of this technology. These focus on specific applications of blockchain (Ballandies, 2022) and build and evaluate theory with formal models (Bautista et al., 2022).

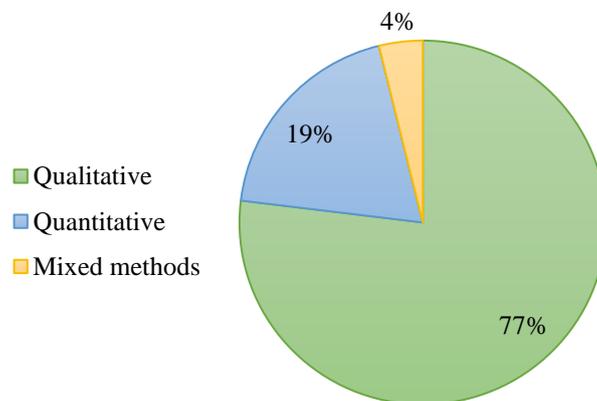


Figure 4. Percentage of qualitative and quantitative papers on blockchain ethics extracted from our database.

Due to the scope of this study and the philosophical nature of blockchain ethics, we expected more conceptual than empirical studies on our database. The proliferation of qualitative papers shows that blockchain ethics is still in its early stages both conceptually and empirically (Frizzo-Barker et al., 2020). Most qualitative studies from

our database are concerned with building theory on blockchain ethics. However, the multitude of topics and approaches to blockchain ethics adds to the fragmentation of the field and shows that there is still a need for a cohesive theory of blockchain ethics.

Additionally, we categorized our total population by the research methods used [Figure 5]. We found exploratory studies (40%); followed by literature reviews (19%); theoretical frameworks (17%); formal models (14%); case studies (4%); interviews (4%), and surveys (2%). The prevalence of exploratory studies aligns with the emergence of blockchain ethics as a topic, with papers exploring how blockchain impacts different industries (Babich & Hilary, 2020). Amongst these, there are studies that question the ability of blockchain to solve ethical issues across industries (Racine, 2021; Seele, 2018), and those enthusiastic about the potential of blockchain to solve ethical problems (Bertino et al., 2019; Carlson, 2019).

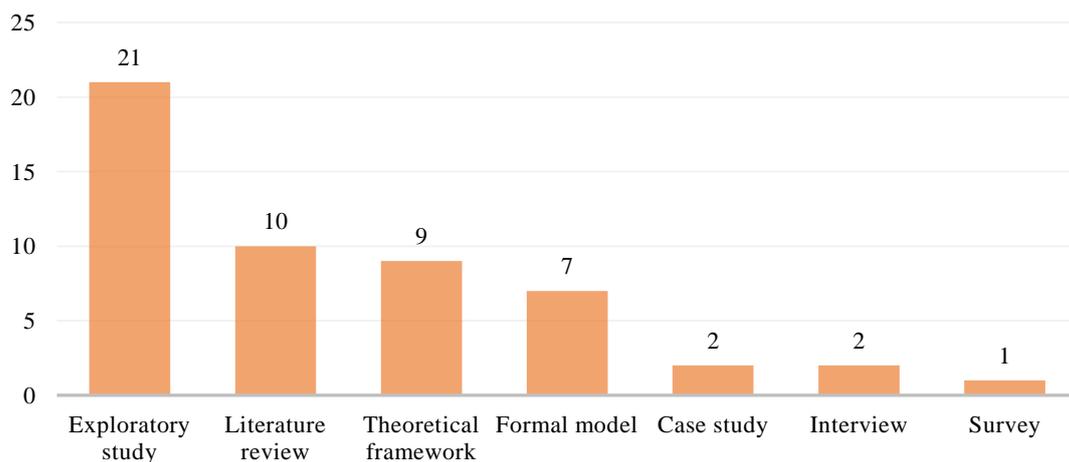


Figure 5. Research methods used in the articles on blockchain ethics from our database.

Literature reviews are the second most used research method within our population. We find papers analyzing the effects of blockchain in specific areas and paving the way for future research (Sherif & Mohsin, 2021; Upadhyay et al., 2021). The third most used research methods are theoretical frameworks, which are concerned with developing guidelines for ethical blockchain use (Tang et al., 2019; Thiebes et al., 2021), and achieving an ethical purpose (Daskal et al., 2019; Khezr & Mohan, 2022). Next, we have formal models, which use empirical data to generate systems that explain a particular phenomenon. In our database, we find models that show how ethics, understood as security and trust, influence blockchain users' satisfaction (Bocean &

Vărzaru, 2022; Koroma et al., 2022). Other works measure how blockchain adoption rests on the reliability of information recorded on the blockchain (Zhou et al., 2022). To a lesser extent, we identified a smaller number of case studies (4%); interviews (4%), and surveys (2%).

