6-14-2021

The Blockchain Effect: From Inter-Ecosystem to Intra-Ecosystem Competition

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THE BLOCKCHAIN EFFECT: FROM INTER-ECOSYSTEM TO INTRA-ECOSYSTEM COMPETITION

Research Paper

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Abstract

Blockchains enable distributed operation, decentralized control, and token-based representations of tangible and intangible assets. Organizations commonly use blockchain technology to foster collaboration. In this paper, we investigate the use of blockchain to foster competition. We conduct a single-case study of Germany's mobility-as-a-service community and its efforts to use blockchain as a technical backbone for mobility ecosystems. The community views blockchain as a technology that embodies organizing principles of empowerment and equality. These principles motivated the community to rethink ecosystem structure. In particular, the community began to question the exclusive, non-adversarial position of mobility service aggregators. We find that rethinking this position might shift their competitive focus from the inter- to the intra-ecosystem level and enables the creation of a larger ecosystem. As a second-order effect, the community began to rethink ecosystem governance. Specifically, it began to explore options for effectively distributed decision making while safeguarding efficiency.

Keywords: Blockchain, Ecosystem, Competition, Collaboration, Governance.

1 Introduction

Blockchain technology plays a prominent role in many areas, such as global trade, the automotive industry, or the management of asylum procedures (Jensen et al., 2019; Rieger et al., 2019; Zavolokina et al., 2020). Technologically, a blockchain is a distributed, tamper-resistant, transactional database with an append-only logic (Rossi et al., 2019). It can enable distributed operation, decentralized control over data access (Guggenberger et al., 2020; Mattila and Seppälä, 2018; Pedersen et al., 2019), and token-based representations of tangible and intangible assets (Oliveira et al., 2018; Swan, 2015). Such functions make blockchains particularly interesting for cross-organizational structures that involve multiple parties with potentially conflicting interests (Chanson et al., 2019; Pedersen et al., 2019).

In related settings, blockchains are predominately understood as means to foster collaboration between these parties (Beck and Müller-Bloch, 2017; Davidson et al., 2018; Pedersen et al., 2019). Serving as a distributed transactional database, blockchains can reduce information asymmetries, democratize information access, and establish a shared truth between organizations (Chanson et al., 2019; Chong et al., 2019; Treiblmaier, 2018). Furthermore, blockchains can lower transaction costs and facilitate collaboration by enabling automation of cross-organizational workflows that were previously carried out manually by intermediary organizations (Fridgen et al., 2018; Gozman et al., 2020; Jensen et al., 2019). As they are operated in a distributed manner, blockchains also reduce dependencies on individual organizations (Guggenberger et al., 2020). Therefore, blockchains reduce threats of opportunistic behavior, as they enable organizations to collaborate without devolving control.

While blockchain's effects on collaboration have been extensively explored, little attention has been given to competition. This one-sided perspective makes it hard to understand the effects of blockchain in contexts such as ecosystems, where organizations need to actively balance collaboration and competition (Hannah and Eisenhardt, 2018; Hoffmann et al., 2018; Labazova, 2019). Ecosystems capture the "alignment structure of a multilateral set of partners that need to interact for a focal value proposition to materialize" (Adner, 2017, p. 42). For a successful ecosystem, participants need to collaborate to fulfil the focal value proposition and co-create value (Hoffmann et al., 2018). However, too much collaboration can threaten participants who receive low shares of distributed value (Hannah and Eisenhardt, 2018). Therefore, participants need to compete to ensure value capture (Dyer et al., 2018; Lavie, 2007). Often, competition also manifests around ecosystem leadership. Ecosystem leaders typically have a strong say in governing the ecosystem and setting rules for value co-creation (Adner, 2017; Wareham et al., 2014). However, too much competition around leadership might hinder the alignment of partners (Adner, 2017). Thus, the question of designing governance in ecosystems in relation to competition may be critical to enable the formation of a well-functioning ecosystem.

While prior research has indicated the effects of blockchain on cross-organizational collaboration, competition and the resulting effects on governance has, so far, been widely neglected. However, a thorough understanding of blockchain's impact on competition and governance is essential, as the balance between collaboration and competition as well as ecosystem governance influence ecosystem success. Hence, further research investigating competition in blockchain-based ecosystems and the resulting effects on governance is required. With our research, we thus aim to address this gap by exploring the following research question:

How does blockchain technology affect ecosystem competition and governance?

To answer this question, we perform an exploratory single-case study (Yin, 2009). Our case study focuses on Germany's mobility-as-a-service (MaaS) community. This community seeks to establish the foundations of an industry-wide mobility ecosystem and explores blockchain as a technological backbone and the use of tokens to facilitate ticketing of MaaS. For our study, we conducted interviews with community participants and studied internal and publicly available documents to identify how blockchain affects collaboration and competition within ecosystems.

We found that Germany's MaaS community interpreted blockchain as a technology embodying two specific organizing principles – empowerment and equality. These principles served as a motivator for rethinking the structure of mobility ecosystems. In particular, the initiative questioned the exclusive, non-adversarial position of the mobility service aggregator. Rethinking this position might enhance competition on the intra-ecosystem level and enable the creation of a larger ecosystem. As a second-order effect, the initiative began to rethink ecosystem governance.

2 Theoretical Background

2.1 Blockchain

The concept of blockchain first emerged in 2008 as the technological backbone of the digital currency system Bitcoin (Nakamoto, 2008). The Bitcoin system implements blockchain as an append-only database, which is redundantly stored on the nodes of a public peer-to-peer network. The co-equal nodes achieve consensus about the state of the database through a consensus mechanism involving a proof of computational work. Entries – transactions – in the database are validated, according to pre-defined rules, by the nodes of the network (Chanson et al., 2019). Through the use of cryptographic mechanisms, transactions are chronologically ordered and made tamper-resistant (Lockl et al., 2020).

Concurrent with a growing public interest in Bitcoin, the community around the digital currency soon developed further use-cases for the underlying blockchain technology. This development led to the rise of different types of blockchain systems (Peters and Panayi, 2016) aiming to expand the applicability of the original instantiation: a differentiation between public and private blockchains defines who is allowed to read data in the system, while the distinction between permissioned and permissionless blockchains denotes who is allowed to take part in the consensus mechanism. Furthermore, consensus mechanisms alternative to the computationally intensive and, thus, relatively inefficient proof-of-work in Bitcoin emerged (Sedlmeir et al., 2020). Driven by the need to implement more complex business logic, the community around the Ethereum foundation introduced smart contracts (Szabo, 1997) as computer programs redundantly stored on a blockchain to the blockchain community (Buterin, 2013). Standardized smart contracts allow the issuance and distribution of assets and corresponding usage policies through digital tokens (Bachmann et al., 2019). The ability to store and execute arbitrary logic on a distributed, tamper-resistant peer-to-peer infrastructure sparked a variety of further applications.

