Commentary

# The Challenges and Trends of Deploying Blockchain in the Real World for the Users' Need

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**Abstract**
Blockchain technology is a decentralized and open database maintained by a peer-to-peer network, offering a "trustless trust" for untrusted parties. Despite the fact that some researchers consider blockchain as a bubble, blockchain technology has the genuine potential to solve problems across industries. In this article, we provide an overview of the development that Blockchain technology has had in 2018 and point out the challenges of deploying blockchain-based applications in the real world from a Human-Computer Interaction view. We propose that blockchain practitioners should design blockchain applications from users' perspective, think about who the users are, and what they need. Furthermore, we also lay out possible future trends for blockchain based systems.

**Keywords:** blockchain, decentralized, human centered design, human-computer interaction, real world applications.

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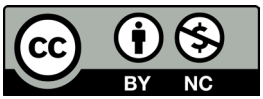

## Introduction

Blockchain technology is mainly known as the technology that supports cryptocurrencies. However, cryptocurrencies are just one of the possible Blockchain based applications that may exist. Blockchain technology is a distributed ledger that verifies and perpetually records the transactions on a distributed peer-to-peer network. Blockchains are used to solve the trust issues among different parties. Researchers and practitioners utilize blockchain technology to solve the existing difficulties in different areas, such as financial institutions, manufacturing industry, and public governance. Although blockchain technology has great potential to revolutionize internet systems and reformulate the industry and economies, only few blockchain-based systems successfully developed (Lavazova et al., 2019). People seldom use blockchain-based systems, and blockchain technology does not play an important role in the real world. Currently, most blockchain researchers focus on introducing blockchain technology in different scenarios or improving the deep infrastructures of the blockchains, while the studies on the users and the potential users of the blockchain systems are limited. It can be said that humans are one of the most important players in a system. A system will be worthless until people actually make use of it. The state of affairs has attracted the attention of numerous Human-Computer Interaction (HCI) researchers to form workshops in order to identify the fundamental human challenges requisite in interactions with blockchain and distributed ledger technology (Elsden et al., 2018; Lavazova et al., 2019). The goal of both workshops is to help blockchain based systems to address people's (including developers and end-users) needs. Still, the necessity to integrate the blockchain technology into user-centered interactive systems calls for an essential challenge for design and engineering. In this commentary, we will review key developments of blockchain technology and provide a guideline for the upcoming blockchain features in 2019 from an HCI perspective.

## Blockchain technology

The concept of blockchains originated from the studies of Nakamoto (2008) that experimented with cryptography to link the current transaction data, called block, to the previous block by recording its cryptographic hash and timestamp. Blockchains ask different computers in the network to help verify the transactions and maintain the network, and these computers are called "node". The blockchain technology cannot be dissociated from the electronic cash system until Buterin (2014) proposed Ethereum that allows the developers to create

consensus-based applications. The applications, also known as smart contracts, allow the performance of credible, trackable and irreversible transactions without third parties. Given that Ethereum helped to reduce the difficulty in developing Blockchain applications, blockchain technology started to develop vigorously.

Blockchains can be separated into two kinds of protocols based on the different types of participants in the blockchain network: "public blockchains" and "permissioned blockchains". Public blockchains, like Bitcoin and Ethereum, enable anyone to become the nodes to verify the transaction. While the permissioned blockchains, such as Hyperledger, only allow the parties which are identified and have permission joining the network. Although permissioned blockchains have better capacity and higher speed than the public blockchains, it hard to say which protocol is better than the other, as the node sizes and end-users are different.

**The state of blockchain in 2018**

Compared to the early years of blockchain technology, enterprises focused more on applying blockchains than exploring them (Deloitte, 2018). Blockchains kept growing in popularity as people across multiple industries found new applications for it in 2018. Researchers and practitioners announced that they had advanced in blockchain applications. Both public and permissioned blockchains made remarkable headway. In the following section, we are going to outline different blockchain applications in different industries in 2018.

**Blockchain in financial services**

The financial sector was the first industry to explore blockchain technology. Beyond cryptocurrency, blockchain technology can be used in other financial services, such as foreign exchange, insurance, and loan. Both public blockchain and permissioned blockchain had a breakthrough. For permissioned blockchains, banks tried to unite to create blockchain platforms that can reduce the operation fee of foreign exchange and bilateral payments. For example, Goldman Sachs and Morgan Stanley used IBM's permissioned blockchain to reduce the cumbersome bilateral payments operations (Baydakova, 2018). Blockchain researchers also used blockchain and IoT for car auto-insurance claim and adjudication (Oham et al., 2018).

