Mine, Yours, … Ours? Managing Stakeholder Conflicts in an Enterprise Blockchain Consortium

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Abstract

When major corporations build and manage own platforms, most of the conflicts are resolved internally. With the rise of blockchain systems, also blockchain-based platforms are increasingly tried out, which are governed in a decentralized fashion. But moving from hierarchical efficiency to a democratic inclusiveness, in which blockchain proponents believe, is difficult: the variety of included actors raise a variety of conflicts, when platform users become platform complementors or even owners. To manage these conflicts, it is necessary to analyze each actor in detail. This paper reflects on the developments within an ongoing enterprise blockchain consortium in a small European country in the automotive domain from a governance perspective. We portray the consortium's stakeholder conflicts, propose solutions for these conflicts and relate them to literature on blockchain governance. Our findings contextualize several theoretical stances, emphasizing the importance of the organizational over the technological embedment in blockchain governance.

1. Introduction

With Bitcoin celebrating its tenth anniversary, blockchain technology continues to attract significant attention in both academia and practice. Thereby, blockchain technology evolved from an enabler from cryptocurrencies to a novel architecture of organizing, transacting, and sharing data in a decentralized manner [1]. This high level of interest in practice is particularly reflected in the growing number of blockchain consortia [2]. In such a consortium, as one instance of an inter-organizational (IO) collaboration, different companies join forces to mutually develop, maintain, and run a blockchain-based system. Main drivers for these efforts are, among others, promises for novel products, process efficiencies, or greater customer intimacy [3]. These promises, however, are not new, as previous research on IO collaboration shows. Reasons like missing management commitment, mistrust, or vested interests are prominent [4]. Dealing with these makes the management and alignment of stakeholder a crucial component.

Blockchain systems, on first sight, stand at odd with concepts like stakeholder management. In their early days, the governance of blockchain systems like Bitcoin, which is one of the most prominent blockchain systems to date, followed principles known from the free-and-open-source software (FOSS) development domain. In these, actors are mostly independent from each other, tend to stay anonymous, and not bound to a particular version of software. These principles make stakeholder alignment methods known from the corporate domain unfeasible. However, blockchains differ from FOSS as blockchains rely on a mutual dependence of software developers, maintainers, and other third parties to assure the system's continuity, security, and also its token's value [5, 6]. And this mutual dependence has a caveat: the inability to manage these stakeholders' interests repeatedly threatened blockchain systems, most famously Bitcoin [7]. Alternative governance concept were tried out [8, 9], which led to the emergence of decentralized autonomous organizations (DAOs) [10] and blockchain consortia. Here, we focus on the latter, which account for network-type settings based on reciprocity, a varying degree of trust, and known actors.

Several researchers call for research on stakeholders of blockchain systems [9, 11, 12], as an improved understanding of stakeholders is a prerequisite to manage potential conflicts and, thus, contribute to a better blockchain governance. This paper contributes to these calls by exploring stakeholder interests, conflicts, and possible ways of managing these with a focus on blockchain consortia. To do so, we report from our involvement in a blockchain consortium in the automotive industry in a small European country, called "CarCon" (anonymized). There, we designed and later strove to improve CarCon's governance. A necessary step to do so has been to understand, what (1) stakeholder conflicts there were and (2) how these potentially could be resolved. We utilized various data sources, such as official project meeting minutes, notes taken as participant-ob-

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server throughout the project duration, as well as 8 interviews with senior stakeholders from the project. Even though blockchain consortia operate differently from public and permissionless blockchains like Bitcoin, we believe several conflicts to overlap because of a blockchain's characteristics, as we will argue below. Our research was led by the following research questions:

RQ 1: Which stakeholder conflicts can be observed within CarCon?

RQ 2: How could these conflicts be resolved by a Blockchain Governance?

RQ 3: How do these conflicts and resolutions relate to Blockchain Governance?

This paper is organized as follows: we outline related work in the following section. After detailing our methodology, we introduce the case of CarCon. Then, we show central stakeholder conflicts within CarCon and possible resolutions to these. In the discussion, we relate observed stakeholder conflicts to blockchain governance literature. We conclude by outlining its limitations and showing potential venues for future research.