5.0 Discussion

In this section, we discuss in detail the six themes extracted from our database and answer the first research question on the state of blockchain ethics research. In the following section, we outline the future research agenda, which answers our second research question on the areas of blockchain ethics that need further development.

5.1 Blockchain in organizations

Papers from this theme focus on blockchain implementation at the organizational level. They examine the readiness of organizations to implement blockchain and the potential of this technology to reach ethical goals undertaken by an organization. Understandably, blockchain in organizations is the category with the most entries as blockchain research is still developing as a field and it has generated a debate around the necessity of implementing it in every industry. For instance, Cascini et al. (2022) found blockchain to be a useful tool to solve accountability, traceability, and transparency issues with genomic data sharing by giving more control to patients over their health data. In another example, Balzarova et al. (2022), assessed the readiness of Fairtrade experts to adopt blockchain in their field. The authors also interviewed blockchain experts and concluded that despite the possible benefits blockchain would bring to the Fairtrade market, the industry is not ready yet to make significant changes. From an IS/IM point of view, studies belonging to this theme are the most relevant as they focus on blockchain's specific applications and assess where this technology would be more beneficial (Rossi et al., 2019). However useful these papers might be, they are limited by a key question: a broader understanding of the nature of blockchain. Articles on this theme describe what, if anything, makes blockchain a feasible tool to reach an ethical purpose. More importantly, these papers assume that blockchain is a neutral instrument lacking biases inherited by the human agents in charge of building this technology. To better grasp how blockchain can help organizations become more ethical, it is necessary to understand that this technology is interdependent on human and material agency, the

latter described by Leonardi (2011, p. 148) as “the capacity of non-human entities to act on their own, apart from human intervention.”

5.2 Blockchain ontology

The BC ontology theme involves works providing an ontological meaning to blockchain and its moral principles. For instance, Markovič (2020) described the technical structure of blockchain and the ethical issues related to its implementation. According to Markovič, the reasons behind blockchain’s limited adoption are its intrinsic moral values. The author used virtue ethics as a roadmap and concluded that to improve blockchain we need to continually improve our collective knowledge and create a standard set of values that will eventually seep into the core ethos of blockchain technology. In line with this is the idea of re-ontologizing the blockchain, that is, reengineering the material structure and rethinking the intrinsic nature of blockchain (Floridi, 2010). Also, in their literature review Tang et al. (2019) analyzed blockchain ethics by its application, its ethical impact and its level of application (micro, meso, and macro). Despite the attempts to provide a theoretical concept of blockchain ethics, both papers attended to many other factors of blockchain that lack a direct link with ethics. Nonetheless, all papers on this theme agree that there is a need for comprehensive theoretical frameworks on blockchain ethics. To create a structured conceptualization of blockchain ethics, scholars ought to rethink the significance of blockchain and its moral implications for businesses and society.

5.3 Blockchain ethical implementation

Articles from this theme examine the ethical issues raised by this technology at the implementation level. Whereas BC in organizations sees blockchain as a tool to solve organizational and societal problems, BC ethical implementation studies blockchain as a tool that raises ethical, organizational and societal issues. Chang et al. (2020), for example, interviewed different blockchain experts and examined the challenges and ethical issues raised by implementing blockchain. The main challenges in blockchain adoption are scalability, security, privacy leakage, and energy consumption. The ethical issues associated with blockchain are privacy, regulation and cybercrime. The authors concluded that blockchain improved efficiency and security, but it had many underlying

issues that needed solutions. Similarly, Kher et al. (2021) systematically reviewed extant blockchain literature and outlined different methodologies to implement blockchain while tackling the issues that may arise along the way. The authors highlighted that the decentralized nature of blockchain has opened a legal debate on trust and privacy among scholars. However, we fail to see a deeper conceptualization of how trust and privacy impact not only blockchain regulation but its implementation. It is worth noting that in both examples the ethical issues raised by blockchain are analyzed along with other aspects of blockchain implementation. This is partly because blockchain ethics as a subfield within blockchain research is slowly emerging and only recently it has been studied as a standalone subject. Furthermore, the ethical issues derived from blockchain implementation are often related to other aspects of blockchain (e.g., security, trust, privacy) and the boundaries and associations between these aspects and the ethical principles of this technology have not been developed, as in the case of other emerging technologies (Floridi, 2019; Whittlestone et al., 2019).