**Blockchain in government**

Governments also have a massive interest in Blockchain technology. They have used the technology for voting, land registry, and digital

identity. Since blockchains cannot be manipulated by a single party, even the government, it helps citizens to trust the governments more which can result in a reduction of corrupt officials. For example, West Virginia government allows its citizens who serve outside to mobile vote through blockchains and digital identity technology (Nguyen, 2018). India also used blockchain for land transform, avoiding local official accepting bribes (Kshetri & Voas, 2018).

The use of Blockchain technology in the public sector represents one highly effective way of providing reliable services, at low cost, based on open and transparent technology for all participants, gaining trust (where is not) in public institutions and effectively combats corruption.

Blockchain has been applied to public policy solutions also in Mexico. In March 2017, the World Economic Forum (WEF) presented a case study on corruption in Mexico, where it issued as a recommendation the development of applications based on Blockchain technology, with the aim of increasing transparency, to ensure the authenticity of public information and improve public confidence in the government (World Economic Forum, 2017). This initiative lead academics, practitioners, and people in government to start designing a national Blockchain strategy (currently under consideration with Mexico federal government) where the technology could be used to fight corruption at scale (Savage et al., 2019). This initiative has started to gain traction from Blockchain accelerators across the world, such as Mousebelt, where they are all working together to design Blockchain based systems that use smart contracts to oversee the progress of infrastructure projects, and ultimately help curb corruption.

**Blockchain in social good**

Blockchain, cannot only impact commercial usage, but it also makes some contributions in social good. Charity or government organizations can use blockchain to trace how they use the funding for helping those in difficult situations. For example, Mexican immigrants remit a lot of money to their hometown for community development, but they have low faith in the government, and thus the contribution is limited (Chiang et al., 2017). Therefore, researchers built a blockchain cooperation platform for community developments (Chiang et al., 2018a). The platform helped the immigrants, citizens, and governments supervise the process of community development.

**Blockchain in the supply chain**

Blockchain records all the transactions, and the records cannot be removed. Companies integrate IoT into the Blockchain to record the

production steps. They build accountable systems for the supply chain. It is easy to find out which process is erring when customers receive poor quality products. For example, Walmart collaborate with IBM, asking its suppliers to record the water quality, temperature when plant and transport mango (Kamath, 2018).

**Challenges about blockchain**

Despite the fact that researchers and practitioners promise a great vision for the blockchain applications, the public seldom uses the application based on the blockchain technology. Not only the blockchain infrastructures but also user adoption is also a key issue that blockchain practitioners have to take into consideration. In this section, we present the challenges of blockchain's widespread adoption from the HCI perspective.

**Users of blockchain applications**

Before starting the blockchain applications design, practitioners have to consider who the end-users of the system is and whether they need blockchain to solve their problems. Despite the blockchain technology are used in different industries, the common point of these applications is to solve the trust problem from the system. For example, Tian (2017) proposed a supply chain traceability system to make the end-users believes the food is safe. What is more, the original intention of blockchains is to replace centralized middleman in transactions or agreements. It is true that centralized middleman can be corrupt and can misappropriate the agreements. However, it does not perform that the public does not trust centralized organizations. The report (Edelman, 2012) revealed that 79% of the public trusted the technology companies, and only 45% public trusted in financial institutions, but only 18% trust blockchain technology more than large financial institutions (Noto, 2017). Although blockchains are committed to providing "trustless trust" (Werbach, 2018), how people trust is the main issue for spreading the technology at scale if the public relies more on the system than in the blockchain technology, the blockchain applications are more difficult to promote.

Therefore, blockchain applications will flourish in areas where people have less faith in the original system, such as public governance, media, and financial services. Government organizations can use blockchain to build transparency, accountability, and civic participation platform to increase citizens' trust in the governance systems (Chiang et al., 2018a). Due to the transparency of the blockchain, citizens can

clearly understand when and why any government agencies execute the strategy. Therefore, the Open Government Partnership (https://www.opengovpartnership.org/) recommends that the affiliate countries should invest in Blockchain Technology as a way to promote OGP principles to improve the co-creation of high-quality governance and dialogue between societies.