2. Related Work

This section highlights related work on modes of governance, blockchain governance and its evolution, and shows the importance of a stakeholder-oriented view on blockchains.

2.1. Markets, Hierarchies, Networks, and Online Modes of Governance

At its core, governance describes how order between different parties is established [13]. Dealing with stakeholders, i.e., in terms of conflict resolution, is highly contingent on the mode of governance – or order – in which (trans-) actions take place. Modes of governance can be classified into hierarchies (control and authority) and markets (price and free choices) [14]. The network mode of governance extends this dichotomy by introducing a relational view on actors, which share a common goal, and whose collaboration is based on reciprocity [15]. These modes of governance do not account for online phenomena, such as commons-based peer production [16]. FOSS is an instance of the latter, and several authors argue that blockchain systems have their roots in these [8]. FOSS is typically characterized by no central steering entity, use of open licenses to promote co-development, and informal relations among actors [17]. Thereby, FOSS stands as an example of how established governance mechanisms, and thereby stakeholder management, are altered by technology. For example, hierarchical control becomes unfeasible, due to its "structurelessness" [18], open licenses are limiting clear property rights, which are necessary for markets, and relational contracting is hindered by anonymity. This is in line with several authors who argue blockchains to alter existing [19] or to constitute new [8] forms of governance, which affects stakeholder relationships and stakeholder management.

2.2. Fundamentals of Blockchain Systems

As this paper focuses on blockchain governance in terms of stakeholder conflicts, technical details of a blockchain system are only introduced to the extent they are necessary. We define blockchain systems as a "blockchain application and (its) organizational embedment" [1]. Blockchains rely on the principles of anonymity, persistency, auditability, and decentralization [20]. These principles depend on the applied blockchain type. An important concept to blockchains are so-called smart contracts, which, in layman's terms, constitute encoded, self-enforcing business logic [21], which is often linked to reduction of transaction costs. Automation depends on deterministic inputs, evaluation criteria, and outputs; as a result, smart contracts are well-suited for routine tasks with predictable outcomes, but ill-suited for personalized tasks with unknown outcomes [21].

The most common and researched blockchain type to date refers to public and permissionless blockchains, such as Bitcoin [22]. In contrast, mostly so-called private and permissioned blockchains [23] are tried out in blockchain consortia. In these, various use-cases are tried out [24], for example, in supply chain tracking [25], land registration and transfer [26], and many others. One has to differentiate business blockchain consortia, such as the latter, from technology-oriented consortia, such as Hyperledger [27]. Our study focuses on one instance of a business blockchain consortium. We define the latter as an IO network of multiple companies working together toward a common purpose utilizing blockchain technology (adapted from Popp et al. [28]).

2.2. Stakeholder Conflicts and Blockchain-based Systems

The alignment of stakeholders is repeatedly considered central for successful projects [29]. To strengthen this alignment, literature streams such as Project Management offer helpful tools, such as weighted decision matrices or organizational design analysis [30]. These tools proved helpful in the corporate domain, in which bureaucratic control can be applied. But even in these, researchers have repeatedly unfolded the complexity of internalities of companies, where stakeholder management has been seen as a fundamental activity for project success [29]. In contrast, bureaucratic control becomes unfeasible in inter-organizational (IO) networks [15],

where parties work together as long as benefits succeed costs: reasons for IO networks to form can vary, from access to and leveraging of resources, seamless service quality and coordination, mutual learning through knowledge exchange, innovation, or sharing risks [28, 31]. Consequently, IO networks are often found to be hindered or even failing due various reasons such as cultural clashes or power imbalances [28], or missing alignment of stakeholder interests [32]. These stakeholder interests can vary greatly: from business conflicts on competition within or outside a consortium [28], or regulatory conflicts [33]. To meet these challenges, it is vital to obtain a detailed understanding of these organizational arrangements [28, 34], especially in regard to the novelties blockchains bring. Seebacher and Schüritz [34] contrasted known challenges in IO information systems implementation against challenges brought forward by blockchain technology: while the majority of challenges are similar, they conclude, that blockchain's promise of decentralization – especially on an organizational level – stands contrary to IO practices, where central stakeholders eventually build their own hierarchy due to their higher negotiation power [35].

