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An exploratory study in blockchain knowledge, perceptions, overconfidence, and optimism

Carl Rebman, Jr., *University of San Diego, carlr@sandiego.edu*
Carol Sargent., *Mercer University, sargent_cs@mercer.edu*
Jennifer Breese., *Pennsylvania State University, jzb545@psu.edu*
Queen Booker., *Metro State University, queen.booker@metrostate.edu*

Abstract

Blockchain has experienced much attention as a new and innovative technology full of promise and solutions. As in the case with data analytics, people are so excited about the possibilities with blockchain that they are talking about its uses without knowing and understanding the technology. In this manuscript, we offer a primer on blockchain for non-technical audiences, including definitions for common jargon terminology and ideas about how various industries use this technology. Survey evidence is also presented calling further attention to what the blockchain "buzz" has contributed to a public misunderstanding what blockchain and the newest technological term 'bitcoin' are and how they work. We surveyed 97 participants, demonstrating that public perception exceeds actual knowledge of blockchain database technology. The findings suggest participant actual knowledge is more related to optimism for the future of blockchain than perceptions. Respondents were more excited and positive about the future of blockchain than bitcoin. This work adds to the literature by addressing that perceived knowledge about blockchain exceeds actual knowledge (overconfidence), and that perceptions about the future of this technology lean towards uses in organizations versus currency applications.

Keywords: blockchain, bitcoin, distributed ledger, technology adoption, cryptocurrency

Introduction

Blockchain technology was first introduced in 1991 and started to generate global attraction in 2008. Many consider the Bitcoin application to be the catalyst that started the propulsion into the minds of practitioner and academic researchers (Bonneau et al., 2015). However, blockchain is a technology that is much more than the Bitcoin currency application, even though people sometimes confuse the two terms (Gamage, et al., 2020). Blockchain networks have gained tremendous popularity for their capabilities to provide immutable distributed ledgers as well as platforms for data-driven autonomous organization (Wang et al., 2019). Many organizations are utilizing or developing plans to utilize blockchain technology (Powell, et al., 2021). While the headlines point to what the technology may offer, the basic understanding of the jargon and features of blockchain are less known. As these special databases begin to find more applications in commerce and public records, a basic understanding of the technology can help consumers and managers decide when and how to engage these unique databases and digital currencies based on them.

In this work, we offer a primer on blockchain for non-technical audiences, including ideas about how various industries use this technology and what typical jargon terms mean. We also present survey evidence that blockchain buzz has created an illusion of comprehension about what blockchain and bitcoin are and how they work. By providing a general overview on how blockchain works, we offer a way to close the gap between perception and actual knowledge about this technology.

Blockchain Basics

Blockchain is a unique database with transaction history "distributed" (i.e, shared across all participant computers called "nodes") in real time. Transactions added to the chain are verified typically for a "mining" fee by chain participants prior to encrypting into blocks that are "immutable or that cannot be changed" (Desplebin, Lux & Petit, 2021). The real time access to events and immutable databases provides opportunities for a wide range of uses across many industries as well as investments, such as crypto currencies or "coins." The possibilities for blockchain are growing at a staggering rate, as shown in Figure 1 that displays the estimated market value of blockchain (Statista, 2022):

