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## **When an Institutional IT Renews a Connected Vehicle Ecosystem: Evidence from the trust-mediator Role of Blockchain Technology\***

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### **Abstract:**

This research focuses on the role of blockchain technology as a vector of inter-organizational trust in a reconfiguring ecosystem phase. Using qualitative analysis of data mainly from semi-structured interviews, this study focuses primarily on the deployment of this emerging technology within a connected automotive ecosystem. Based on the notion of "trust-mediator technology", we show how blockchain technology is perceived as an institutional technology offering a new form of governance for all transactions and exchanges between the ecosystem actors. Although the functionalities offer automation to reduce the use of trusted third parties, preliminary results still show a strong commitment to current governance systems, such as regulatory and contractual frameworks. Ecosystem actors consider that complementarity between traditional institutional structures and decentralised blockchain is paramount for the success of any cooperation and collaboration on data on a connected vehicle.

**Keywords: Blockchain, trust, institutional technology, connected vehicle, ecosystem renewal.**

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## **Quand une technologie institutionnelle renouvelle un écosystème de véhicules connectés : Enjeux empiriques de la technologie Blockchain comme médiateur de confiance\***

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### **Résumé en français :**

Cette recherche se concentre sur le rôle de la technologie blockchain en tant que vecteur de confiance inter organisationnelle dans un écosystème en reconfiguration. En utilisant une analyse qualitative de données provenant principalement d'entretiens semi-directifs, cette étude se concentre sur le déploiement de cette technologie émergente au sein d'un écosystème véhicules connectés. En s'appuyant sur la notion de "technologie médiatrice de confiance", nous montrons comment la technologie blockchain est perçue comme une technologie institutionnelle offrant une nouvelle forme de gouvernance pour l'ensemble des transactions et des échanges entre les acteurs de l'écosystème. Bien que les fonctionnalités offrent une automatisation permettant de réduire le recours à des tiers de confiance, les résultats préliminaires montrent encore un fort attachement aux systèmes de gouvernance actuels, tels que les cadres réglementaires et contractuels. Les acteurs de l'écosystème considèrent qu'une complémentarité entre les structures institutionnelles traditionnelles et la décentralisation de la blockchain est primordiale pour le succès de toute coopération et collaboration en matière de données sur un véhicule connecté.

**Mots clés : Blockchain, confiance, technologie institutionnelle, véhicule connecté, reconfiguration d'un écosystème**

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# 1. Introduction

In the current digital transformation context, new generations of digital technologies revolutionise industries and society. In a recent definition of its business impacts, Vial (2019) describes "digital transformation" as a process initiated by technology disruption, leading to a strategic response from organisations and giving rise to value creation at all levels, including ecosystem ones. In this new context of emerging technologies, blockchain technology (henceforth, BCT) aims at providing a trusting data-sharing solution for both organisations and end-users.

So far, IS scholars mainly focus on the technological implementation of blockchain at the organisational or governmental level (Kokina *et al.* 2017, Batubara *et al.* 2018, Duy *et al.* 2018, Holotiuk & Moormann 2018, Clohessy & Acton 2019). Existing research also emphasises the role of external/environmental variables in the adoption process of organisations (Schmitt *et al.* 2019, Chang *et al.* 2020, Malik *et al.* 2020), and the importance of BCT in improving inter-organisational dynamics (e.g., at the supply chain level, Wong *et al.* 2019). More recently, scholars claim that one of the main benefits associated with Blockchain technology is its trust-mediator role (Bodò 2020) and its potential in shaping collaboration and cooperation (Lumineau *et al.* 2021). Yet, existing contributions lack understanding of this trust-mediator role in inter-organisational dynamics and changes at the ecosystem level. This gap in the literature is problematic since, in reality, traditional organizations are leveraging BCT according to its benefits in shaping new and current collaboration and cooperation. New consortiums are emerging at the industry and ecosystem level, specifically following blockchain's definition as a "trust machine"<sup>1</sup>.

BCT's trust-mediator role is particularly relevant to study when looking at the renewal phase of a specific ecosystem. It is assumed that traditional business models' digital transformation occurs at the renewal phase of their ecosystems. Defined as the fourth phase of an ecosystem life cycle (Moore, 1996), renewal occurs when innovations imperil mature business communities - as it is the case with BCT implementation in the connected vehicle ecosystem stressed in this paper. During this fourth phase, the main challenge for ecosystem members is to ensure their competitive survival. This requires reconfiguring the ecosystem's core elements and related complementary components. While strategic challenges (coopetition and leadership management) faced during this activity have been stressed in the seminal work of Moore (who used the traditional auto-industry as empirical context; 1996); less is known about the role of disruptive technology, such as BCT, in achieving reconfiguration of an ecosystem, as a whole.