Complementary to a transaction-cost-centric view, principle-agent conflicts [36, 37] add an additional perspective on stakeholder conflicts. At its core, it deals with one party (principal) delegating work to another (agent), and possible conflicts among these, such as diverging goals or attitudes towards risk [37]. Principle-Agent conflicts can be resolved in several ways, such as direct supervision, lowering information asymmetries, establishing shared values, or proper incentivation [37]. Similarly, in blockchain systems, several of these are being applied: for example, central operations, such as mining, place incentives to assure honest mining behavior, and information asymmetries are lowered through publicly visible transactions or change proposals [38]. Aside from the blockchain system operation, a central principle-agent conflict in the blockchain domain revolves around the inability of users to assess ongoing developments around a project [7]: often, change proposals are written in technical terms, which necessitates knowledge on technicalities, which users might lack. Consequently, users, at least to a certain degree, must trust core developers to act honestly, while having limited means to assess their work. This centrality of technical knowledge but also on technical decision rights is discussed widely in blockchain governance literature [7, 10] and seen controverse, as it stands contrary of the principles of decentralization blockchains originated from.

Phenomena such as FOSS development, reintroduced a logic based on a gift economy rather than market principles [39]. A central reason for the gift economy to work was that one's use did not affect another's – facilitated by marginal replication costs, cheap computational power, and a widely-accessible network [5]. Blockchains differ in their mode of governance from FOSS due to the mutual dependence of actors on one specific version of software at a time [5, 8]. Consequently, the idea of developing and maintaining a shared resource – in this instance: a shared information infrastructure – emphasizes the so-called "tragedy of the commons" [40] within the digital domain. The tragedy of the commons was first conceptualized in the 1840ies [41] and later became central in Nobel Laurate Elinor Ostrom's work [42] "Governing the Commons". Its underlying problem refers to a shared-resource setting, in which actors spoil the commons through opportunistic action, thus, working for own instead of shared interest. Hardin [43], in his own interpretation of the tragedy of the commons, labeled such behavior as "privatizing profit and socializing losses". Possible resolutions to the tragedy of the commons refer to assigning property rights to commons, which effectively privatizes commons, top-down regulation (e.g., a regulator defines rules of using the commons per actor), which re-introduces principle-agent problems, or the development of a collective action agreement (e.g., parties agree on rules for common usage among themselves) [42].

The role of commons in blockchain-based systems is already being explored in academia by several authors [44 - 46]: Rozas et al. [45] identified affordances, such as tokenization or transparentizing, brought forward by blockchain technology and discussed them against Ostrom's principles for commons governance [42], while Calcaterra [44] explores DAOs' governance through the lens of Ostrom's principles. Shackelford & Meyers [46] study Ostrom's principles through the lens of the governance of – instead of by – blockchains.

While these works focus on rather public and permissionless blockchains, it remains unclear, if there are differences to business blockchain consortia. This is relevant, as blockchain consortia also constitute by definition a shared-resource setting in blockchain development and maintenance.

3. Methodology

This paper reports on findings from a project called CarCon[1], in which the authors were involved as research partners. The research team has been involved from the

[1] Please note, that CarCon started as an innovation project, which lasted from spring 2017 until November 2019; in April 2019, CarCon founded the CarCon Association as separate legal body to continue to advance CarCon after the innovation project's completion.

project's initial idea in spring 2017 until the innovation project's end in March 2020. In this time, the research team worked on operational (e.g., business analysis) as well as strategic (e.g., founding of a legal body) matters; these tasks allowed us to gain a concise understanding on the ongoings within the projects from different perspectives, as well as the access to an extensive documentation of meeting notes throughout the project.