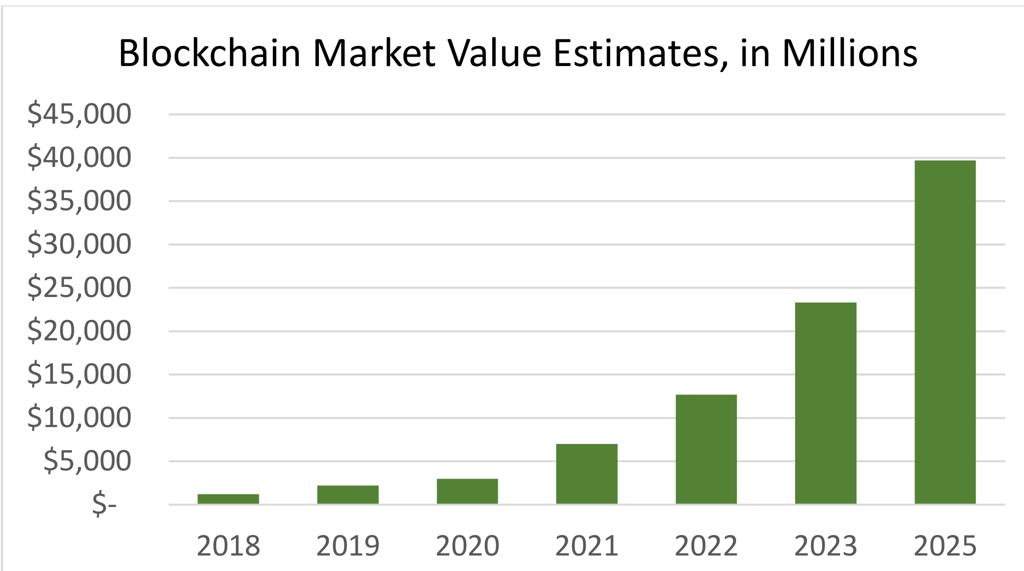


Figure 1: Estimated market value of blockchain worldwide by year (Statista, 2022)

Information can provide a competitive advantage, and so the ability to share data in real time across a consortium of business partners permits cooperation about what to produce, how items are traveling, and how much is demanded (Ramaswamy, 2020). Ramaswamy adds that blockchain can be coded with "smart contracts" to release funds after the chain verifies specified activity while the software acts as a bank or escrow. Self-executed, coded agreement that delivers guaranteed payments can revolutionize financing, especially for small firms with less access to funding. The key innovations of blockchain include the following listed below (O'Leary, 2017):

- Encoding rules into the database ("smart contracts")
- Cleaner ("verified") real-time data
- Highly (but not perfect) tamper resistance data ("immutable")
- Data protection (duplicates exist if failure at one node)

Blockchain Technology Terminology

Blockchain technology literature is full of jargon, making it difficult for the general business audience to keep up with current news and literature. Understanding the terminology is important because it helps indicate how the technology can be beneficial and applied to different industries and uses. Exhibit 1 below explains terms and features of blockchain terminology in non-technical language.

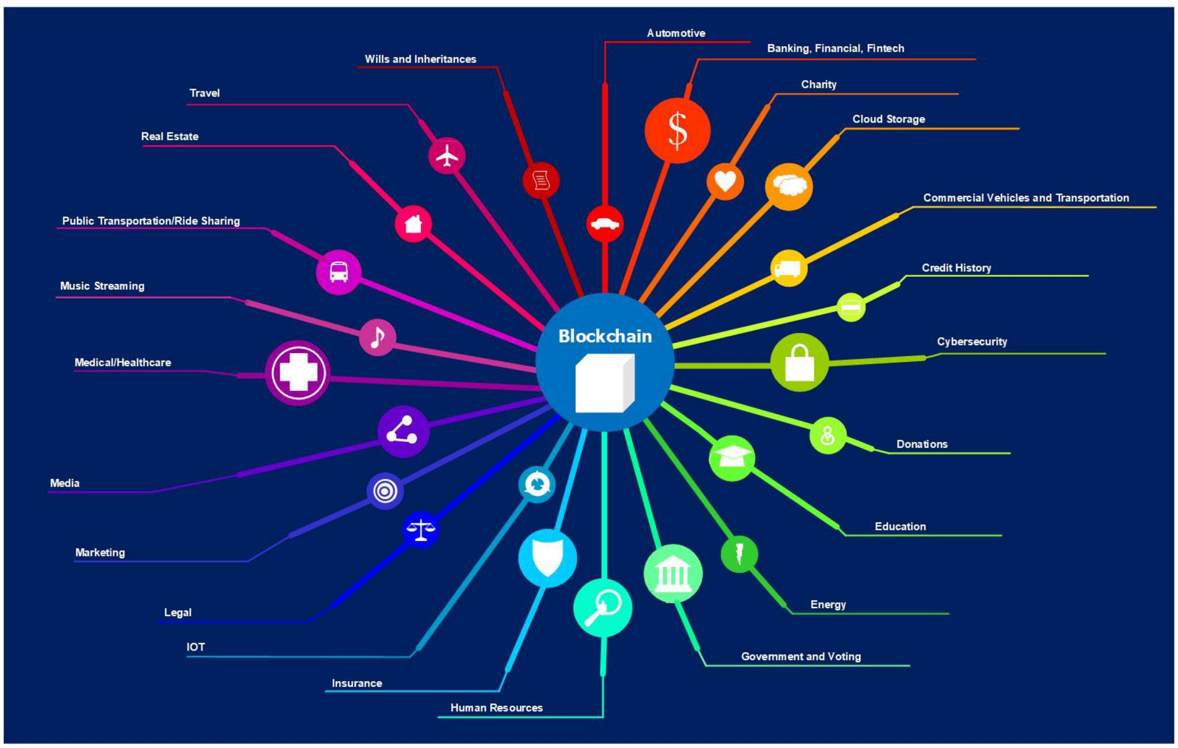
Exhibit 1 Terms and Features of Blockchain