5.4 Blockchain benefits and challenges

Articles from this category emphasize the risks and benefits of blockchain implementation. They investigate how blockchain's inherent features may lead to ethical, technical, and organizational concerns that may outweigh the presumed benefits of implementing this technology. Babich & Hilary (2020), for instance, evaluated the technical, organizational, and governance characteristics of blockchain in operation management (OM). Their findings revealed five key strengths, five weaknesses, and three research themes derived from blockchain implementation in OM. The authors also cautioned against falling for the hype of blockchain, as there are still theoretical and technical questions that need to be answered. Similarly, Ishmaev (2020) analyzed the advantages and disadvantages of blockchain-enabled markets for the privacy of IoT users. The author identified the technical and economic aspects of blockchain implementation in the IoT domain. He also highlighted the ethical limitations of blockchain when used as a universal solution to privacy issues. The author concluded that blockchain uses for IoT privacy are only a partial solution to the right to privacy and that blockchain's technical features may lead to even more privacy issues. Both articles agree that researchers and practitioners from every field should proceed with caution regarding blockchain use and implementation. However, we find studies on this

theme overly descriptive and too reliant on the technical features of blockchain and their implications for organizations. Instead, blockchain research would benefit from shifting the focus from organizations to the technology itself. Further conceptualization of the risks/benefits of blockchain for the design and purpose of the technology itself is still needed.

5.5 Blockchain intentional use

Regarding this theme, we find articles that examine the ethical aspects of blockchain's different features. For example, Bertino et al. (2019) focused on data transparency and data ethics as critical aspects of data quality. Their study explores how blockchain features, like transparency and decentralization, support other technologies such as AI, in delivering, storing, and exchanging quality data. The authors see blockchain's features as a step forward toward achieving true data transparency. Carlson (2019), on the other hand, centers her research on blockchain's immutability, transparency, and autonomy and how these features can ensure artificial general intelligence (AGI) safety. The author also observes that blockchain and its features provide an immutable and (data) transparent platform necessary to instill ethics into AGI systems. Remarkably, both papers enter the realm of ethics as a quality blockchain's features can provide. Also, in both cases, blockchain's features are conceived as an aid for other technologies, such as AI. Nevertheless, the combination of both technologies leads to the theoretical development of AI to the detriment of blockchain, which is examined as an outlet rather than as a means of itself.

5.6 Blockchain technical use

The theme with the least entries, blockchain technical use, studies the technical infrastructure and design of blockchain applied for ethical purposes. It targets the technical design and the infrastructure behind blockchain which could be used to achieve an ethical goal. That is the case for Baharmand et al. (2021), who created a theoretical framework for the design of humanitarian blockchain-based projects. The framework was later validated through three case studies. The authors highlighted ethics as one of the key components of their design and as part of the context where

humanitarian blockchain-based projects are carried out. In contrast to the theoretical framework, Arulprakash & Jebakumar (2021) created an applied mobile tool based on Mobile crowd-sensing networks and blockchain to achieve data transparency and security. Their paper is applied and shows the different ways blockchain is being utilized for ethical purposes. Although in both cases the goal is an ethical one, studies from this theme tend to be field-specific and lack the ethical dimension of technology design. Hence, it is crucial to question the ethical values embedded in blockchain to better conceptualize, design, and implement this technology. As we have seen with the methodological approaches used in our pool of papers, the technical aspects of blockchain are more appropriate for other disciplines. However, transferring the debate on the ethical design of blockchain from computer science to the IS/IM field would be beneficial for the development of this and other technologies.

6.0 Future research agenda

After analyzing the dataset, we found gaps in the literature on blockchain ethics that point to the most pressing areas that need further development. Overall, we found that most papers analyzed called for more tools to investigate blockchain ethics and its impact on business and society. Instead of calling for more context-specific research on blockchain, we call to action for a broader conceptualization of blockchain ethics. To do so, we have gathered a set of research avenues based on themes from our research for IS/IM scholars to explore [Table 4].