This research is designed as an action research following the methodology proposed by Baskerville [47] and focuses on CarCon's governance. More specifically, this research focuses on fall 2019, when it became apparent, that a more advanced governance concept for CarCon became necessary (**diagnosing**; see results section). The research team, together with practitioners, initiated a focus group [48], agreed upon a scope and project activities to be conducted by the group to evaluate the current governance concepts, where it falls short, and how it can be improved (**action planning**). Due to space limitations, within this paper, we only focus on stakeholder conflicts and proposed resolutions for these, and not on other parts of the developed governance concept. As for the first cycle of **action taking**, we applied a simplified stakeholder analysis model adapted from Smith [49] and Cleland [50], which analyzes stakeholders along the dimensions of their influence on the project, each stakeholder's importance of the project, and their main interests for participating in the project. We applied this model for each stakeholder based on notes taken from in-person discussions, triweekly project meetings, quarterly meetings of the strategic committee, and the official project documentation and meeting minutes. Then (**evaluating**, cycle 1), we validated our initial stakeholder analysis with eight senior project stakeholders as part of semi-structured expert interviews [51]. The set of interviewees consisted mainly of parties involved from the beginning on. During the interview, we asked every stakeholder to evaluate and argue the importance of the project, influence on the project, perceived conflicts, and interests for his respective organization but also for other stakeholders and among these. This allowed us not only to evaluate most of the stakeholders' views on their own involvement, but also to obtain valuable insights on how stakeholders viewed each other. Our interviews yielded over 12 hours of audio material, which were transcribed and coded as a preparation for the second cycle of **action taking**. For the latter, we utilized the obtained feedback from the expert interviews for a consequent elaboration of a proposal for a to-be governance concept. As part of this (**action taking**, cycle 2), we extended our initial stakeholder analysis by categorizing perceived conflicts into conflict categories (competition, principle-agent, commons vs. privates, and regulatory conflicts), conflict areas (subcategories), conflicts, and initial proposals on how these could be dealt with (see results); this categorization related our findings to associated concepts and theories from academic literature. As this categorization is based on our empirical analysis instead of academic frameworks, it allows us to argue its relevance for blockchain consortia such as CarCon. As a last step (**evaluating**, cycle 2), the focus group evaluated our stakeholder analysis, derived conflicts, and proposed solutions for these conflicts. After taking obtained feedback into account and reworking our governance proposal, this engagement phase has been concluded with an official handover of our results to CarCon. This paper documents the established link of our results the theoretical contributions of our action research (**specifying learning**). Table 1. below summarizes our applied methodology.

Table 1. Action Design Research Description

Step	Activity
Diagnosing	Improved governance needed due to problems in practice, as seen in operational and strategic meetings; participant observation [52]
Action Planning	Research and practitioner set up a focus group [48], project scope, and project activities (constituents of governance concept as described below) to be conducted by focus group.
Action Taking	**Cycle 1:** Stakeholder analysis, review of the current governance concept, application of an IT governance framework, and conceptualizing a proposal of a to-be governance concept. **Cycle 2:** Rework of governance concept. Transcription of interview recordings, rough coding centering around stakeholder interests and improvements to our proposal.
Evaluating	**Cycle 1:** Evaluation with eight senior stakeholders within semi-structured expert interviews [51]. **Cycle 2:** Reworked governance proposal evaluation with three subject-matter experts in a dedicated focus group [48]
Specifying Learning	Hand-over of our findings to organization. Theoretical contribution worked out by research team within this paper.

4. Case Description: Towards a Blockchain within CarCon

In the following, we first introduce the case of CarCon and its related stakeholders. Then, we show observed stakeholder conflicts and relate them to possible resolutions. Thereby, this section answers research question one and two.

4.1. Introduction to CarCon: Overall Idea and Governance Evolution

CarCon was initiated in 2018 and deals with a consortium of several major stakeholders in the car ecosystem in a small European country. This consortium is led

by the vision of lowering the information asymmetry between buyers and sellers of cars in the used-car market, which refers to the work of Nobel laurate Akerlof [53]. To do so, as shown in Figure 1. below, CarCon is implementing a blockchain-based system to store car-related data over a car's lifecycle, from its import to its wrecking. Data, together with basic functionalities, are provided in the infrastructural layer. This infrastructure is then utilized to power so-called "dapps" (decentralized applications), which represent use cases developed within the consortium. While the infrastructural layer and some dapps belong to the commons, dapps can also be developed by and for oneself (private). Lastly, a dapp needs to be integrated into the stakeholder's system. In general, CarCon beliefs a blockchain-based system to allow for (1) new product offerings, such as an algorithmically verified car history (CarCon dossier), (2) digitizing existing processes among members in the car ecosystem, allowing for operational excellence, and (3) higher customizability of existing products, such as individualized and automatically enforced car insurances [3]. While some of these can be realized by information/process integration among few parties, central to CarCon is the complete CarCon dossier, which can be seen as one instance of dapps. The value of such a dossier depends widely on the integrity, reliability, and completeness about information of a car [8]. This, however, is difficult to obtain, as a car encompasses numerous actors over its lifecycle, such as insurances, state agencies, or various owners. Consequently, information about a car is structurally fragmented and maintained inconsistently, which leads to various "truths" of a car.