Blockchain has found its way into a wide range of application areas such as finance, education, healthcare, energy, supply chain management, government, or the internet-of-things (Casino et al., 2019; Upadhyay, 2020). In these areas, blockchains are predominantly used to automate cross-organizational workflows, enable decentralized clearing and settlement of financial transactions, and build trust between various entities. These applications profit from the technical properties of blockchain, such as its ability to provide transparency between multiple parties and to ensure the tamper-resistant storage of information. One marked similarity between these use-cases is that blockchain is employed to facilitate collaboration between unequal parties in fragmented, multi-organizational settings (Jensen et al., 2019; Mattke et al., 2019; Zavolokina et al., 2020). While concerns about rivals capturing competitive positions initially hindered collaboration, the introduction of a blockchain infrastructure enabled collaborative interactions. Whether blockchain technology provides value in cross-organizational settings depends on a variety of influencing factors. Labazova (2019) suggests that the degree of cooperation required between involved parties, social structures, and economic constraints, such as competitive pressure in a market, influences the success of introducing blockchain in cross-organizational settings.

2.2 Ecosystems

Building on Adner (2017, p. 42), we define an ecosystem as the "alignment structure of a multilateral set of partners that need to interact for a focal value proposition to materialize" where alignment captures "the extent to which there is mutual agreement among the members regarding positions and flows." Ecosystems typically include economic and structural components (Hein et al., 2020). Economic components describe a set of complementary products or services, while structural components capture the activities, actors, positions, and their relationships necessary to enable the underlying value proposition (Adner, 2017; Hein et al., 2020; Jacobides et al., 2018). Ecosystems differ from other cross-organizational structures for value co-creation in their integration of customers, lack of fully hierarchical control, and the creation of non-generic complementarities (Jacobides et al., 2018). In particular, ecosystems differ from other value systems such as platforms or value chains due to the presence of multilateral interdependencies between providers and their integration of customers, who can select complements and choose how these are combined (Adner, 2017; Jacobides et al., 2018).

For a successful ecosystem, the alignment of partners is essential and every participant must agree on its position (Adner, 2017). Furthermore, participants need to balance the inherent tension between the divergent activities of collaboration and competition (Hoffmann et al., 2018; Jacobides et al., 2006; Kapoor and Lee, 2013). Participants collaborate to foster value creation and compete to increase value capture (Dyer et al., 2018; Lavie, 2007). However, too much collaboration might threaten individual participants if they are unable to capture enough value. Conversely, cross-organizational interactions dominated by competition can inhibit ecosystem formation (Hannah and Eisenhardt, 2018). Ecosystem competition can take place on two levels: the inter-ecosystem level and the intra-ecosystem level. On the inter-ecosystem level, the ecosystem as a whole seeks to gain competitive advantage and competes with rival ecosystems to attract customers and create and capture value. On an intra-ecosystem level, participants compete for activities and positions to increase their share of distributed value (Adner, 2017). In this sense, participants seek to gain a powerful role by occupying an exclusive position and preventing others from entering this position. In this way, participants can maximize their ability to capture value (Jacobides et al., 2006; Xia et al., 2018).

2.3 Governance of Blockchain-based Ecosystems

Ecosystem governance is essential to establish a shared ecosystem vision and achieve alignment of partners (Adner, 2017). Ecosystem governance broadly refers to the decision rights, rules, and incentives that shape ecosystem structure and relationships among participants (Hein et al., 2020; Jacobides et al., 2018; Wareham et al., 2014). A critical aspect of ecosystem governance is the extent to which governance is distributed between participants and the manifestation of leader-follower roles (Adner, 2017; Tiwana, 2014; Wareham et al., 2014). Powerful participants often act as ecosystem leader, shaping ecosystem strategy and governance, which enables participants to develop a shared ecosystem vision (Adner, 2017; Jacobides et al., 2018; Moore, 1997). In these cases, ecosystem governance is predominantly centralized, as decision rights and control are assigned to a single entity. Nevertheless, participants retain some control over their own assets (Jacobides et al., 2018). While in some cases, ecosystem participants accept and defer to a single leader, in other cases, participants might compete for a role as ecosystem leader. Such competition can threaten ecosystem success due to the lack of a shared vision and participants' unwillingness to align (Adner, 2017; Moore, 1997). To this end, collective or distributed governance can be established with shared decision rights and control (Tiwana, 2014; Wareham et al., 2014).

However, the underlying technological infrastructure in an ecosystem may also affect its governance, as it can limit as well as open up the options for participation. In blockchain-based systems, the choice of the blockchain type also affects the locus of governance. While public permissionless blockchains are typically more decentralized, private permissioned solutions typically entail a larger degree of centralization (Chong et al., 2019). In general, two attitudes towards governance seem to prevail – on-chain and off-chain governance (van Pelt et al., 2021; Zavolokina et al., 2020). On-chain governance considers governance by blockchain technology, where governance mechanisms are implemented on the blockchain (Ølnes et al., 2017). Off-chain governance considers the allocation of decision rights, accountabilities, control mechanisms, and incentives concerning the blockchain use and development (Beck et al., 2018; Schulze et al., 2020; van Pelt et al., 2021). Off-chain governance closely relates to general ecosystem governance as it defines roles, relationships, and rules (van Pelt et al., 2021; Ziolkowski et al., 2020). Several practical examples illustrate that the design of off-chain governance, particularly the definition of decision rights, influences the adoption of blockchain-based systems (Jensen et al., 2019; Mattke et al., 2019). Furthermore, Lacity (2019) demonstrates that different blockchain systems might require different off-chain governance implementations. Moreover, a temporal perspective suggests that the rules and norms governing interactions between participants in cross-organizational blockchain systems are subject to change over time and need to evolve (Jensen et al., 2019; Ziolkowski et al., 2020).

2.4 Mobility-as-a-Service

The concept of mobility-as-a-service aims to provide customers with user-oriented mobility services by combining multiple modes of transport via a single user interface (Smith and Hensher, 2020; Sochor et al., 2018; Utriainen and Pöllänen, 2018). MaaS enables a paradigm shift within the mobility sector, from personal ownership of individual transportation modes towards the use of mobility services (Sochor et al., 2018). To this end, the value proposition of MaaS requires collaboration and coordination between service providers within an ecosystem to enable travel planning, ticketing, and payment via a single user interface (Schulz et al., 2019; Smith and Hensher, 2020). The MaaS ecosystem comprises various actors including, mobility aggregators that combine multiple service offerings, public- and private transport operators such as car- and bike-sharing, taxi, bus or train providers, ride-sharing providers, and IT service providers (Utriainen and Pöllänen, 2018). The established ecosystems are similar to platform-based systems, as mobility providers are all linked to a central mobility service aggregator (Schulz et al., 2019).

However, these mobility ecosystems differ due to the multilateral interdependencies between mobility providers, in that MaaS requires the combination of a multitude of mobility services. Prior research illustrates the potential of blockchain to facilitate collaboration in MaaS ecosystems. In this context, blockchain can enable the automation of business logic. For example, by tokenizing currency and assets, ticketing and revenue sharing could be facilitated via micropayments (Bothos et al., 2019; Nguyen et al., 2019). Thus, blockchain-based solutions can enable combined mobility offerings while reducing barriers to entry and eliminating the need for intermediaries (Hoffmann et al.).