Term or Feature	Brief explanation
Immutable	*Data base contents are encrypted into a block. Changes to that block require massive resources and agreement across the chain.*
Trustless	*The blockchain makes it easier to trust the details of activity on chain (verified by others) and contract terms will be executed as agreed (since automated).*
Unstoppable	*Once the conditions are set (coded into the chain)*
Executable code (smart contracts)	*One or more outcomes are encoded in the software and are executed once criteria is met (e.g., shipment arrives so payment sent without need to request payment).*
Real time access	*Each "node" (computer) can view the data in real time, giving visibility to all chain participants*
Chain rules changed by consensus	*Blockchain data and chain rules can be changed only by consensus of the participants, meaning "immutable" is not absolute.*
51% attack	*In any blockchain, 51% of the participants can decide to change rules or events on the chain. This causes a "fork" creating a new database supported by the majority.*
Private key	*Participations have a private key that verifies their identity. Without this key, participants cannot access the node (i.e., verify their authenticity).*
Verifiers	*Each chain decides how many participants must "verify" transactions (e.g., Ethereum requires 20) before encryption onto a chain. This is called consensus verification. It reflects a consensus of verifiers, not consensus of participants.*
"Miners" who consume computer resources to encrypt a block	*Miners use substantial computer resources to encrypt transactions into an immutable block (with mathematical algorithms). Miners in cryptocurrency earn payment for their work (and electricity consumption) in tiny fractions of a coin.*
Append only	*Participants can add but not delete or change data.*
Resource intensive	*The "mining" (i.e., encrypting the data into blocks) uses substantial electricity and computer resources.*
Public blockchain	*A decentralized network of computers open to anyone wanting to view or submit a transaction.*
Private blockchain	*Blockchains that belong to a consortium in which a central party invites participants and administers the chain.*
Hybrid blockchain	*A combination of public and private blockchain.*
Sidechain	*A blockchain running parallel to the main chain and improves scalability and efficiency.*
Document retention	*All transactions are "chained" to prior blocks and cannot be retired or purged as part of document retention plans.*
No centralized data storage needed	*All participants have an original copy so backup copies are not needed.*
Centralized (permissioned or private chain) vs.	*A traditional database has an owner who administers access, backups, and rules for add/delete/append. The owner can change*

decentralized control (changes by consensus)	*the rules and knows the identity of those with access. A blockchain database can be permissioned (private, centralized owner) or non-permissioned (original author sets rules and changeable by consensus).*

Uses/Use Cases by Industry

Blockchain has the potential to dynamically revolutionize many industries (O'Leary, 2017). Kevin Doubleday of Fluree.com (2018) summarized a vast range of these different areas that could be dramatically affected by blockchain. Figure 2 below illustrates the possible uses by several industries (Egbedion et al., 2021):



Automotive – Track history of vehicle from pre-production to sale. Manage parts in supply chain based on demand.

