Contextualizing Blockchain Technology Within Information Systems and Institutions

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**Abstract**:

 Blockchain technology has exploded within the last several years with a variety of disciplines now exploring the potential of its implementation. Spear-headed by scholars including Victoria Lemieux as well as the San José State University iSchool, blockchain is now investigated through the lens of the information sciences. In this essay I summarize some of the major research regarding blockchain and its uses within information systems including the potential benefits and challenges of its implementation as explored by a variety of resources. Overall, these resources illustrate a hopeful, while skeptical optimism about the potential of this new technology while recognizing the ever-changing nature of this area of study. I examined a selection of essays and books that approach blockchain from a range of backgrounds from medical sciences, art and more. Despite coming from different disciplines, the authors have similar sentiments regarding blockchain.

**Introduction**:

 Blockchain technology, also sometimes referred to as distributed ledger technology or DLT, is a fairly new invention that allows information to be stored with its own record-keeping system that makes it difficult to alter its contents (Hirsch, 2020, p. 10). As Lemieux suggests, blockchain technology is a new, complex system which is heavily associated with, but not inherently tied to bitcoin (2018, p. 37). The ability of blockchain to store information and create records makes it an appealing resource for information professionals. With how new this technology is, however, there has not been enough research into the actual implementation of this technology within information systems; much of the academic material focusing on blockchain theorizes ways in which it could potentially be used instead. This is the case especially with non-fungible tokens and other related technology, and as is the case with technology, it will likely continue to become more complicated with time. In this essay, I attempt to provide a brief overview of some of the literature discussing current and future implications of blockchain technology within the information sciences. This is an important topic for information professionals as it could change the nature of archiving and record keeping in substantial ways.

**Literature Review**:

 Change is inevitable, especially within the discipline of information sciences, as professionals often rely heavily upon currently available technology in order to store and manage data and metadata. Within the last several years, a new type of technology has emerged that may change the field entirely. This new technology, blockchain, was theorized as a vehicle for the first major cryptocurrency, bitcoin, which was revealed by “a pseudonymous author” (Roth, 2015, p. 528) known as Satoshi Nakamoto in 2009 (Ghosh, 2019). Bitcoin may be the first association most people have with block-chain, especially with discussion in recent media and news outlets regarding various other types of cryptocurrencies within the last several years; the topic itself has become seemingly more mainstream. Within the last several years however, as evidenced by the American Library Association’s 2020 publication, *Blockchain*, professionals are beginning to question the potential of blockchain within specialized fields including information sciences. This ALA publication suggests that blockchain has a great deal of potential in information institutions but acknowledges that there are challenges that must be overcome before it has a place within the field (Hirsch & Alman, 2020, p. 12). The editors note that it is important for librarians to understand new technologies but suggest that they should also be cautious of new, “unproven technologies that would not be useful” (Hirsch & Alman, 2020, p. 12). Because this technology is so new and somewhat ambiguous, it can be a confusing concept to grasp. This is likely why much academic reporting on the subject begins by breaking the concept down into more simple terms.

 As outlined by Ghosh, bitcoin was revealed by Satoshi Nakamoto after the major financial crash of 2008 (2019). The concept was introduced as a way to conduct online transactions without the use of third-party systems such as a bank or other entity (Ghosh, 2019). While Lemieux asserts that blockchain has no “internationally accepted definition” (Lemieux, 2018, p. 34), Beck et al. define it as “a distributed ledger technology in the form of a distributed transactional database, secured by cryptography, and governed by a consensus mechanism” (2017, p. 381). Lemieux explains that blockchain operates as a series of nodes that connect with one another to form a network or ledger (2018, p. 34). Within the ledger, there is a series of blocks, each of which records and stores transactions or changes to the ledger (Lemieux, 2018, p. 34). When these changes occur, a hash composed of a series of random numbers is generated, effectively producing a signature (Lemieux, 2018, p. 34). As more and more hashes are created, they are strung together in order to create the blockchain (Lemieux, 2018, p. 34).

Especially with the effects of COVID-19, we have seen many resources and materials become available or more prevalent online and within a global context, blockchain seems to provide answers that many information specialists are looking for. Lemieux points out the desirability of a decentralized system within a globalized world, as blockchain can operate by essentially governing itself (2018, p. 34). O’Dair suggests that we consider “blockchain technology as representing the ‘internet of value (internet 2.0), as opposed to the ‘internet of information’ (internet 1.0)” (2019, p. 30). Blockchain currency itself is a global unit of value and in an increasingly globalized society, it may help us navigate our digital experiences. Coghill also examines how Satoshi Nakamoto’s concept of a “society where self-enforcing rules would supplant traditional laws” (2018, p. 68), could enable librarians to navigate disputes more easily with non-domestic entities (2018).

**Implementation of Blockchain:**

Dolan et al. suggest several ways in which different types of information institutions could implement this technology. For example, libraries specializing in law could work directly from primary sources as opposed to using a third-party organizational method (Dolan et al., 2019). The authors also suggest that public libraries could implement a “universal library card, which would retain a patron’s records across all participating institutions” (Dolan et al., 2019), requiring less personal and private information to be collected and stored by the library itself (Dolan et al., 2019). Some are already developing ways to use blockchain within information systems. Bell et al. have developed ARCHANGEL, a block-chain technology that intends to authenticate born-digital content such as videos and images (2019). In report on a presentation at the Special Libraries Association 2019 Annual Conference, given by Bohyun Kim and Sandra Hirsch, four traits of blockchain technology are outlined including decentralization, immutability, security and reliability (Zhang, 2019). Summarized, these traits enable blockchain to operate without the involvement of outside parties, store information regarding alterations to data as well as reliably prevent changes from unauthorized parties (Zhang, 2019). Specific uses for information centers addressed include the ability to keep data attached to specific objects as well as management for international transactions, library card implementation and more (Zhang, 2019). For professionals working with rare materials in archival settings, the ability to store information directly is useful for helping in issues of provenance (Zhang, 2019).