3 Research Method

To investigate the effects of blockchain on ecosystem competition and governance, we conducted an exploratory single-case study (Yin, 2009). Case study research is suitable when a phenomenon, like the effect of blockchain on competition, cannot be studied in isolation from its contextual conditions, in this case, ecosystems (Benbasat et al., 1987; Yin, 2009). Exploratory case study research can be useful when a theoretical foundation is absent (Benbasat et al., 1987; Eisenhardt, 1989; Sarker et al., 2018). Thus, we undertake an exploratory single-case study to enable in-depth investigations of the effects of blockchain on ecosystem competition and governance. Limiting our research to a single case inevitably affects the generalizability and robustness of our research. However, a single case is suitable when it covers a longitudinal case, provides a critical case for testing a hypothesis, covers a rare phenomenon, or – as in our example – considers a representative case or provides revelatory research access (Yin, 2009).

The case we focus on is the German MaaS community. In April 2017, Germany's MaaS community started to explore the potential of blockchain for MaaS. We selected Germany's MaaS community as it represents a typical case of a cross-organizational initiative exploring blockchain as the technical backbone of mobility ecosystems to foster collaboration between competing mobility providers. Furthermore, the various participants provide unique insights and different perspectives to investigate how blockchain affects competition in ecosystems. Three authors accompanied the community for a total of two and a half years, gaining access to important observations and longitudinal data that helped us to develop a deeper understanding of the emerging ecosystem vision. This richness of data adds rigor to our case study (Eisenhardt and Graebner, 2007; Klein and Myers, 1999). To increase objectivity in the team of researchers, one researcher had no interactions with the community. This provides us with different perspectives on the case (Eisenhardt, 1989).

As interviews are among the preferred sources of primary evidence (Eisenhardt and Graebner, 2007; Yin, 2009), we conducted 22 semi-structured interviews in two stages. The first set of 14 interviews was conducted in April and May 2019, where we approached members of a joint research project that investigated the potentials of blockchain technology for MaaS on a conceptual basis. A year later, we conducted additional 8 interviews with organizations working on prototypes for blockchain-based mobility systems. These interviews allowed us to gain a deeper understanding of the role of blockchain for MaaS and the considerations regarding ecosystem governance. Within this stage, we approached some organizations taking part in the first stage of our interviews, enabling us to investigate whether and how the ecosystem considerations were changing over time. We selected our interviewees based on three rationales. First, we approached interviewees with direct involvement in blockchain-based MaaS initiatives. Second, we approached technology and business representatives of different hierarchical levels. Third, we reached out to various organizations (e.g., public transport organizations, car manufacturers, train providers, bus providers, MaaS startups) to gain a holistic view on the envisioned MaaS ecosystem. To reduce threats of cultural differences when focusing on the German MaaS community, we included internationally operating organizations. We used semi-structured interviews, rather than pre-defined and limiting questions, to encourage interviewees to provide more wide-ranging and detailed answers (Schultze and Avital, 2011). Our questions firstly addressed current approaches for MaaS and blockchain technology, in general. Thereafter, we focused on the motivation of the German MaaS community to establish a blockchain-based mobility system and the challenges it faced. Finally, we investigated the envisioned ecosystem structure. Table 1 details the professional backgrounds of our interview partners. All interviews spanned from 30 to 60 minutes, were audio-recorded, and, later, fully transcribed. We also studied both internal and publicly available documents to complement evidence from the interviews (Yin, 2009). Internal documents included presentations, proposals, and workshop protocols. Press releases and statement papers were among the publicly available documents.

ID	Organization	Role	Phase
1	Car Manufacturer	Researcher	1
2	Car Manufacturer	Senior Strategic Manager	1
3	MaaS Provider	Project and Product Manager	1
4	Car Manufacturer	Senior Strategic Manager	1
5	Mobility Infrastructure Provider	Business Development Manager	1
6	MaaS Startup	Founder & CEO	1
7	Bus Provider	Founder	1
8	Identity Service Provider	Partner Relationship Manager	1
9	Public Transport Organization	Project Manager	1
10	Identity Service Provider	Founder, CEO & CTO	1
11	Transport Association	Member of Executive Board	1
12	Car Manufacturer	Senior Technology Manager	1
13	Mobility Financial Service Provider	Partner Relationship Manager	1
14	Public Transport Organization	Managing Director	1
15	Car Manufacturer	Senior Blockchain Analyst	2
16	Car Manufacturer	Blockchain Engineer	2
17	Car Manufacturer	Product Owner	2
18	Car Manufacturer	Blockchain Developer	2
19	Car Manufacturer	Product Developer	2
20	IT Service Provider	Senior Blockchain Developer	2
21	IT Service Provider	Managing Consultant	2
22	Train Provider	Project and Product Manager	2

Table 1. Interview partners.

To analyze our data, we followed a two-staged process. We began with open coding to provide a neutral starting point for further exploration (Saldaña, 2013). Thereby, we assigned initial codes to identify data relevant to our research question. Following open coding, we applied axial coding to refine the codes, link identified categories, and specify the properties and dimensions of each category (Corbin and Strauss, 1990; Saldaña, 2013). We refined the respective constructs and decided on final propositions by iterating between data and theory and triangulating the different sources of evidence to enhance construct validity and generalizability (Corbin and Strauss, 1990; Eisenhardt et al., 2016; Gibbert et al., 2008; Yin, 2009). We stopped iterating between data and theory when we obtained only minimal incremental insights and no new themes emerged from data analysis (Bowen, 2008; Saunders et al., 2018).

4 Case Study

4.1 Case Description

Recognizing the need for MaaS, several participants across the German MaaS community began to establish proprietary mobility ecosystems to extend their service offerings (Schulz et al., 2019). These participants sought to act as a mobility service aggregator by aligning the heterogeneous set of mobility providers needed to enable MaaS. Mobility service aggregators retain an exclusive, non-adversarial position within the ecosystem as they provide the customer interface for travel planning, ticketing, and billing of mobility services.

While several participants in the German MaaS community established small ecosystems, they were unable to align the participants needed for MaaS. In particular, participants in Germany's MaaS community refrained from integrating their services due to concerns about potential dependencies on the mobility service aggregator who, they felt, might exercise power and dictate rules. They also feared losing the customer interface and valuable strategic data to the mobility service aggregator. Hence, mobility providers refused to align themselves within mobility service aggregators' proprietary ecosystems to prevent losing strategic data and, thus, weakening their competitive position in the mobility market. Consequently, the exclusive mobility aggregator position was highly contested and marked by inter-ecosystem competition. Multiple participants established rival ecosystems that competed to attract customers and mobility service providers to gain a dominant position in the mobility market. Interviewee 2 explained this movement using the following metaphor:

> *"Everyone would like to be the central spider on the web. Everybody would like to be the central player who integrates all mobility providers, and everybody is afraid that someone else will become this player, and therefore it hinders these integration efforts, as one would imagine it now."*

Although multiple rival mobility ecosystems emerged, these ecosystems failed to reach the critical mass. Nor were they able to realize the underlying value proposition of MaaS as mobility aggregators could not align the required mobility providers. The following statement by Interviewee 19 describes a thorough understanding of the ecosystems' core weakness:

> *"What we see is that everyone who attempts to set up this platform fails because he does not reach the critical mass."*

When blockchain technology gained momentum, a new movement within the German MaaS community emerged. At first, a part of the community started a research initiative to explore the potentials of blockchain for MaaS. Importantly, the blockchain could serve as a joint back-end infrastructure and industry-wide standard to facilitate mobility offering, token-based ticketing, and automated revenue sharing between participants. Furthermore, it could enable all participants to maintain their proprietary applications and enable the coexistence of multiple customer interfaces. Later on, a more technical-oriented part of the community started developing a blockchain-based prototype for MaaS. Technically, the community considered a private permissioned solution based on Hyperledger Fabric as they started prototyping. Both streams were initiated and introduced to the community by technical-oriented organizations, with particular expertise in the field of blockchain, in cooperation with a mobility service provider. The technical-oriented organizations were willing to invest initially, as they seek to gain expertise in the design of the blockchain-based mobility ecosystems, increasing their chances of serving as a technology provider and consultant for MaaS providers in a mature ecosystem. MaaS providers were willing to invest, as they aimed at shaping the design of the technical solution and ecosystem structure according to their needs. These initiating participants set the direction of both streams. However, they soon opened the streams to the community to jointly define the specific design of a blockchain-based MaaS ecosystem.

