The limits of trust-free systems: A literature review on blockchain technology and trust in the sharing economy

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ABSTRACT

At the tip of the hype cycle, trust-free systems based on blockchain technology promise to revolutionize interactions between peers that require high degrees of trust, usually facilitated by third party providers. Peer-to-peer platforms for resource sharing represent a frequently discussed field of application for "trust-free" blockchain technology. However, trust between peers plays a crucial and complex role in virtually all sharing economy interactions. In this article, we hence shed light on how these conflicting notions may be resolved and explore the potential of blockchain technology for dissolving the issue of trust in the sharing economy. By means of a dual literature review we find that 1) the conceptualization of trust differs substantially between the contexts of blockchain and the sharing economy, 2) blockchain technology is to some degree suitable to replace trust in platform providers, and that 3) trust-free systems are hardly transferable to sharing economy interactions and will crucially depend on the development of trusted interfaces for blockchain-based sharing economy ecosystems.

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1. Introduction

"Together, we are entering the trust age" (Mazzella et al., 2016, p. 31).

The rise of peer-to-peer platforms has paved the way for commercial interactions among private individuals on large scale. In recent years, technology startups have leveraged the potential of higher resource utilization within the so-called sharing economy (Horton et al., 2016). Such transactions involve at least three parties. First, providers offer a private, usually under- or unused resource for sale, rental, or co-usage. These may be hosts on Airbnb, people renting out cars (e.g., on Turo), drivers offering spare seats during a ride (e.g., on BlaBlaCar), and so on. Second, consumers seek to use, rent, or experience the offered products and services (i.e., guests, passengers, renters, etc.). Third, (online) platforms serve as two-sided marketplaces. They match supply and demand, facilitate search, communication, and the initiation of transactions, as well as payment- and other processes (e.g., in cases of conflict settlement). The platforms enable short-term peer-to-peer sharing among private individuals (Fraiberger and Sundararajan, 2015). A fundamental prerequisite for such interactions to take place is mutual trust (Hawlitschek et al., 2016c).

According to Mazzella et al. (2016, p. 27), trust represents the "key building block of society" and thus also plays an essential role for the formation of interactions and relationships in the context of peer-to-peer marketplaces and services. For example, renting out an apartment on Airbnb does not only require hosts to trust potential guests to behave in a considerate and respectful manner (toward both the host and the apartment) but also to trust in Airbnb's ability, integrity, and benevolence with regard to booking and payment processes. Also guests heavily rely on their (prospective) host and the offered apartment to be adequate and fulfill their needs. In all this, the platform provides not only the technical infrastructure, user interfaces, and process guidance but also services such as insurance and reputation systems, thus taking a pivotal role in establishing and maintaining trust among users (Hawlitschek et al., 2016a; Katz, 2015; Teubner et al., 2017).

Against this backdrop, blockchain technology is said to facilitate "the exchange of value [...] without the need for an intermediary" (De Filippi, 2017). A blockchain refers to a cryptographically secured distributed ledger with a decentralized consensus mechanism (Risius and Spohrer, 2017). In recent years, it was sometimes denoted a "trust-free technology" (Beck et al., 2016) – and it is proposed as the fundament of an alternative scenario for today's mainly platform-driven sharing economy. Trust-free systems rest on the idea to utilize blockchain technology to automatically create an immutable, consensually agreed, and publicly available record

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of past transactions that is governed by the whole system to mitigate trust issues in peer-to-peer systems (Greiner and Wang, 2015). As the underlying technological and economic system, it enables verified and transparent recording and value exchange mechanisms without the need for a central authority or institution (Nakamoto, 2008; Notheisen et al., 2017b; Puschmann and Alt, 2016).

While the business model of platforms such as Airbnb and Uber is based on their role as intermediaries between peers and private resources, the blockchain is stated to provide an infrastructure with the potential to organize truly decentralized markets (Avital et al., 2016; Xu et al., 2016). In fact, several cooperatives such as Lazooz or Share&Charge have set out to establish decentralized sharing platforms with remarkable success in first crowdfunding campaigns (Sundararajan, 2016). The question arises how a technological shift towards sharing platforms based on "trust-free" blockchains will affect user behavior in the still developing platform landscape, or in other words, whether the *trust machine* is capable of disrupting the *trust business* of sharing economy platform providers (Economist, 2017, 2015).

Rachel Botsman, one of the pioneers of collaborative consumption, suggested that the distribution of trust among people, accelerated by blockchain technology will fundamentally transform the way trust is built (Botsman, 2016; Botsman and Rogers, 2010). Moreover, a recent discussion paper by IBM stated that blockchains have the potential to create a "sharing economy 2.0" by decentralizing trust (Lundy, 2016). Also much of the academic literature suggests blockchain technology to overcome trust-related issues and hence to contribute to the resolution of one of the fundamental challenges of peer-to-peer markets and sharing economy activities (Glaser, 2017).

