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BLOCKCHAIN

EDITED BY SANDRA HIRSH AND SUSAN ALMAN

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FOREWORD

BY MIGUEL A. FIGUEROA

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FOR ITS 2019 GLOBAL BLOCKCHAIN REPORT,[1] DELOITTE SURveyed 1,386 senior executives in a dozen countries, finding that 53 percent of respondents view blockchain as a critical priority for their organizations and 83 percent see compelling use cases for blockchain in their sectors. Across news articles and reports, 2019 appears to have been the year when blockchain shifted from novel technology to something more viable that could provide solutions to problems across industries. And while this enthusiasm could be dismissed as part of a normal competitive business enthusiasm (the executives surveyed for Deloitte's report represented US companies with US$500 million in revenue or more and international companies with US$100 million or more), there is growing curiosity and interest in blockchain across healthcare, government, the art world, and telecommunications.

Blockchain grows out of Drs. Sandra Hirsh's and Susan Alman's experience with a project funded by the Institute of Museum and Library Services to investigate the possible uses of blockchain technology in libraries. What I appreciate about that project's process and eventual National Forum—and what I appreciate about this volume—is the mix of perspectives, enthusiasm, and skepticism that have been brought to

1. https://www2.deloitte.com/content/dam/Deloitte/se/Documents/risk/DI_2019-global-blockchain-survey.pdf.

this discussion. In so many ways, it represents a spirit of librarianship that recognizes the emergence of a new need or interest within the community and brings to bear a process of inquiry, reflection, and discernment to help understand libraries' roles in relation to that need. For those readers who bring an enthusiasm for technology generally or blockchain specifically, there will be much to find in this collection. For those who bring a healthy skepticism, so too, will there be contributions that reinforce and some that challenge our assumptions. And for those who hold an enthusiasm for libraries' ongoing development and adaptation, this collection provides an accessible introduction to a topic that many people are discussing and that we would all do well to be more informed about.

In line with the previous volumes in this series, editors and contributors have done important work to not only frame the emerging trend and issue, but to also root their discussion in fundamental and timeless library roles, purposes, and values.

"Understanding Blockchain" helps readers establish the fundamentals of blockchain technology, the risks and opportunities, and how it fits into broader movements in technology. Jason Griffey contextualizes the innovative importance of blockchain, focusing on the potential user-facing services and systems that this decentralized technology might provide. Bohyun Kim promotes the positive potential for the technology while also tempering enthusiasm with considerations for interoperability, scalability, security, energy consumption, and the very basic concern that libraries may not yet have compelling use cases to justify investments of time and money.

"Before the Hype" presses pause on ambitions to consider some of the issues still being sorted out for the technology. In addition to Todd Carpenter's consideration of standards, Dan Blackaby's legal

considerations, and Tonia San Nicolas-Rocca's security concerns, Toby Greenwalt provides a very practical perspective on the value trade-off in time, training, and infrastructure for operations that may improve existing library services and practices or challenge issues of trust, storage, bandwidth, and cost.

"For the Future" brings together eight speculative use cases that might improve operations and experiences in libraries. The range of uses spans academic libraries, instruction, and programming (MacKenzie Smith on scholarly communication; Heather McMorrow and Amy Jiang on credentialing); content, collections, and the organization of information (Timothy A. Thompson on metadata; John Bracken and Michael Della Bitta on born-digital content); administration and promotion of libraries (Annie Norman on assessment; M. Ryan Hess on community-based collections); and medical libraries and health information (Victoria Lemieux, health information; Frank Cervone on health records). While these contributions outline very specific use cases, they also help prepare a framework for thinking more broadly about how blockchain could change operations and practices in libraries and in the sectors around us.

Finally, a brief "For the Present" offers Link Swanson's thoughts for libraries' roles in educating communities about blockchain's possibilities.

Is a path forward with blockchain assured? Absolutely not. The conversation is still very much a debate. With this in mind, *Blockchain* is not meant to be a guide or manual, but a conversation starter. These contributions from experts and innovative thinkers will help strengthen our discussion and refine our prioritization for this technology.

BY SANDRA HIRSH AND SUSAN ALMAN

INTRODUCTION

An Investigation of Blockchain Applications: Beginnings and Implications

BLOCKCHAIN HAS GENERATED A LOT OF BUZZ DUE TO THE potentially disruptive and transformative possibilities it offers. It is clear from the expanding literature that blockchain technology is on the brink of revolutionizing the public and private sectors. Conferences, books, white papers, start-ups, and numerous back-channel discussions have explored the ways blockchain technology can address seemingly endless processes. The extensive media coverage of the growing popularity of blockchain technology, and their predictions of its being a game changer, caught our attention, and we began to think of possible blockchain use for library applications and how this could be investigated. As we looked into it more, we discovered that blockchain technology was being discussed widely, but without clear directions for library applications.