4.2 Rethinking ecosystem competition through blockchain

In our case study, we observed that Germany's MaaS community perceived blockchain not as a purely technical instrument, but rather as a socio-technical one that embodies specific organizing principles. These principles encouraged the community to rethink ecosystem structure. In particular, they considered eliminating the exclusivity of the mobility aggregator position, which might enable a shift from inter- to intra-ecosystem competition.

More specifically, Germany's MaaS community interpreted blockchain as a technology that embodies the organizing principles of empowerment and equality. These principles are closely related, and both rooted in the technical properties of blockchain. In contrast to traditional proprietary mobility ecosystems, blockchain-based systems are typically not operated by a single entity. Instead, the operation of blockchains is equally distributed between multiple entities. Therefore, blockchains empower participants to act independently from a central system operator and maintain a greater degree of control over service offerings and transparency when it comes to data. This also prevents the emergence of a central entity that might abuse its position, dictating rules or discriminating against other ecosystem participants. As Interviewee 22 illustrates:

> *"it [blockchain] does not belong to your competitor. Instead, it is ours, just like it is my competitors'. And no one has total sovereignty, but we all work in one system. And for me, that is the greatest benefit that blockchain creates. And this doesn't take place technologically but, primarily, politically and in people's minds."*

Consequently, the community interpreted blockchain as a technology that empowers participants to act independently from a central entity (Interview 2,6-8,12,18-20,22). Furthermore, they viewed blockchain as a technology that offers every participant an equal opportunity to control the system and build its business (Interview 2,4,10,12,15,17,18,21,22). While participants in the MaaS community initially refused to collaborate, we observed that the principles of empowerment and equality served as a mobilizer for collaboration in a joint mobility ecosystem (Interview 4,6,13,18,19,22). As Interviewee 19 describes:

> *"one of the main benefits that blockchain creates is starting a discussion, that people even think about working together on an open and collaborative platform under the guise of a blockchain-based application. [...] What I actually want to say is that the point about blockchain, which I think is the most relevant in the current expansion stage, is not the technology itself, but rather the, let's say, the economic implications, the very right of participation and this governance framework [...] where no one is completely in control."*

Organizing principles	Description
Empowerment	Blockchain prevents the emergence of a central entity that can dictate rules and enables participants to act independently.
Equality	Blockchain is free from discrimination and provides every participant with the same rights and opportunities.

Table 2. Organizing principles embedded in blockchain.

We, moreover, observed that the embedded organizing principles of blockchain induced a rethinking of the mobility aggregator position, moving from an exclusive, non-adversarial position towards a competitive and dynamically changing position. Based on the principles of empowerment and equality, the German MaaS community envisions a mobility ecosystem that grants every participant the same opportunity to offer and combine varying mobility services (Interview 2,4,10,15,18-22). In particular, all participants can use the blockchain to aggregate different mobility services and jointly offer them to customers via their proprietary applications (Interview 2-5,8-10,13,16,18,19,22,21). The following statement from Interviewee 5 highlights this rethinking of ecosystem structure:

> *"For me, the main problem with mobility-as-a-service is that the planning tools and the booking tools were developed in a very centralized way in recent years. And this means that providers of mobility-as-a-service and customers are very dependent on using one of the big solutions. Therefore, it would be important to have an open system, so that there is increased competition because otherwise the platform operators would be in control and set the rules for mobility providers."*

Accordingly, customers can access and combine the same mobility services with applications offered by various participants. As a result, the mobility aggregator position is no longer exclusive and non-adversarial. Instead, depending on the interface that customers use to access MaaS, the mobility service aggregator role is constantly allocated to a different participant, and thus, *"ultimately every provider would be a provider of M[ultiple] mobility services"* (Interview 2). Consequently, the mobility aggregator position changes dynamically when multiple customers select different participants to act as mobility service aggregator.

Most importantly, we identified that this rethinking of the mobility aggregator position might cause a shift from inter- to intra-ecosystem competition. Currently, participants compete for the exclusive mobility aggregator position by establishing rival ecosystems. Therefore, competition mainly manifests at the inter-ecosystem level, where several mobility service aggregators compete to align mobility providers with and attract customers to their proprietary ecosystems (Interview 2-4,8,10-12). Building on the organizing principles of equality and empowerment, the MaaS community established a vision of an open mobility ecosystem that prevents the emergence of a dominant player by granting every participant the same rights to the mobility service aggregator position (Interview 1-4,6,8,10-12,14,16-19,22). This would enable the creation of a larger ecosystem, as it addresses the core weaknesses of current ecosystems and allows participants to maintain their strategic position in the market. Moreover, eliminating the exclusiveness of this position would allow participants to compete for serving as the customer interface for providing MaaS (Interview 2-4, 6-9,11,12,14,16,18,19). Interviewee 8 highlights the participants' increased willingness to enable competition within the ecosystem:

> *"and then it would also be the case that, in such a decentralized mobility system there is, for example, competition between routing tools, [...] There is competition between booking tools through which mobility services can be purchased. [...] That's the idea, that you simply don't have any lock-in effects and, above all, no technical lock-in that you won't be able to get out of in the long run."*

As Figure 1 illustrates, multiple rival ecosystems currently compete over the provision of MaaS to customers. In contrast, a blockchain-based mobility ecosystem enables all participants to compete for customers. Hence, competition over the mobility service aggregator position no longer requires the establishment of proprietary ecosystems as blockchain might enable competition on an intra-ecosystem level. Interviewee 14 illustrates this shift from inter- to intra-ecosystem competition around the mobility service aggregator position:

> *"then it gets interesting, because then I don't monopolize the booking possibilities at an app or provider level, but it's rather the question of who has the best app and the best customer contacts and processes the customers best, and there will be competition for the end customer and no longer [...] for the amount of data."*