Banking, Financial, Fintech – Efficient and secure payment processing. Enable global transactions without foreign currency issues. Transactions cleaned of honest errors during verification process.

Charity – Tracking donor activity, share mission outcomes, improve accountability and donation payment processing.

Cloud Storage – Allows crowdsources of unused cloud storage, higher security for centralized networks, stronger security for decentralized networks.

Commercial Vehicles and Transportation- Ability to tracking routes; combined with IoT for gathering drive data.

Credit History – More complete, accurate and accessible credit reports.

Cybersecurity – Ability to deter changing of encoded data by hackers and reduce threat of single point of failure (e.g., DDoS attack).

Donations – Provide secure trail for donations to deter fraud. Ensure crowdfunded campaigns receive donations and contributors are recognized.

Education- Digital academic credentials. Federated record of academic information specific, to class, professor, and student.

Energy – Bypass public utility with cheaper, peer-to-peer energy feeds. Enable smart utility metering.

Forecasting – Decentralized forecasting with machine learning algorithms.

Government and Voting – Provide efficient, digitized, and verified audit trail to reduce voter fraud. Increase accountability and compliance for government agencies. Identity validation of citizen data.

Gun Safety – Track gun ownership/possession data. Track criminal ID history including firearm purchase activity.

Human Resources – Efficient and complete verification of background, identity, and employment history. Use of smart contracts for payments and benefits.

Insurance – Streamline multi-party contracts and claims adjudication. Reduce disputes with open agreement of shared data.

IoT – IoT contributes transactional data to blockchains. Sensing and encoding environmental data may benefit many industries (agriculture, transportation, medical, supply chain).

Law Enforcement – Improved chain-of-custody data with time stamps, evidence, resist to alterations.

Legal – Encoded auto-executing contract rules (smart contracts) increasing trust and contract settlements. Improved accessibility for relevant parties.

Marketing – Bypass intermediaries, cost-effective advertising possible.

Media – Control of authorship and owner's rights. Better protection against piracy/copyright infringement. Improved artist compensation/legal proceedings with smart contracts. Utilizes payment processing that is cryptographic, secure, and anti-3rd party (this opens up content availability internationally).

Medical/Healthcare – Provide pharmaceutical supply chain integrity. Patient databases, claims adjudication, and medical supply chain management possible. Transparent and automated patient-to-hospital or patient-to-doctor data capture. Auditable trail of data exchange for clinical trials. Efficient, private , and shareable patient health data.

Music Streaming – Identify illegal downloading of music. Provide compensation for purchased music to artists.

Public Transportation – Capture more detailed public transportation activity to better understand payment for rides, utility consumption, and maintenance needs.

Real Estate – Better title records, including the range of records kept and transfer between owners. Digitalized ability to verify owners and property history with less paperwork and professional time.

Travel – Capture passenger identity, boarding, passport, payment, and other activity digitized and verified. Digitize loyalty programs.

Wills and Inheritances – Encoded data indicates automatic asset assignments upon death through smart contracts.

Perceived knowledge versus actual knowledge about blockchain

As an exploratory study, we surveyed a convenience sample of 97 participants to see if perceived knowledge of blockchain corresponded with actual knowledge of blockchain. Furthermore, we investigated if actual knowledge was related to how' bullish' participants were about the future of blockchain and cryptocurrencies.

Methodology

Participants

Participants were recruited through an electronic link provided to undergraduate classes at four different universities across the U.S. and a posting in LinkedIn and Facebook. The 99 responses were decreased to 97 due to two incomplete responses.