As we started exploring blockchain possibilities, we were frequently asked: can you please provide a *simple* explanation of what blockchain is? The problem is that blockchain, as a new and emerging technology, still feels like an abstract concept. Blockchain still has very few actual implementations, which makes it hard for many of us to get our minds wrapped around what it is, how it can be used, and why people are so excited about it.

Simply put, blockchain is a decentralized and distributed ledger technology (DLT) that has no central authority. It is used to record (and store) the same information in a block across many computers.

These blocks are linked together in a chain. A record cannot be altered after it is created unless the majority of users agree to make the change in the chain or blocks. As Darra Hofman, one of the experts who participated in our blockchain project and a PhD candidate at the University of British Columbia, explains: "A blockchain is basically a distributed database where lots of different parties can read and write transactions to the database. Instead of a third party checking those transactions, the blockchain has a built-in consensus mechanism that checks transactions to make sure they're good (that I have the $20 I just tried to spend, for example)."[1]

Each record that is put into the chain is given a unique digital signature created by a cryptographic hash function or algorithm; this acts like a digital fingerprint. In addition to a hash, each block in the blockchain also includes the hash of the previous block, a timestamp, and data about the proof-of-work algorithm (this is how new blocks are mined and verified). This creates the "chain" part of the blockchain. This is also what makes blockchains hard to tamper with, because if anything changes in any of the blocks (even if it is just the deletion of a period), this changes the hash (the unique identifier) of the block, which then breaks the blockchain.

The information in a blockchain cannot be changed unless the majority of users in this decentralized group agree to it. If there is no agreement, then the record reverts to its original value. This feature has enabled blockchain to be a trusted and reliable technology. There are instances from cryptocurrency blockchains where more than fifty percent of the network was controlled by members who could make changes or block new transactions from taking place or being confirmed. A 51

1. https://americanlibrariesmagazine.org/2019/03/01/library-blockchain-reaction/.

percent take-over is less likely to occur in a private or permissioned blockchain where users are not able to participate individually. Centralized organizations like libraries are most likely to use permissioned or private blockchains.

As we learned more about blockchain, we wondered if the buzz over it was all hype, or whether the technology could be used effectively in libraries and information centers. To answer this question, in 2017, San José State University's (SJSU) School of Information secured a grant from the Institute of Museum and Library Services to launch an eighteen-month examination to explore the ways that libraries can utilize blockchain for practical library applications while the implementation of the technology is still in development. An advisory committee helped to develop the scope of the project, which included five main components: (1) develop recommendations on the future uses of blockchain technology within the information professions; (2) create a *Blockchain* blog[2] and website; (3) offer a free virtual conference, called Blockchain Applied: Impact on the Information Profession;[3] (4) engage in deep discussions with leading experts at a National Forum,[4] an invitational gathering to discuss the feasibility of blockchain applications in libraries; and (5) develop and offer a blockchain MOOC (massive open online course).

Through this process, we have discovered that blockchain technology has many potential applications in libraries. However, the path forward includes a number of issues and tasks that must be resolved. This book includes a compilation of what librarians and information professionals need to understand about blockchain technology, and offers several speculative visions for how blockchain could support the core work

2. https://ischoolblogs.sjsu.edu/blockchains/blog/.
3. http://www.library20.com/page/blockchain.
4. https://ischoolblogs.sjsu.edu/blockchains/national-forum/.

of libraries. Librarians need to understand new technologies in order to determine which ones will improve operations and services, while also avoiding new and unproven technologies that would not be useful.

As a next step in this project, we plan to develop models that will indicate if blockchain applications in library settings are feasible and scalable. These pilot projects will allow librarians to experiment with real-life examples. Blockchain is currently an unproven technology for the information profession, with many advocates, skeptics, and opponents. We have a professional obligation to examine this technology's potential applications in order to make informed decisions about it. The essays in this book are written by information professionals who have interest and experience in blockchain technologies, and who offer their ideas for exploration and consideration. We invite you to explore their ideas in this book, and also contribute to the Blockchain blog at https://ischoolblogs.sjsu.edu/blockchains/.

ABOUT THE EDITORS

DR. SANDRA HIRSH is director and professor of the School of Information at San José State University. She is a past-president of ASIS&T and is the president-elect of ALISE. Her research interests include information seeking behavior, online education, and LIS education, and she was the co-PI of the IMLS-funded blockchain investigation. Hirsh cofounded and cochairs the global virtual Library 2.0 conference series.

DR. SUSAN ALMAN is a member of the San José State University School of Information faculty. Prior to this appointment, she taught at the University of Pittsburgh's School of Information Sciences and the University of Michigan. She was the co-PI in the IMLS-funded project, Investigation of Possible Uses of Blockchain Technology. Alman's areas of interest are in online teaching and learning, foresight studies and emerging technologies, marketing/PR, and interpersonal communication.