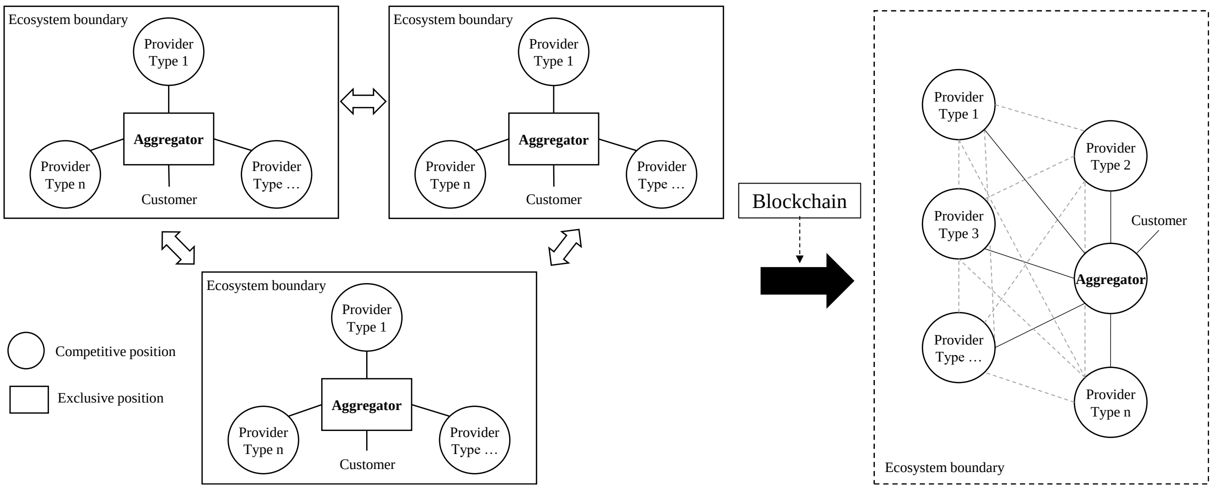

Figure 1. Rethinking ecosystem competition through blockchain.

4.3 Establishing a governance framework that supports competition

In our case study, we identified that rethinking ecosystem structure based on the organizing principles of empowerment and equality necessitates the establishment of a governance framework that supports these principles and allows for intra-ecosystem competition. To this end, the community focuses on defining a viable off-chain governance framework that is able to evolve.

In current mobility ecosystems, the mobility aggregator acts as the ecosystem leader, and ecosystem governance is directly linked to the exclusive, non-adversarial mobility service aggregator position. Thus, the mobility service aggregator is responsible for decision-making. However, participants across Germany's MaaS community perceive this prevailing centralization of governance as a core weakness of mobility ecosystems, which may undermine competition. To overcome this problem, the community used blockchain and the embodied organizing principles of equality and empowerment as a means of rethinking ecosystem structure. However, we observed that the choice of a private permissioned blockchain solution impacts on the principles of empowerment and equality. In particular, the proposed solution based on Hyperledger Fabric assigns different rights to different technical roles. Thereby, the technical design might restrict equality between ecosystems participants. Furthermore, the permissioned design places a barrier to entry, and therefore restricts empowerment, as participants need to be approved to join the blockchain network.

To account for these restrictions induced by the envisioned technical design and safeguard empowerment and equality, the MaaS community relies on organizational measures. The community seeks to reduce barriers and provide every organization the right to participate in decision-making, development, and system operation. To this end, they envision a mobility ecosystem where no member is in complete control (Interview 2-4,6,8,12,13,16,20-22). This, in turn, influences considerations about the appropriate governance framework, as centralized decision-making would conflict with these principles. The following statement from Interviewee 5 illustrates the need to rethink ecosystem governance:

> *"in a larger ecosystem, where all participants must have equal rights, there must be no centralized control that permanently remains the same."*

As a result, Germany's MaaS community recognized the need to distribute decision rights between ecosystem participants (Interview 3,4,6,12-16, 21,22). Doing so would reflect the principles of empowerment and equality and foster competition, while simultaneously securing collaboration within the ecosystem. As Interviewee 4 describes:

> *"for me, as a car manufacturer, it would be very, very attractive if the operation of a mobility platform were very strongly democratized. Because then the market power itself would shift away from the aggregator and the platform operator towards a greater distribution within this chain."*

While all participants in the community shared a common understanding of the underlying organizing principles and the resulting need for distributed governance, they envisioned different ways in which distribution should be achieved. However, to establish a successful ecosystem and achieve the alignment of participants, ecosystem governance must be defined in a way that is agreeable to every organization (Interview 7,8,15,19). As Interviewee 7 noted, this is a major challenge for ecosystems:

> *"that the decision rights and the requirements that each party demands at the beginning, that these are configured in such a way that each of these parties acknowledges them and considers them as good, fair and non-discriminatory. And this is the difficulty."*

Furthermore, we observed a trade-off between efficient and effectively distributed ecosystem governance. For a successful ecosystem, it is essential to align the partner needed for MaaS. The distribution of decision rights between multiple actors across the German MaaS community appears to be an effective means of achieving the desired alignment. This approach reflects the core principles in ecosystem governance and simultaneously safeguards collaboration and competition between participants. In particular, establishing a democratic governance framework ensures the participants' equal representation of interests, and empowers them to take part in strategic decision-making. However, distributing decision rights can result in increasing organizational complexities when the number of decision-makers grows (Interview 9,12,14,16,18,20-22). This can be detrimental to ecosystem formation if multiple decision-makers are unable to find consensus regarding the future of the ecosystem. To mitigate this trade-off between efficient and effectively distributed decision-making, the German MaaS community considers the need to start with a closed consortium and, thus, reduce organizational complexities (Interview 12,16,17,20-22). Interviewee 16 describes the need for more centralized governance at the point of ecosystem formation:

> *"First of all, perhaps the most difficult, it [the ecosystem] balances the individual interests of all participants. And this makes it more sensible to start with a smaller consortium because then there are fewer participants than if there are about one hundred. One hundred participants would, of course, make it much more difficult to find a consensus on the concept to be implemented."*

This select group of participants would facilitate ecosystem formation and consensus-finding over the implementation and future strategy of the ecosystem. To achieve this, the community also highlights the need for a diversified consortium to ensure that the varied interest groups across the German MaaS community are equally represented during ecosystem formation, as illustrated by Interviewee 12:

> *"I believe it always starts with a stronger degree of centrality. I believe that setting it [the ecosystem] up fully decentralized with a thousand participants right from the beginning does not work. I think it becomes too complex. The negotiations will be too difficult. Therefore, I believe a small diversified group must take the first step."*

Afterward, the community aims to open the ecosystem, step by step, to other participants across Germany's MaaS community (Interview 12,16,17,20-22), fostering intra-ecosystem competition. The community also realized that ensuring future participants' interests were represented would rely on a temporally evolving governance framework. In particular, the community seeks to provide new entrants the same decision rights to ensure equality and empowerment within the growing ecosystem, as the following statement by Interviewee 21 illustrates:

> *"In the future, I'm sure that we will have to open ecosystem governance to new entrants so that not only the founding members determine the direction. We need to find a mechanism [...] that enables all kinds of mobility providers to engage in decision-making because the mobility ecosystem will not thrive on only a set of train providers or only a set of airlines. That's not what it is supposed to be."*

5 Discussion

Our findings reveal that blockchain can serve as an enabler for rethinking ecosystems. First, our findings indicate that blockchains can encourage the transformation of highly fragmented industries by enabling an industry-wide ecosystem that allows participants to simultaneously compete and collaborate. Our research supports the preliminary conclusions of Lianos (2019) that indicate blockchain might promote intra-ecosystem competition. This is also in line with previous studies of blockchain initiatives that present blockchain as a means to establish industry-wide standards and enabling collaboration between competing organizations, rather than establishing closed and fragmented systems (Jensen et al., 2019; Mattke et al., 2019; Zavolokina et al., 2020). As our case of analysis illustrates, using blockchain to establish industry-wide standards can eliminate cross-organizational dependencies and, most importantly, may result in a higher degree of competition. Thus, when engaging in blockchain-based systems, participants may need to rethink their current roles and prepare for increased competition over their position. However, blockchain solutions might be subject to forking, which might facilitate the emergence of multiple competing ecosystems (Lianos, 2019). Beyond this, introducing blockchain to cross-organizational settings other than ecosystems may differently affect competition. Settings where hierarchies are inherent in the process, such as in supply chains (Jensen et al., 2019; Mattke et al., 2019), might react differently regarding competitive positions. Yet, while the introduction of blockchain may not change cross-organizational structures or individual positions in some settings, we assume that relationships between stakeholders may change due to the technical properties of blockchain (Treiblmaier, 2018). A more distributed and equal governance is also evident in such settings (Jensen et al., 2019).