Despite the global hype, we would like to point towards the possibility that blockchain technology may actually fall short of many of the high expatiations associated with it (Notheisen et al., 2017b). As we sketch out in the following, it is not probable that blockchain technology will eliminate the need for trust between transaction partners in the sharing economy. Yet, it is worthwhile to describe and estimate its potential for challenging the way how trust is built today. Consequently, our study addresses the question how "trust-free" systems based on blockchain technology may impact the notion and formation of trust in the sharing economy.

To shed light on the potential of blockchain technology in today's sharing economy landscape, an interdisciplinary approach is required (Notheisen et al., 2017b). Information Systems (IS) research provides both the perspective on blockchain technology as an IT-artifact as well as the corresponding interactions with related tasks, existing structures, and the broader sharing economy context (Benbasat and Zmud, 2003). In order to pave the way for future research within this complex environment, we conduct a dual literature review on the topics of trust in the context of the sharing economy and blockchain technology within the IS literature.

Following the idea of "analyzing the past to prepare for the future" (Webster and Watson, 2002), we uncover and conflate the intersection between the ideas of trust-free economic systems and trust-based peer-to-peer sharing. Our contribution is twofold. First, we provide a comprehensive, concept-centric overview of existing IS literature on trust in the contexts of the sharing economy and blockchain technology. Second, we integrate the two perspectives within a joint framework to point out and evaluate issues and paths for future research. Our findings suggest that 1) the conceptualization of trust differs substantially between both contexts, 2) blockchain technology is suitable to overcome the issue of trust in platform providers to some degree (raising the issue of trust in algorithms), and 3) trust-free systems are hardly transferable to typical sharing economy interactions and will crucially depend on the development of trusted interfaces to blockchain-based sharing economy ecosystems. Therefore such trust-free systems require further attention from researchers as well as practitioners.

The remainder of this article is organized as follows. In Section 2, we introduce the terms and concepts of blockchain technology, the sharing economy, and trust as a foundation for the subsequent literature review. In Section 3, we describe the literature search and selection process. We then present our findings in Section 4. Finally, Section 5 concludes with a discussion of theoretical and practical implications, nascent challenges, and suggests paths for future research.

2. Foundations

As a foundation for our literature review, this section introduces the central terms and concepts. First, we provide a brief introduction to *blockchain technology*. We then sketch out the scope and meaning of the *sharing economy* umbrella term, and last, define and introduce the notion of *trust* from an IS perspective.

2.1. Blockchain technology

A blockchain may be defined as a database that is shared among its users and allows them to transact valuable assets in a public and pseudonymous setup without the reliance on an intermediary or central authority (Glaser, 2017; Risius and Spohrer, 2017).

The first mainstream blockchain system that was put in operation is the cryptocurrency Bitcoin (Nakamoto, 2008). Bitcoin is an electronic, peer-to-peer cash system, designed as an alternative means of payment – independent of governments, central banks, and other parts of the traditional monetary system. Since the introduction of Bitcoin in 2008, the technology has emerged from its role as a verification mechanism for cryptocurrencies and heads to a wider field of economic and commercial applications. With its potential for disintermediation, its disruptive impact is not limited to a specific industry (Wörner et al., 2016) but rather enables the creation of a distributed, tamper-free, and transparent record of almost anything (Böhme et al., 2015). Potential applications in the context of the sharing economy include multi-sided, collaborative, and peer-to-peer markets (Glaser, 2017; Sun et al., 2016, Bogner et al., 2016), legitimization and identification services (Wörner et al., 2016), and payment and transaction systems (Beck et al., 2016; Notheisen et al., 2017a).

From a technical perspective, a blockchain is a composition of a distributed database, a decentralized consensus mechanism, and cryptographic algorithms. More specifically, transactional data is stored in a potentially infinite sequence of cryptographically interconnected data blocks. These blocks are ordered by a decentralized time stamping algorithm (Gipp et al., 2015), which allows users to vote on the validity of database updates and eventually agree on the correct order of transactions and a shared system state at any given point in time. As a result, the users of a blockchain system can interact without the need for a central authority that resolves conflicting views of the correct order of transactions. However, the utilized consensus mechanism needs to be tailored to the specific use case of a system. In public and pseudonymous scenarios on one hand, appending new data has to incur a sufficient amount of (computational) costs, in order to prevent malicious or corrupted nodes from easily spreading incorrect information (Lamport et al., 1982) and to impede Sybil attacks (Douceur, 2002; Dinger and Hartenstein, 2006). In permissioned networks on the other hand, blockchains are less decentralized and identity-based authentication schemes can provide more efficient alternatives (Bellare et al., 2009; Li et al., 2015). Independent