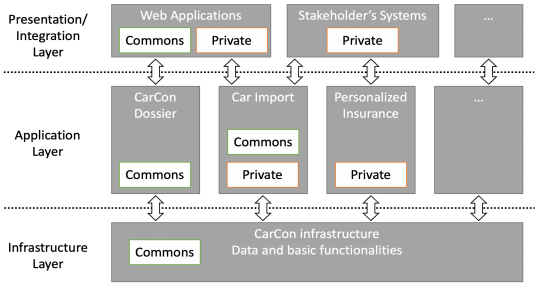

Figure 1. Overall functioning of CarCon

To achieve a minimal viable car record, from the onset on, the consortium was planned to cover major stakeholder of different roles within the ecosystem. Choosing not to include competitors early on allowed CarCon to avoid potential conflicts while maintaining pace. At the beginning, CarCon consisted of several industry stakeholders, such as a mobility service provider (CarShare), a road traffic agency (RTA), a major importer and repair shop (CarImport1), and a major insurer (CarInsurer1), who contribute their domain expertise and data to CarCon. In addition to these, the initial consortium included a large software company (ITConsult), a team of legal experts (PrivacyUni), and us as the research team (ResearchUni). Several other parties, such as CarImport2, joined the consortium shortly after its legal body was founded. Note, that several other CarCon stakeholders were not part of our analysis, as they joined either at the time of our analysis or later.

4.2. Exploring Stakeholder Conflicts within CarCon

In the following, we explore the stakeholder conflicts within CarCon one by one along the four main identified areas of competition, principle-agent, regulatory, and commons conflicts. For each of these, we show our proposed resolutions to these.

Competition Conflicts. Several of CarCon's stakeholders stand in direct competition within and around CarCon. We categorized these conflicts into *market*, *research*, and *IT* competition. As for *market competition*, several actors compete outside of CarCon in their own respective core business (e.g., CarImport and CarImport2), others in complementary but similar product offerings (e.g., CarCon and CarImport). To mitigate problems arising from these conflicts, we proposed several measures: (1) each stakeholder can declare conflicts of interest on a specific form, available to seen by all parties of CarCon, which increases the transparency of a stakeholder's action. For example, CarImporter1 ran a project like CarCon's internally and disclosed it to CarCon early on. (2) Further, if stakeholders would fail to settle a conflict amongst themselves, a so-called fairness board allocated within CarCon would arbitrate as a neutral third party. Thereby, it would enforce an agreed-upon code-of-conduct, comprising fundamental rules and procedures how these conflicts should be dealt with. (3) Lastly, CarCon should allow to accommodate private (exclusive) workstreams, which allows stakeholders to work on own solutions, e.g., own, novel products or efficiency-enhancing systems.

As for *research competition*, two conflicts were mentioned: (1) competition on research funds offered by CarCon or individual stakeholders (e.g., for specific workstreams) between ResearchUni, PrivacyUni, or others, and (2) the conflict of relevance for theory and practice, related to the question of what research specifically should be funded, as businesses may have limited interest in funding research without tangible, business-oriented outcomes. We proposed to tender research grants publicly within CarCon, where research partners would compete for these. CarCon-related research grants would then be decided within CarCon's steering committee – funding of individual research projects is naturally subject to agreement between a research partner and the respective CarCon member.