Materials

Participants indicated their gender, region, and level of education. Each answered nine questions about blockchain technology and rated their opinion of the future of blockchain technology on a seven-point Likert scale. The participant attributes are provided in Table 1 below. Most respondents fell either in the undergraduate range (21%) or the post graduate range (21%). The respondents' gender was uneven with males (58%) outnumbering females (37%) and other/prefer not to say (3%). Most respondents came from the west coast (California 62%), followed by NE (14%), SE, (16%), NW (2%), MW (3%), and SW at (2%).

		Percent
Gender:		
Male	58	60%
Female	36	37%
Other/Prefer not to say	3	3%
Education:		
Some college	41	42%
Associate degree	3	3%
Undergraduate degree	20	21%

Some graduate courses	3	3%
Graduate level certificate or less	2	2%
Graduate degree MBA	4	4%
Graduate degree specialist master	5	5%
Post Graduate degree	19	20%
Law	0	0%
Region:		
NE	14	14%
NW	2	2%
MW	3	3%
SW	2	2%
SE	16	16%
W	60	62%

Table 1: Participant attributes (N=97)

Measures

Perceived blockchain technology knowledge was measured on a four-point scale, from "I know it very well" to "I have heard about it." The mean response was 2.866. See responses to this item in Table 2 bekiw.

Rate your current blockchain understanding:	count	percent
I know it very well	9	9%
I know it well	15	15%
I know very little	53	55%
I have heard about it	20	21%
	97	100%

Table 2: Perception of blockchain knowledge

Actual blockchain knowledge was measured using nine questions for a total score from 0 to 9 (each item is worth one point). The mean for all responses was 5.062. The questions, answers, and participant responses are shown in Table 3 below.

Survey question (correct answer):	% Correct
1. Is blockchain the same as Bitcoin? (no)	89%
2. When a record is on a blockchain, who can access it? (Multiple people)	50%
3. Once the records are submitted on a chain, can they be altered? (no)	59%
4. Is it possible to record transaction automatically? (yes)	73%
5. Are blockchains fully public? (It depends)	42%
6. Who was blockchain invented by? (A. Satoshi)	57%

7. Where is bitcoin central server located? (None of the above, no central server)	63%
8. When was blockchain technology implemented? (2008)	44%
9. What was the blockchain file size in August 2014? (20 GB)	31%

Table 3: Measure of actual blockchain knowledge

Optimism about blockchain and cryptocurrency were measured using a seven-point Likert scale with the responses reported in Table 4 below.

Optimistic about the future of blockchain	count	percent
Strongly agree	26	27%
Agree	36	37%
Somewhat agree	17	18%
Neither agree or disagree	11	11%
Somewhat disagree	4	4%
Disagree	3	3%
Strongly disagree	0	0%
	97	100%

Optimistic about the future of bitcoin	count	percent
Strongly agree	17	18%
Agree	21	22%
Somewhat agree	31	32%
Neither agree or disagree	12	12%
Somewhat disagree	11	11%
Disagree	4	4%
Strongly disagree	1	1%
	97	100%

Table 4: Perceived optimism of future of blockchain/cryptocurrency

Analysis of perceptions versus knowledge and optimism about blockchain and bitcoin

We tested if perceptions of blockchain knowledge differed from actual blockchain knowledge measured by the nine questions (Pearson correlation = -.164, p=.11). Perception and actual knowledge differed significantly (t=-9.28, p<.001). The perceived knowledge mean was closest to "I know it well" (mean 2.866 and "I know it well" = 3). The actual knowledge mean was 5.062 (out of 9 points possible, 62.4% correct). This indicates that perceptions ran considerably higher than actual knowledge about blockchain.