Potential research areas from the BC in organizations theme tackle blockchain ethics and organizational behavior. Scholars interested in this topic could address the interrelation between ethical blockchain and (un)ethical organizations. They could also explain the limitations organizations face when trying to make responsible use of blockchain. Additionally, scholars can assess the capacity of blockchain to alter the ethical codes of different industries. Regarding BC ontology, potential research avenues are related to the conceptualization of blockchain before it is implemented. Scholars interested in this topic could create an ethical framework for the ethical implementation of blockchain that could be applied in any organization. From the BC ethical implementation theme, scholars can explore the consequences of implementing blockchain ethically. The impact of ethical blockchain implementation and the effect it

has on society and organizations are also potential research avenues. These areas are particularly relevant for IS/IM scholars because they are interdisciplinary in nature and have a better understanding of the impact blockchain has on technology, businesses, and society (Tang et al., 2019).

With regards to the BC benefits and challenges theme, some areas of inquiry to explore are the ethical risks and benefits of blockchain for society, and how these can be measured from an ethical perspective. Additionally, researchers could explore the potential disadvantages of implementing blockchain and how to overcome them. Future research avenues from the BC intentional use theme lead to questions about blockchain's features and how these fit within an agenda for ethical blockchain implementation. From the BC technical use theme, scholars could explore the ethical design of blockchain from the outset. It would also be beneficial for the IS/IM field to address the ethical codes that would be written into the blockchain and to develop appropriate frameworks that facilitate the ethical evaluation of a blockchain.

Research area	Research questions
BC in organizations	What ethical principles does an organization need to have to implement blockchain? How to align an organization and blockchain ethical principles? How to reach an ethical balance between the economic interests of an organization and the nature of blockchain? How to assess the accountability of blockchain misuse?
BC ontology	How to conceptualize an ethical blockchain? Can blockchain ever be ethical if it is massively distributed? How to develop an ethical blockchain that benefits humanity? What ethical code should blockchain follow?
BC ethical implementation	What strategies should organizations adopt to ensure they implement blockchain ethically? What are the ethical implications of blockchain adoption? How does the ethical implementation of blockchain impact society? How to rate blockchain ethical implementation success?
BC benefits/challenges	What ethical risks/benefits does blockchain pose for the future of data communication? How to accurately measure blockchain's risks/benefits from an ethical perspective? How can organizations outweigh the potential negative impact of blockchain at the implementation level?

BC intentional use	<p>How to design an ethical framework for the use and implementation of smart contracts?</p> <p>What frameworks should be implemented to ensure smart contracts are used ethically?</p> <p>How can information societies benefit from data transparency?</p> <p>How to keep blockchain's decentralized feature if it is massively distributed?</p>
BC technical use	<p>Is it possible to design an ethical blockchain?</p> <p>What ethical codes should be embedded into blockchain to ensure it serves an ethical purpose?</p> <p>What frameworks/guidelines should be followed to assess whether a blockchain is ethically designed?</p>

Table 4. Future research avenues identified in our review requiring scholarly attention.

7.0 Conclusions

We have studied extant literature on blockchain ethics to provide a theoretical grounding for the development of blockchain ethics as a standalone subject. We have taken an Information Systems/Information Management approach to explore the impact of blockchain ethics in society, business, and technology. Moreover, we have defined an emerging research agenda of areas of blockchain ethics that need further development. Our results show that most studies on blockchain ethics focus on how blockchain can be used in different fields to achieve ethical objectives within organizations. Understanding that blockchain is dependent on its technical characteristics and its interaction with humans is key when theorizing about the ethical goals of this technology.

Therefore, to develop blockchain ethics as a standalone field, it is necessary to conceptually set the boundaries of technology, ethics, and its implications for society. As we have observed from our findings, blockchain ethics research is slowly developing, with much research focused on specific uses and applications of blockchain. These specialized works are helpful for blockchain ethics theorists, as they provide empirical evidence of the aspects of blockchain that could be improved.

We extracted *blockchain ontology* as a theme from our review and found that there is little emphasis on studying blockchain from a normative perspective. Furthermore, the diversity in topics from our database contributes to the fragmentation of blockchain ethics as a field and calls for more standardized methods of ethical analysis. We

conclude that a deeper conversation on the ethics of blockchain is much needed to develop a robust theory of blockchain. Likewise, we intend to redirect blockchain research to the ethics field as the implicit and explicit consequences of adopting this technology have not yet been developed.

Blockchain is not an all-in-one solution to all ethical problems, but it can certainly help to mitigate the impact of those problems in real life. We believe that blockchain is a technology with great possibilities to change the way we communicate and conduct business. The consequences of using this technology have a real impact on our world. Therefore, blockchain must be conceptualized, designed, implemented, and distributed with the greater good in mind. We expect to find more scholarly research on blockchain ethics in the upcoming years.

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