Lastly, *competition on IT* revolved around allocation of decision rights regarding development and operation of IT. These decisions rights are financially attractive, as they may result in a high dependence on one IT provider, which also benefits from gained know-how, which can then be applied to other projects. This conflict has not been prevalent within CarCon, as we focused on getting the system itself to run. For its future governance, however, to avoid being dependent on one single IT provider, we proposed to (1) install a central IT steering committee, which holds major decision rights from an architectural perspective, (2) introduce a dedicated IT partner management as an organizational function within CarCon, which coordinates between the IT partners, and to (3) tender architectural functionalities to all IT partners to be decided upon by CarCon.

Principle-Agent Conflicts. We observed three principle-agent conflicts, which we characterized as *customer-supplier* conflicts as detailed in the following. Our first observed principle-agent conflict revolves around the missing ability of members to assess IT providers in terms of their actions, e.g., system planning, development, operation, or maintenance. Complementary to the previous conflict on know-how and funds, this conflict revolves around the centrality IT providers inhere, and the consequent dependence upon their judgement, i.e., how to design the overall system. Instead of putting the consortium's interest first, IT providers might be inclined to make technological choices to their benefit, e.g., to lock-in clients in their technological eco-system. We proposed to deal with this conflict with means of supervision provided by an IT steering committee, where major architectural decisions are allocated, and a dedicated technology management, which aligns all IT providers. To assure transparency of technical choices and proposals, the development of architectural functionalities (not dapps or individual solutions) should be tendered among IT providers and decided upon in the CarCon steering committee.

Another conflict targets the provision and sharing of data itself. Naturally, several stakeholders inhere more data about a car than others, while others might depend on specific datasets to realize a desired dapp. Stakeholders can consequently be classified into being primarily data sources or data sinks. As part of a data market governance, as we propose, it is necessary to counter monopolies of data (only one party inheres data) with lowering the dependence on these parties by, e.g., relying on data from complementors, for example, car users. Of course, this is not possible in all cases.

For last, data consumers cannot assess the quality of data provided by data providers. There are several ways, how this can be handled, e.g., in compensating data provision or opening channels to report false data, or even triangulating data between more reliable data sources. All of these are part of a dedicated data market governance, which we suggested to implement.

Regulatory Conflicts. We saw two conflict areas regarding regulatory conflicts: *supervisory* and *sectorial* conflicts. As for *supervisory conflicts*, the RTA found itself in a conflict with CarImport, as the RTA, due to antitrust laws, cannot favor any for-profit party over others. This necessitated full transparency of the RTA's actions and proper external communication; if only the perception would be established, that RTA would favor a for-profit party, the RTA would have to leave CarCon. For the same reason, referring to its *sectorial conflict* (public vs. private sector), the RTA can be involved in the development of dapps, but these dapps (and their corresponding workstreams) must be publicly accessible and transparent in terms of revenue. This contingency excludes RTA's involvement in promising, but private workstreams. Furthermore, state bodies can be involved in dapps targeting cost-coverage at best, but never for-profit workstreams; regulation, however, allows for surpluses, which then are gathered and redistributed within the state body. As some of these conflicts might be interpreted as inhibitors, an early alignment with regulatory entities, such as the RTA, legitimizes the consortium's work and, consequently, can be seen as crucial for a project's success [54].

Another conflict concerned the compliance of our system with given data protection laws. Fostering this compliance has been a central reason for PrivacyUni to join CarCon. To assess the degree of compliance of CarCon's system, due to its complexity, PrivacyUni must rely on ITConsult's assessment, at least to a certain degree. We proposed to underline the importance of data compliance within CarCon by a close collaboration with CarCon's compliance function with the development, making regular compliance checks important milestones in the system development lifecycle.

Commons and Privates. The last conflict area we observed regards the division between *common (shared) and private goods*. A core conflict refers to the privatization of benefits, while costs are socialized. In other words: CarCon necessitates commons, e.g., a running infrastructure and basic functionalities, and most of our stakeholder necessitate these. However, from a temporal perspective, stakeholders are inclined to wait for others to develop commons. Furthermore, stakeholders could be inclined to transfer specific functionalities for own use to the commons because there all parties would share the costs. This is especially true for in-workstream-developments and common functionalities. Every workstream entails development, adaption, or usage of CarCon's transaction layer and its functionalities or ongoing transaction-layer-specific workstreams. We proposed to deal with this conflict by developing a tax scheme, which assigns weights for usage, development,

or adaption of the transaction layer and its functionalities. This would allow us to discriminate between "light" and "heavy" usage, development, or adaption to achieve a fair distribution of costs. Furthermore, it is necessary to assign the responsibility of proving the function in question to belong to the commons to the workstreams. If this function would be commonly developed, the intellectual property (IP) rights would remain with CarCon, so its usage would be taxed.