Second, we observed that the ecosystem participants interpreted blockchain as a technology that embodies specific organizing principles, which served as a mobilizer for rethinking ecosystem structure. However, equality and empowerment might be affected by the underlying blockchain solution. Consensus mechanisms directly impact on equality. For instance, proof-of-work privileges participants based on computing power, while proof-of-stake grants participants privileges based on their share of value in the network, which might cause inequality between participants (Sedlmeir et al., 2020). Moreover, the selected blockchain type might additionally influence empowerment and equality. In contrast to public permissionless solutions, private permissioned blockchains place additional rules for access and transaction supervision (Peters and Panayi, 2015). For example, Hyperledger Fabric allows to provide certain participants with privileges for validating transactions. As our case illustrates, to safeguard equality and empowerment, a more sophisticated off-chain governance is required in such settings.

Lastly, our case study indicates that the shift from exclusive, non-adversarial to dynamically changing positions requires redistribution of ecosystem governance. Specifically, to achieve the desired alignment of participants, ecosystem governance needs to be designed to enable competition while safeguarding collaboration. This requires the redistribution of governance within the ecosystem, as a centralized decision-maker could use their dominant position to undermine competition. Consistent with previous studies on blockchain, we identified that blockchain initiatives face a trade-off between efficient and effectively distributed governance (Lacity and Kahn, 2017; Zavolokina et al., 2020). This is also in line with the empirical study of Chen et al. (2020) that indicates an inverted U-shaped relationship between distribution of governance and performance of decentralized platforms. Distributing control is a key factor in enabling the alignment of partners and mitigating concerns about being subject to a central entity (Jensen et al., 2019; O'Mahony and Karp, 2020). Thus, distributing governance could be a viable way to enable the creation of a larger ecosystem while securing competition. This is also in line with Adner (2017), who suggests that, in cases where competition around leadership might threaten ecosystem formation, leadership can be distributed between multiple participants. Since distributing decision rights can increase organizational complexities and reduce efficiency, more centralized governance frameworks and a closed consortium might be necessary at nascent ecosystem stages to find consensus and quickly reach the critical mass (Beck et al., 2018; Lacity, 2019; Zavolokina et al., 2020). However, this assigns a more powerful role to ecosystem initiators who define ecosystem governance and strategy according to their specific interests. Blockchain-based ecosystems are often initiated by IT service providers with particular expertise in a specific blockchain technology stack (e.g., IBM and Hyperledger Fabric). This influences the choice of the underlying blockchain solution, and thereby, grants these IT service providers a more powerful position within the blockchain-based ecosystem (Jensen et al., 2019). Conversely, this can block ecosystem growth if the defined ecosystem governance and strategy disregards the organizing principles and the specific interests of future ecosystem participants. Thus, a temporal perspective on ecosystem governance is needed, as governance must evolve in accordance with ecosystem growth to balance collaboration and competition and ensure long-term ecosystem success (Jensen et al., 2019; Ziolkowski et al., 2020). To establish a viable governance framework, practitioners can rely on experiences from related fields. For instance, within its blockchain projects, IBM transfers best practices from other IT projects. (Jensen et al., 2019; O'Mahony and Karp, 2020).

6 Conclusion

Prior research has illustrated blockchains' potential to enable collaboration but fails to consider how the introduction of blockchain impacts competition. This one-sided view makes it especially difficult to explain the use and implications of blockchains in settings such as ecosystems, where organizations need to actively balance the diverging activities regarding collaboration and competition. This paper attempts to provide a complementary perspective that explores the impacts of blockchain on ecosystem competition and governance. To analyze blockchain's effects on competition and governance, we conducted a single-case study on the German MaaS community. Our case study indicates that blockchain's embodied organizing principles of empowerment and equality can serve as a mobilizing factor for rethinking ecosystem structure. Specifically, Germany's MaaS community began to rethink the position of mobility service aggregators, transitioning from an exclusive, non-adversarial position to one that is competitive and dynamically changing. This rethinking of ecosystem structure might enhance competition on the intra-ecosystem level. As a second-order effect, the rethinking of ecosystem structure also induced a rethinking of ecosystem governance. In particular, the community explored options for effectively distributed governance to ensure competition while safeguarding efficient decision-making.

7 Limitations and Further Research

Our work has some limitations, offering opportunities for further research. Given the design of our single-case study focusing on the German MaaS community, the generalizability of our results might be limited and subject to cultural differences. Thus, our research could benefit from further validation through multiple case studies across different industries. The effects of blockchain on competition in other cross-organizational settings should also be considered.

Furthermore, our case of analysis comprises a blockchain-based ecosystem in the early stages of its development. Therefore, our findings concerning cross-organizational competition are limited to the nascent stages of ecosystems and the perceptions of our interviewees. In particular, our study was conducted during the conceptualization phase, where prototype development was still at a very early stage and only few technical details were set by the German MaaS community. Therefore, how ecosystem competition will evolve over time and whether conflicts between collaboration and competition will arise cannot be captured by our case. Longitudinal case studies could be conducted to investigate how collaboration and competition in blockchain-based systems evolve over time. Besides, further research could investigate the effect of blockchain on competition and governance in a more mature blockchain-based ecosystem. In a more mature environment, empirical research could also investigate the impacts of blockchain on competition and ecosystem success.

This paper illustrates that the governance of blockchain-based ecosystems is subject to a trade-off between efficient and effectively distributed decision making. Since the German MaaS community is in the very early stages of establishing an industry-wide blockchain-based ecosystem, our case cannot fully explain how to mitigate this trade-off or predict the extent to which the community's envisioned approach will succeed. Therefore, further research could focus on how governance can be designed to simultaneously secure collaboration and competition within blockchain-based systems. In this context, it would also be worth investigating which additional governance challenges and tensions might arise. Moreover, future research could apply a temporal perspective to the governance of blockchain-based systems and investigate the long-term interplay between governance, competition, and collaboration and thereby ensure wide-spread applications of blockchain-based ecosystems.

References

Adner, R. (2017). "Ecosystem as Structure" *Journal of Management* 43 (1), 39–58.

Bachmann, N., B. Drasch, M. Miksch and A. Schweizer (2019). "Dividing the ICO Jungle: Extracting and Evaluating Design Archetypes" *14. Internationale Tagung Wirtschaftsinformatik (WI 2019)*, 1709–1723.

Beck, R. and C. Müller-Bloch (2017). "Blockchain as Radical Innovation: A Framework for Engaging with Distributed Ledgers". In: *Proceedings of the 50th Hawaii International Conference on System Sciences*.