In an ANOVA, we tested to see if optimism about the future of blockchain correlated with optimism about bitcoin. Optimism for the future of blockchain differed significantly from optimism about bitcoin (F=11.29, p<.001). As a follow up, we ran a second ANOVA to see if actual or perceived knowledge were more strongly related to optimism about blockchain and cryptocurrency. Actual knowledge was significantly related to optimism about blockchain (F=5.15, p=.03) but not perceived knowledge (F=.01, p=.93). Neither actual nor perceived knowledge were significantly correlated with optimism about bitcoin (F=.76, p=.38 and F=.002, p=.96, respectively).

Discussion

We offered a primer on the basics of blockchain, including definitions for common jargon and non-technical discussion about a wide range of use cases for blockchain technology. Afterwards, we explored how perceived knowledge about blockchain compares with actual knowledge, including how both measures of knowledge correlated with optimism about the future of blockchain and bitcoin. We found that perceptions of knowledge about blockchain ran higher than actual measured knowledge based on nine basic questions, a pattern we call "overconfidence." This supported the need for a basic primer for non-technical audiences to help align perceived and actual knowledge. Non-technical audiences may need basic terminology to participate and support in wider scale adoption of blockchain, which is likely on the horizon.

The results indicate that while most participants did not have much knowledge of blockchain, they are quite bullish on its future. This seems to mirror the perception of blockchain technology in general. Optimism for blockchain was not uniform across both applications surveyed. Optimism for blockchain ran significantly higher than for bitcoin. To delve into the concept further, we correlated perceived and actual knowledge with participants' optimism about blockchain and bitcoin's future. Actual knowledge was highly related to their prediction of blockchain's future but neither measure correlated with predictions about bitcoin's future. This indicates that opinions about bitcoin's future may be based on a combination of asset-risk and emotional measures rather than based on how the technology works. Optimism about blockchain database uses were significantly related to actual knowledge (but not perceived knowledge). This is good news for technology adoption, as increasing actual knowledge about this technology could increase optimism about the benefits of implementing blockchain technology in organizations and public chains.

This paper introduces to the literature the possibility that overconfidence in blockchain technology (where perceived knowledge exceeds actual knowledge) impacts optimism about the technology. Balasubramnian and Sargent (2020) found that overconfidence of financial literacy led to weak decisions. Overconfidence, optimism, and attitudes towards the benefits of this unique database technology may influence decision makers and users in discussions about adoption and utilization of blockchain across a wide range of tasks. As an exploratory study, we signal that overconfidence may be a variable of interest in future research.

Limitations and future work

The results of this survey are limited due to a low sample size and that the convenience sample included a high percentage of students. The perception could change considerably if respondents were employed in various industries and if they did not have the same exposure to information systems trends in their coursework. Future work may recruit a participant pool with more diversity, especially with more employment history.

This study did not ask any of the participants if they would invest in bitcoin or cryptocurrency, which may impact their responses. The survey was distributed during summer 2022, right after bitcoin values dropped nearly 50%, potentially influencing participants' opinion of the future of bitcoin. Our measure of actual blockchain knowledge may have included minor questions (i.e., date of blockchain use) rather than deeper understanding of the database features and uses. A future work may fine-tune this measure and re-test its correlation with perceptions, optimism, and intentions to adopt. The measure for perception of knowledge may also be fine-tuned to include several levels so that the measures of perception and actual knowledge use the same seven-level scale.

Conclusion

This research contributed to the literature in several ways. First, it offered a primer on blockchain, including explaining jargon in non-technical language and showing a wide variety of potential use cases. Second, we present survey evidence of a patten of overconfidence in blockchain knowledge. That is, actual knowledge was considerably lower than perceived knowledge about blockchain. Actual knowledge was related to optimism of blockchain future. Overall participants were quite positive about the future of blockchain and bitcoin, with blockchain showing more optimism. Positive perceptions should be helpful for those organizations seeking to embark on a blockchain initiative. This paper guides those who are looking for a better understanding of the terms and uses of blockchain.

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