The conflict between *commons and privates* is also evident in the planning of the development pipeline. For example, the technology provider might develop certain features for another project of its own first, while CarCon would need certain features earlier. We proposed to deal with this conflict by enforcing transparency between ITConsult's development pipeline as well as its pipeline for CarCon's development; this would allow other parties to synchronize their development efforts in accordance with recent developments and, if crucial functions would have to be available earlier, the development costs could be shared. It is also necessary to steer dapp development. While parties would want to develop dapps as they like, there must be a necessary quality and commonly shared standards. We therefore proposed to deal a dapp quality management and dapp admission process, which assesses (1) technical feasibility and (2) fit with CarCon's strategy.

For last, inhering complete and accurate record of car data is commonly desired, while individuals might omit entering or falsify data to their benefit. We proposed therefore to develop incentive mechanisms to assure data quality [55], instantiating a data quality management function, and linking CarCon's data to its partners' operational systems (triangulation of data).

5. Discussion

The description of CarCon has shown a case of mutually dependent actors. To answer research question three, a wider discussion follows, in which we relate our findings from the case of CarCon to the academic blockchain governance discourse shown in the related work.

Business Blockchain Consortia and their Mode of Governance. Chapter two shows that economic activity can be accommodated in markets, hierarchies, networks [14, 15], and outside of these [16]. Several authors argue that blockchain systems compete with these modes of governance, seeing blockchains as general-purpose technology [56], and referring to constituents of stakeholders' mutual dependency using the analogy of 'tribes' [5]. Contrasting CarCon's stakeholder conflicts, to which order must be established, shows a mismatch to these. To say the least, these modes of governance do not explain CarCon's governance regarding no clear assignment of property rights and price is not the only governance mechanism employed (contrary to markets), bureaucratic control cannot be enforced (contrary to hierarchies), there is, to a certain degree, mistrust among parties (contrary to networks), and parties are not anonymous (contrary to 'tribes') or mutually-dependent (contrary to FOSS). Rather than trying to understand CarCon's through one governance mode, we inspect CarCon's conflicts, which need to be governed, and our proposed resolutions in the following.

Inspecting Areas of Governance. Within CarCon, we have seen several **principle-agent** conflicts manifesting as customer-supplier conflicts. For all of these, we utilized existing literature to meet these (e.g., [37]), relying on means of supervision, decentralization of IT and data provision, or proper incentivation. What is remarkable is that for most of these our hands were tied: we were only able to propose structures, which might prevent these conflicts to happen, instead of measures dealing with actual instances of these problems. This is because, in contrast to bureaucratic control, in a network-like setting, authority has limits, and we can narrow down agents' action spaces but hardly impose actions. For example, the development of a data market governance can incentivize good and punish bad behavior regarding data provision. However, if an actor chooses to not report data which would be harmful to oneself, there are limited mechanisms CarCon could apply. This problem, in general, refers to the garbage-in garbage-out problem [57], in which blockchains are valuable in persisting data but unable to assess data inputs.

As for conflicts between **commons and privates**, CarCon constitutes an artificial material commons, where a complex system, its infrastructure, and resources are developed through peer production [58]. Creating an artificial commons, i.e. an infrastructure which not only benefits one-self, is a novel approach to business networks, in which information or process integration is frequently applied [59]. Within CarCon, we have observed several conflicts between commons and privates. Especially the conflict between privatizing benefits and socializing costs – to which the title of this paper refers – is prominent: even though we observed several parties to inhere a good understanding of beneficiary business cases for themselves, these could not have been tried out as the necessary infrastructural layer was missing. Furthermore, a first mover would have had to finance commons – infrastructural functions to the benefit of everyone – on top of his own investment in the development of his dapp. Consequently, this partly led to a stalemate, where stakeholders wait for others to invest first. This conflict only serves as an example of the importance of culture in a network-setting, in which parties only collaborate to the degree it is beneficial for them; as a result, culture constrains strategy [60].