Beck, R., C. Müller-Bloch and J. Leslie King (2018). "Governance in the Blockchain Economy: A Framework and Research Agenda" *Journal of the Association for Information Systems* 19 (10).

Benbasat, I., D. K. Goldstein and M. Mead (1987). "The Case Research Strategy in Studies of Information Systems" *MIS Quarterly* 11 (3), 369–386.

Bothos, E., B. Magoutas, K. Arnaoutaki and G. Mentzas (2019). "Leveraging Blockchain for Open Mobility-as-a-Service Ecosystems". In: *Proceedings, 2019 IEEE/WIC/ACM International Conference on Web Intelligence Workshops (WI 2019 companion). Thessaloniki, Greece, 13-17 October 2019*. Ed. by P. Barnaghi. New York, New York: The Association for Computing Machinery.

Bowen, G. A. (2008). "Naturalistic inquiry and the saturation concept: a research note" *Qualitative Research* 8 (1), 137–152.

Buterin, V. (2013). *Ethereum white paper*. URL: https://www.weusecoins.com/assets/pdf/library/Ethereum_white_paper-a_next_generation_smart_contract_and_decentralized_application_platform-vitalik-buterin.pdf (visited on 11/18/2020).

Casino, F., T. K. Dasaklis and C. Patsakis (2019). "A systematic literature review of blockchain-based applications: Current status, classification and open issues" *Telematics and Informatics* 36 (7674), 55–81.
Chanson, M., A. Bogner, D. Bilgeri, E. Fleisch and F. Wortmann (2019). "Blockchain for the IoT: Privacy-Preserving Protection of Sensor Data" *Journal of the Association for Information Systems*, 1272–1307.
Chen, Y., I. Pereira and P. C. Patel (2020). "Decentralized Governance of Digital Platforms" *Journal of Management* 108, 014920632091675.
Chong, A. Y. L., E. T. K. Lim, X. Hua, S. Zheng and C.-W. Tan (2019). "Business on Chain: A Comparative Case Study of Five Blockchain-Inspired Business Models" *Journal of the Association for Information Systems* 20 (9), 1308–1337.
Corbin, J. and A. Strauss (1990). "Grounded Theory Research: Procedures, Canons, and Evaluative Criteria" *Qualitative Sociology* 13 (1), 3–21.
Davidson, S., P. Filippi and J. Potts (2018). "Blockchains and the economic institutions of capitalism" *Journal of Institutional Economics* 14 (4), 639–658.
Dyer, J. H., H. Singh and W. S. Hesterly (2018). "The relational view revisited: A dynamic perspective on value creation and value capture" *Strategic Management Journal* 39 (12), 3140–3162.
Eisenhardt, K. M. (1989). "Building Theories from Case Study Research" *Academy of Management Review* 14 (4), 532–550.
Eisenhardt, K. M. and M. E. Graebner (2007). "Theory Building from Cases: Opportunities and Challenges" *Academy of Management Journal* 50 (1), 25–32.
Eisenhardt, K. M., M. E. Graebner and S. Sonenshein (2016). "Grand Challenges and Inductive Methods: Rigor without Rigor Mortis" *Academy of Management Journal* 59 (4), 1113–1123.
Fridgen, G., S. Radszuwill, N. Urbach and L. Utz (2018). "Cross-Organizational Workflow Management Using Blockchain Technology - Towards Applicability, Auditability, and Automation". In: *Proceedings of the 51st Hawaii International Conference on System Sciences*, pp. 3507–3516.
Gibbert, M., W. Ruigrok and B. Wicki (2008). "What passes as a rigorous case study?" *Strategic Management Journal* 29 (13), 1465–1474.
Gozman, D., J. Liebenau and T. Aste (2020). "A Case Study of Using Blockchain Technology in Regulatory Technology" *MIS Quarterly Executive* 19 (1), 19–37.
Guggenberger, T., A. Schweizer and N. Urbach (2020). "Improving Interorganizational Information Sharing for Vendor Managed Inventory: Toward a Decentralized Information Hub Using Blockchain Technology" *IEEE Transactions on Engineering Management* 67 (4), 1074–1085.
Hannah, D. P. and K. M. Eisenhardt (2018). "How firms navigate cooperation and competition in nascent ecosystems" *Strategic Management Journal* 39 (12), 3163–3192.
Hein, A., M. Schreieck, T. Riasanow, D. S. Setzke, M. Wiesche, M. Böhm and H. Krcmar (2020). "Digital platform ecosystems" *Electronic Markets* 30 (1), 87–98.
Hoffmann, I., N. Jensen and A. Cristescu. "Decentralized Governance for Digital Platforms - Architecture Proposal for the Mobility Market to enhance Data Privacy and Market Diversity". In *2021 IEEE 18th Annual Consumer Communications & Networking Conference (CCNC)*.
Hoffmann, W., D. Lavie, J. J. Reuer and A. Shipilov (2018). "The interplay of competition and cooperation" *Strategic Management Journal* 39 (12), 3033–3052.
Jacobides, M. G., C. Cennamo and A. Gawer (2018). "Towards a theory of ecosystems" *Strategic Management Journal* 39 (8), 2255–2276.
Jacobides, M. G., T. Knudsen and M. Augier (2006). "Benefiting from innovation: Value creation, value appropriation and the role of industry architectures" *Research Policy* 35 (8), 1200–1221.
Jensen, T., J. Hedman and S. Henningsson (2019). "How TradeLens Delivers Business Value With Blockchain Technology" *MIS Quarterly Executive* 18 (4), 221–243.
Kapoor, R. and J. M. Lee (2013). "Coordinating and competing in ecosystems: How organizational forms shape new technology investments" *Strategic Management Journal* 34 (3), 274–296.
Klein, H. K. and M. D. Myers (1999). "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems" *MIS Quarterly* 23 (1), 67–93.

Labazova, O. (2019). "Towards a Frameworks for Evaluation of Blockchain Implementations". In: *Proceedings of the 40th International Conference of Information Systems (ICIS 2019)*. Munich, Germany.

Lacity, M. and S. Kahn (2017). "Exploring Preliminary Challenges and Emerging Best Practices in the Use of Enterprise Blockchain Applications". In: *Proceedings of the 52nd Hawaii International Conference on System Sciences,* pp. 4665–4674.

Lacity, M. C. (2019). "Addressing Key Challenges to Making Enterprise Blockchain Applications a Reality" *MIS Quarterly Executive* 17 (3), 201–222.

Lavie, D. (2007). "Alliance portfolios and firm performance: A study of value creation and appropriation in the U.S. software industry" *Strategic Management Journal* 28 (12), 1187–1212.

Lianos, I. (2019). "Blockchain Competition" *Ph. Hacker, I. Lianos, G. Dimitropoulos \& S. Eich, Regulating Blockchain: Political and Legal Challenges, OUP*.

Lockl, J., V. Schlatt, A. A. Schweizer, N. Urbach and N. Harth (2020). "Toward Trust in Internet of Things Ecosystems: Design Principles for Blockchain-Based IoT Applications" *IEEE Transactions on Engineering Management* 67 (4), 1256–1270.