Blockchain for media helps the socially vulnerable groups outspeak their opinion without the bother from centralized organizations. For example, Tucker and Pang (2018) reported that Chinese "#MeToo" activists document stories on the blockchains to avoid the suppression of the Chinese government.

**The boundaries between blockchain networks and real-world**

Current blockchain networks are not sufficient to address the needs of intended users. The two main technical problems of using blockchain in the real-world are the re-intermediary and the oracle problem. The Re-intermediary problem refers to the fact that the public still needs a middleman to get connected to the blockchain as they cannot easily access the blockchain networks. For instance, looking at the example of what is taking place in the food supply chain Kamath (2018) reported that Walmart reduced the time for tracking mango origins through IBM's Hyperledger Fabric. Hyperledger Fabric is a permissioned blockchain network, which only allows for the permission parties to verify and view the data. In other words, the public cannot discern the truthfulness of the information directly. The public has to rely on these permission parties, such as Walmart and IBM, revealing the information on Hyperledger Fabric to know the source of mango. From customers perception, they still have to believe centralized organizations. Using blockchain, in this case, draws no difference with using centralize databases or distribute databases across companies.

Oracle service is a data carrier which provides off-chain information to blockchains. Blockchain-based applications (smart contracts) generally do not have any information about the real world. However, they do require such information to initiate the contracts. For instance, a flight insurance smart contract assures the customer's flight will not delay. If delayed, the contract would compensate for the customers' damages. To trigger the contract, the application has to identify whether the flight was delayed or not. Thus, they need oracle service to obtain information from external APIs. However, most oracle services are centralized, which create another reintermediation problem, and can only handle simple information provided by APIs.

To solve the reintermediation problem, the permissioned blockchain providers have to delegate their capability of control to the public, allowing the public to supervise how the data creates and inputs to the network. The public blockchains have to reduce the block sizes and improve the mobile blockchain applications so that the end users can easily access the information on the blockchain without the middleman. For the oracle problem, researchers can integrate the blockchain with IoT (Internet of Thing) to provide authentic data, or probe into the design of decentralized oracle service through human powered, such as the people they trust or crowd workers. For example, Chiang, Kasunic and Savage (2018b) proposed ChainGov, which allows immigrants' family and friends help immigrants to supervise how the government uses the funding, shown in Figure 1. Despite researchers always employee crowd workers for simple tasks, there is some tool to train crowd workers to do more complex work (Chiang et al., 2018b). We believe integrating blockchain with crowdsourcing can solve more complicated oracle request in 2019.

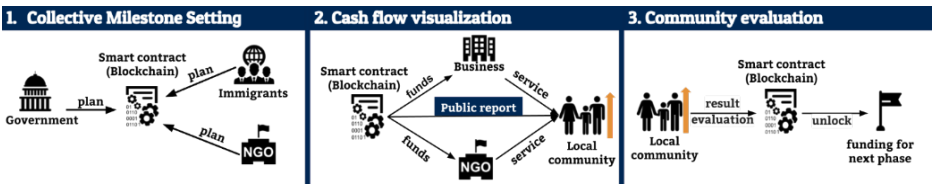


*Figure 1.* ChainGov workflow, which allows the local community as the agents of immigrants to supervise the government

**What will it bring in the future?**

From the HCI perception, it is important for blockchain researchers and practitioners to focus more on the users of blockchains. Blockchain technology should not be used as "trustless trust" to replace current systems but as "trustworthy trust" to help the users have more confidence in current systems. As Orcutt (2019) commented, "In 2019, it (blockchain) will start to become boring." In 2019, researchers will reduce the publications on how to use blockchain in some "fancy" use case and start to make blockchain applications more practical and fit users' lifestyle. From the users' need, the blockchain will have better development in public governance, media, and financial services industries. Moreover, permissioned blockchain providers will start to decentralize their control capability to the public from allowing verified customers to join the permission blockchain. Public blockchain developers will decrease the difficulties of connecting to the network and

provide decentralized oracle service. Most of all, both public blockchain and permissioned blockchain will integrate with IoT to provide trustful data.

**Declaration of Conflicting Interests**

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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