As for **conflicts on competition**, naturally, stakeholders are free to leave a business network upon their liking. In a setting of mutually dependent actors, competition conflicts can be constrained for the sake of common gains. For example, after time, several competing businesses, e.g., a second car importer, joined CarCon. Both importers' rationale is that, despite competing for the same customers, there are value potentials, which benefit both – and eventually their customers. We observed various of such conflicts, either within (similar products as CarCon) or outside (same business domain) of CarCon. In addition to these, there were conflicts on CarCon's further development, either from a research or technological side. Our proposed solutions revolved around a culture of fairness, i.e., to make conflicts of interest among parties explicit, or publicly tender any further developments around CarCon and let elected supervisory boards decide upon best fit. We were certain these measures to tackle the inherent informal networks in a business environment [61]. Consequently, the decentralization of major decision rights within CarCon has been central to the revisited governance concept in the second cycle of our action research.

For last, **regulation**, in the sense of local laws and their application, have frequently been cited as a detriment to blockchain adoption [62]. Consequently, collaborating with regulatory entities, CarCon has shown, how working alongside regulators can enhance CarCon's success [54]. At the same time, the collaboration with regulatory entities shaped CarCon's structure and operations, as regulatory entities cannot favor single parties over others, while their actions must be transparent, which effectively make them unsuitable contributors to a business' private workstream. For last, because of many questions in the form of their collaboration, CarCon serves as an example of how regulatory functions, such as our proposed fairness board, compliance function, or business/IT steering committees are a result of a common regulatory process in the very sense of commons governance [42], and how these were institutionalized in an own legal body, the CarCon association.

Building Common Ground. All these conflicts require own rules, on how they can be dealt with. Aside from these, there must be a rule-setting entity, which not only specifies these rules, but also provides rules for changing these rules if need arises. Furthermore, such an entity must also define the overall structure, e.g., which conflict is being dealt with in which realm or by which process. For most of these matters, within CarCon, the CarCon association has been responsible, providing common ground among its stakeholders. For some of these questions, counterintuitively, DAOs, can be helpful: to at least partly overcome opportunistic actions, hence, narrowing down an agent's action space, DAOs encode various governance operations, such as decision-making or changing its underlying ruleset, "on-chain" utilizing smart contracts [10]. This is necessary, as actors in such blockchains tend to stay pseudonymous [5], which would entice opportunistic behavior, to which immutable smart contracts are a solution. But even in these systems, smart contracts cannot account for the formal and informal networks with "off-chain" procedures [38], which render smart contracts unnecessary. It is common among public blockchains to found legal bodies as point of reference to their communities (e.g., Bitcoin's association). To assure that conflicts are met adequately, it is common to provide meta-structures of governance, which accommodate different kinds of decisions, e.g., in organizational or technical boards, which was also part of our work within CarCon.

6. Conclusion

This paper studies business blockchain consortia governance by examining stakeholder conflicts and possible resolutions to these. We discussed our findings against blockchain governance literature and distilled discussion points related to agency, regulation, commons, and competition. As with every research, our research is not free from limitations. First, even though we were part of CarCon since for over three years, our research shows a snapshot of stakeholder conflicts. This is also due CarCon's growth from initially 9 parties to over 22 and counting. Even though we are certain cover central stakeholder conflicts, it can be expected, that these new parties will bring new or alter stakeholder conflicts within CarCon. Furthermore, we cannot ensure the generalizability of our findings. We are confident, however, that CarCon resembles several features from a commons-based blockchain consortium, which, at the very least, stands for a class of blockchain consortia.

We see several future research opportunities. First, studying a consortium over time, with problems in practice, would yield greater detail on which resolutions work and which are altered by blockchain technology. Lastly, our findings in CarCon, show a gap between on-chain functionalities, such as on-chain voting or resource allocation, which DAOs are heavily trying out. Understanding, when to encode which functionality, and criteria for these, might lead to a better understanding on both governance *of* and *through* blockchains.

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8. References

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