Mattila, J. and T. Seppälä (2018). "Distributed Governance in Multi-sided Platforms: A Conceptual Framework from Case: Bitcoin". In A. Smedlund, A. Lindblom and L. Mitronen (eds.) *Collaborative Value Co-creation in the Platform Economy*, pp. 183–205. Singapore: Springer Singapore.

Mattke, J., C. Maier, A. Hund and T. Weitzel (2019). "How an Enterprise Blockchain Application in the U.S. Pharmaceuticals Supply Chain is Saving Lives" *MIS Quarterly Executive* 18 (4), 245–261.

Moore, J. F. (1997). *The death of competition. Leadership and strategy in the age of business ecosystems.* 1. paperback ed. New York, NY: Harper Business.

Nakamoto, S. (2008). *Bitcoin: A Peer-to-Peer Electronic Cash System*. URL: https://bitcoin.org/bitcoin.pdf (visited on 11/06/2020).

Nguyen, T. H., J. Partala and S. Pirttikangas (2019). "Blockchain-Based Mobility-as-a-Service". In: *ICCCN 2019. The 28th International Conference on Computer Communications and Networks : July 29-August 1, 2019, Meliá Valencia Hotel (Avenida de las Cortes Valencianas, 52), Valencia, Spain*. Piscataway, NJ: IEEE.

Oliveira, L., L. Zavolokina, I. Bauer and G. Schwabe (2018). "To Token or not to Token: Tools for Understanding Blockchain Tokens". In: *Proceedings of the 39th International Conference on Information System Sciences*. San Francisco, USA.

Ølnes, S., J. Ubacht and M. Janssen (2017). "Blockchain in government: Benefits and implications of distributed ledger technology for information sharing" *Government Information Quarterly* 34 (3), 355–364.

O'Mahony, S. and R. Karp (2020). "From proprietary to collective governance: How do platform participation strategies evolve?" *Strategic Management Journal* 49 (2), 15.

Pedersen, A. B., M. Risius and R. Beck (2019). "Blockchain Decision Path: 'When to Use Blockchain?' - 'Which Blockchain Do You Mean?'" *MIS Quarterly Executive* 18 (2).

Peters, G. W. and E. Panayi (2015). *Understanding Modern Banking Ledgers through Blockchain Technologies: Future of Transaction Processing and Smart Contracts on the Internet of Money*. URL: http://arxiv.org/pdf/1511.05740v1.

Peters, G. W. and E. Panayi (2016). "Understanding Modern Banking Ledgers through Blockchain Technologies: Future of Transaction Processing and Smart Contracts on the Internet of Money". In *Banking beyond banks and money,* pp. 239–278. Cham: Springer.

Rieger, A., F. Guggenmos, J. Lockl, G. Fridgen and N. Urbach (2019). "Building a Blockchain Application that Complies with the EU General Data Protection Regulation" *MIS Quarterly Executive* 18 (4), 263–279.

Rossi, M., C. Mueller-Bloch, J. B. Thatcher and R. Beck (2019). "Blockchain Research in Information Systems: Current Trends and an Inclusive Future Research Agenda" *Journal of the Association for Information Systems* 20 (9), 1388–1403.

Saldaña, J. (2013). *The Coding Manual for Qualitative Researchers.* 2nd Edition. Thousand Oaks, CA, USA: SAGE Publications Inc.

Sarker, S., X. Xiao, T. Beaulieu and A. S. Lee (2018). "Learning from First-Generation Qualitative Approaches in the IS Discipline: An Evolutionary View and Some Implications for Authors and Evaluators (PART 2/2)" *Journal of the Association for Information Systems* 19 (9), 909–923.

Saunders, B., J. Sim, T. Kingstone, S. Baker, J. Waterfield, B. Bartlam, H. Burroughs and C. Jinks (2018). "Saturation in qualitative research: exploring its conceptualization and operationalization" *Quality & quantity* 52 (4), 1893–1907.

Schultze, U. and M. Avital (2011). "Designing interviews to generate rich data for information systems research" *Information and Organization* 21 (1), 1–16.

Schulz, T., M. Böhm, H. Gewald and H. Krcmar (2019). "Door-to-Door Mobility Integrators as Keystone Organization to Smart Ecosystems: Resources and Value Co-Creation - A Literature Review" *14. Internationale Tagung Wirtschaftsinformatik (WI 2019)*, 1463–1477.

Schulze, T., S. Seebacher and F. Hunke (2020). "Conceptualizing the Role of Blockchain Technology in Digital Platform Business". In: Springer, Cham, pp. 150–163. URL: https://link.springer.com/chapter/10.1007/978-3-030-38724-2_11.

Sedlmeir, J., H. U. Buhl, G. Fridgen and R. Keller (2020). "The Energy Consumption of Blockchain Technology: Beyond Myth" *Business & Information Systems Engineering* 51 (2), 54.

Smith, G. and D. A. Hensher (2020). "Towards a framework for Mobility-as-a-Service policies" *Transport Policy* 89, 54–65.

Sochor, J., H. Arby, I. M. Karlsson and S. Sarasini (2018). "A topological approach to Mobility as a Service: A proposed tool for understanding requirements and effects, and for aiding the integration of societal goals" *Research in Transportation Business & Management* 27, 3–14.

Swan, M. (2015). *Blockchain: Blueprint for a new economy.* First Edition. Sebastopol, CA, USA: O'Reilly Media, Inc.

Szabo, N. (1997). *Formalizing and Securing Relationships on Public Networks*. URL: http://firstmonday.org/ojs/index.php/fm/article/view/548.

Tiwana, A. (2014). *Platform ecosystems. Aligning architecture, governance, and strategy.* Amsterdam, Waltham MA: MK.

Treiblmaier, H. (2018). "The impact of the blockchain on the supply chain: a theory-based research framework and a call for action" *Supply Chain Management: An International Journal* 23 (6), 545–559.

Upadhyay, N. (2020). "Demystifying blockchain: A critical analysis of challenges, applications and opportunities" *International Journal of Information Management* 54 (12), 102120.

Utriainen, R. and M. Pöllänen (2018). "Review on mobility as a service in scientific publications" *Research in Transportation Business & Management* 27, 15–23.

van Pelt, R., S. Jansen, D. Baars and S. Overbeek (2021). "Defining Blockchain Governance: A Framework for Analysis and Comparison" *Information Systems Management* 38 (1), 21–41.

Wareham, J., P. B. Fox and J. L. Cano Giner (2014). "Technology Ecosystem Governance" *Organization Science* 25 (4), 1195–1215.

Xia, J., Y. Wang, Y. Lin, H. Yang and S. Li (2018). "Alliance Formation in the Midst of Market and Network: Insights From Resource Dependence and Network Perspectives" *Journal of Management* 44 (5), 1899–1925.

Yin, R. K. (2009). *Case Study Research. Design and Methods.* 4th Edition. Thousand Oaks, CA, USA: SAGE Publications Inc.

Zavolokina, L., R. Ziolkowski and I. Bauer (2020). "Management, Governance, and Value Creation in a Blockchain Consortium" *MIS Quarterly Executive* 19 (1), 1–17.

Ziolkowski, R., G. Miscione and G. Schwabe (2020). "Decision Problems in Blockchain Governance: Old Wine in New Bottles or Walking in Someone Else's Shoes?" *Journal of Management Information Systems* 37 (2), 316–348.