**NFTs and Arts Applications:**

 This past summer, Quirion addressed one aspect of blockchain that has exploded after an NFT, or non-fungible token, sold at Christie’s auction house for $69,346,250 in February (Quirion, 2021). This object is a photo collage by the artist known as Beeple, titled *The First 5000 Days*, which is the “first digital only artwork ever sold at Christie's auction house” (Patrickson, 2021, p. 587). As defined by Valeonti et al., an NFT is a “cryptographically unique, indivisible, irreplaceable and verifiable token that represents a given asset, be it digital, or physical, on a blockchain” (2021, p. 4). NFTs, as Patrickson explains, are digital objects which can only be rightfully shared by the true owner of the file (2021). In most cases, this involves a born-digital image such as a painting or graphic. The image may be copied and shared, but the true rights remain with the owner (Patrickson, 2021). Quirion brings attention to the metadata that is recorded in an NFT, which includes the “creator, date of creation, title of the piece, copyright ownership, property ownership, and any property ownership transactions” (Quirion, 2021, p. 11). This type of information is of special interest to archivists as it can be used to trace provenance and therefore establish value.

O’Dair also examines blockchain within creative industries like visual arts and music. His 2019 publication, *Distributed Creativity: How Blockchain Technology Will Transform the Creative Economy*, concerns blockchain specifically in its application in the creative economy (p. 17), which by the definition the author utilizes, includes many information institutions or those that house information systems such as “museums, galleries and libraries” (O'Dair, 2019, p. 18). These “creative economies” (p.18) handle copyrighted creative materials on a daily basis. Copyright is certainly a major concern for libraries and other information systems, especially with major shifts to digital-only or digital-born content such as eBooks, videos, and other media.

**Discussion**:

 Most writers seem cautiously optimistic about the potential of blockchain, with some such those heading the ARCHANGEL project as well as Lemieux coming across as seemingly more optimistic. There are a number of obstacles facing the implementation of blockchain, many of which are outlined by O’Dair including those that are economic, social, environmental, and legal in nature (2019, pp. 83-84). Lemieux seems to suggest that blockchain will completely change the way information systems operate. She outlines “computational archival science” (2018, p. 42) or CAS—a new discipline that is rising in response to many of these technological developments, which she describes as a “blend of computational and archival thinking” (2018, p. 42). As Bell et al. address, in our present day of fake news hysterics, conspiracy theories and other elements of a “post-truth” (2019, p. 3) era, it is sometimes difficult to trust or provide trust in digital content (2019). The authors report that they are able to detect dropped frames from videos and they suggest that their technology could be used to combat the use of deep fakes or other AI-generated content (Bell et al., 2019, p. 3). As time passes, this technology could likely become even more sophisticated as well. At present, the issues of cost and implementation are likely one of the biggest barriers. In institutions where funds are already likely heavily restricted, how does one convince a “university purchasing office to agree to and accept a Bitcoin/Blockchain transaction” (Coghill, 2018, p. 67).

 As discussed by Dolan et al., “in 2018, the Institute of Museum and Library Sciences (IMLS) provided funding to the San José State University iSchool (SJSU) to explore potential uses of blockchain in the library” (2019). According to their official website, SJSU began offering an online course in blockchain technology which began in March of 2019 and is still listed in their 2021-2020 academic catalogue (SJSU, 2021). The syllabus intends to teach students to do the following: “The goal of this course is to equip students to be blockchain engineers. After completion of this course, the student is expected to be versed in the various subjects of interest in cryptocurrencies and comfortable with the technologies needed.” (Austin, 2021). As evidenced by their course syllabus, the university seems to anticipate blockchain becoming an important element in the information sciences. Most of the research involving blockchain’s use within information systems seems to be associated with the university, including the essay I have examined here by their current graduate student, Alison Quirion (2021). San José State University may see positive results from their foray into blockchain, and it is possible that we may see dramatic shifts in other programs to include blockchain within its program offerings. The development of CAS as a discipline may create an entirely new job market requiring new skillsets. Lemieux argues that archivists “will become more adept at coding and more knowledgeable about computational methods” (2018, p. 41), though she does not dismiss the importance of “an appreciation of the contextual nature of records” (2018, p. 41), affirming that the information specialist is still necessary (2018).

**Conclusion**:

Blockchain is certainly catching the attention of many information specialists, though we may not see the effects of its implementation until farther into the future. Most disciplines seem to share a similar sentiment that blockchain could be groundbreaking, but that implementation is still uncertain and could be a costly or difficult process. Like many, I remain skeptical of this new technology, but I am now more cautiously optimistic about the opportunities it could provide, especially for record-keeping. With a greater understanding of how this technology works and can be utilized, information professionals from a variety of backgrounds and settings may find that this technology completely revolutionizes their day-to-day work. There has likely been more interest in blockchain and similar technology due to COVID and its effects on travel and in-person communications, but this is an area of research that is has yet to be fully explored from the perspective of information sciences.

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