As a result, this paper **leverages the concepts of trust by technology and mediated trust (Bodò 2020, Söllner *et al.* 2012) to analyse how BCT (and its applications, such as smart contracts<sup>2</sup>) establishes new logics of trust creation or transformation of pre-existed trusting relationships between ecosystem members.**

This paper provides an understanding of the role of BCT for shaping trust dynamics in the renewal phase of a connected vehicle ecosystem. It contributes to the existing literature on BCT by questioning the main benefits of this technology in trust dynamics through the analysis of two use cases. Our research contributes to the literature by challenging an emerging perspective

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<sup>1</sup> Definition from The Economist, October 31, 2015, "The Trust Machine".

<sup>2</sup> In 1997, Nick Szabo defines smart contracts as computerised protocol that implement clauses and terms of a contracts in an automatic manner. These digitalized contracts are considered as one of the most promising uses of the blockchain.

considering BCT as an "institutional technology". We mainly question the coexistence of social and regulatory-based procedures with the new technology-based mode of organization. Consistently, the aim of the paper is threefold. First, it provides evidence on BCT's role as a trust mediator in an ecosystem reconfiguration. Second, it offers an original contribution to the IS literature dealing with "institutional technology" (Davidson *et al.* 2018) looking at the shift from a traditional governance system to new coordination mechanisms offered by BCT. Last but not least, at a more empirical level, this paper illustrates the use of BCT in the automotive industry, which is significantly less studied than other sectors (such as finance and industry).

In line with its main content, this paper falls into five main parts: 1) A literature survey on blockchains as 'institutional technologies'; 2) the empirical context of the paper - the role of BCT in a connected vehicle ecosystem; 3) the research method; 4) preliminary results and 5) concluding remarks.

## **2. Blockchains as "institutional technologies" enabling digital transformation**

The invention of blockchain in 2008 is emblematic of the current digital transformation era, seen as a complex phenomenon triggered by significant changes brought about by digital technologies in the automation of business processes and company's business model and ecosystem. Scholars still diverge on the distinctive nature of digital transformation strategy; some arguing that digital strategy should be implemented as a part of a firm's IT strategy; while others claim that digital transformation demands a standalone strategy that is not part of a functional strategy (Hess *et al.*, 2016). Vial (2019) argue that the current digital transformation process generates changes in value creation paths. It is increasingly fostered by relationships between people, groups of people and organisations, on the one side, and between users and innovative digital technologies, on the other. Hence, a digital strategy cannot be exclusively aligned with the firm's IT strategy anymore but has to develop at the ecosystem level. This is especially the case when one studies the distinctive features of blockchain and its recent economic implications.

### **2.1. Blockchain technology as an enabler of new forms of economic activities' coordination**

Recent contributions reject the definition of blockchain as a "traditional" digital platform defined as firm operating multi-sided markets. By contrast, blockchains are seen as a new category of digital platforms where "*management is distributed, or decentralised across a large number of (...) block validators and developers*" (Allen *et al.* 2020; de Filippi & Lovelock, 2016). Initially introduced in the field of institutional economics, the concept of "institutional technology" is concerned with processes and mechanisms that enable alternative systems of governance for economic exchange and economic activities' coordination (Davidson *et al.* 2018). Since "institutional technologies" operate at the economic organisation level, they differ from traditional "industrial technologies" that usually impact industrial productivity inside the firm. To that extent, while introducing new forms of coordination and governance, blockchains facilitate "institutional entrepreneurship" and shift adoption issues from individual to group level. To sum up, blockchain technologies enable a wide range of governance systems, including those based on commons management (Ostrom, 1990).

Consensus protocols, smart contracts, and other blockchain features provide new forms of coordination, especially throughout the appearance of new digital platforms for facilitating data transferring and transactions between organisations. Therefore, blockchain technology is defined as an assemblage of processes and mechanisms that enable new governance systems for coordination (Alen *et al.* 2020). Because blockchains can drive new forms of coordination between economic activities, it is worth wondering what drives actors to participate in a blockchain-based ecosystem. BCT's mediator role between heterogeneous actors is the working hypothesis formulated in this paper.

## **2.2. Trust as a blockchain technology benefit enabling the digital transformation of an ecosystem**

A community of heterogeneous actors producing value-based goods and services to customers, who are themselves members of this community is defined as a business ecosystem (Moore, 1996). As a business ecosystem matures, it faces four fundamental challenges that respectively characterise the four phases of its life cycle: birth, expansion, authority and renewal or death (*ibid*). To avoid death, the ecosystem's keystone actor must succeed in achieving one main challenge: "*ensuring that the business sustains continuous performance improvement*" (*ibid*, p. 83). Several strategies or processes, such as digital transformation, could be chosen to realise such improvement. The use of new digital technologies to improve major business or uncover new ways to create value is defined as a digital transformation process (Vial, 2019). As a result, implementing blockchain technology in the extant product architecture of an ecosystem should improve one or more value creation mechanisms. This potentiality can be identified through BCT's benefits. As its main advantage is to be presented as a "trustless consensus engine", BCT's material properties reflect such benefits (Beck *et al.* 2016, Werbach 2018a). Here, it is argued that two main types of trust have to be considered to analyse how an ecosystem can improve its business performance by shifting to new system governance of its economic activities' thanks to blockchain technology:

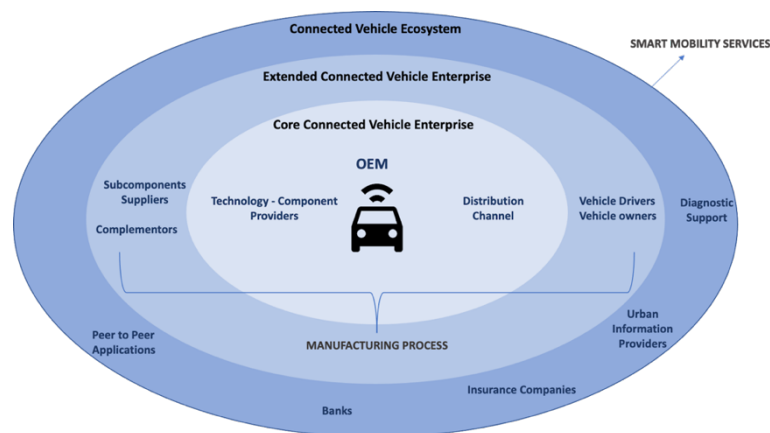
1. **Interpersonal trust mediated by technology** (Bodò, 2020). One prerequisite condition to reach this level of trust is to develop an initial "trust in technology" (Sollner, 2011 and McKnight *et al.* 2011). In this paper, because we look at extant coordination of economic activities in which actors are familiar with blockchain technology, it is assumed that this prerequisite condition is implicitly validated. As claimed by Bodò (2020, p. 2), blockchains shape "*how humans trust each other, and that in order to fulfil this task, they need to be trustworthy*". Put differently, we will assume free trust in the blockchain protocol.
2. **Institutional trust** (Davidson, 2018). Because of the technology's governance-related nature, the second category of trust is concerned with third-party verification. Secured blockchains are seen as a 'trustless' distributed ledger. The production of consensus avoids requiring centralised trust.

As pointed out by Allen (2020), blockchains' diffusion as institutional technologies questions institutional stability. The new room given to institutional entrepreneurship underlies an increasing competition between 'blockchain-based institutions' and 'existing' traditional institutions. This coexistence is also questioned in this paper: ***How do new forms of blockchain-supported governance and more traditional governance mechanisms could coexist in the same ecosystem?***

To answer this question, we choose to conduct a qualitative case study on the connected vehicle ecosystem's digital transformation.

### 3. Blockchain implementation in the connected vehicle ecosystem: The case of Renault

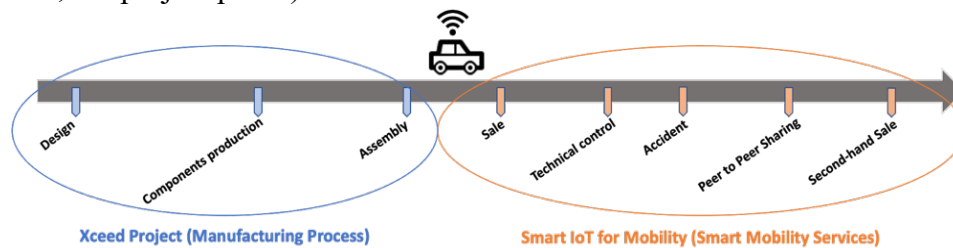
The Smart Mobility transition refers to the digital transformation in the mobility system (Docherty *et al.* 2018). Smart Mobility is an outstanding example of digital transformation involving emerging technologies, such as the Internet of Things, peer to peer applications, connected vehicles and autonomous systems challenging industry and, more broadly, all players in the ecosystem. Indeed, the idea of having a single automotive manufacturer taking care of all activities from design to final vehicle assembly is outdated given today's globalisation. Today, a global network of small and large players deals with vehicle components' production and assembling, and their activities' coordination (e.g., design, logistics, production) could be sometimes challenging. For this reason, several automotive players are investigating the potential of blockchain technology to simplify, secure, and perform coordination mechanisms at the industrial level (see, blockchain projects of Mercedes-Benz, Ford for supply chain). BCT will provide a transparent and trustable environment for collecting, validating, storing and sharing data, also throughout the use of smart contracts. As a result, new collaborations will conceive a customer-based approach in offering smart mobility services. Moreover, the end-users will also directly benefit from the blockchain-system during the vehicle's whole ownership duration. Such digital transformation leads to a renewal of the core connected vehicle ecosystem with the entrance of new actors and/or the digitalisation of extant members' interactions (Figure 1). This renewal results from Original Equipment Manufacturers (OEMs), insurance companies, and banks, efforts to conceive and deploy innovative services that meet new needs related to emerging technology use, such as BT.



**Figure 1: An illustration of a Connected Vehicle Ecosystem**

To study the trust-mediator role of BCT in ongoing ecosystem reconfiguration, we investigate the connected vehicle ecosystem of Renault Group. The French automotive manufacturer collaborates with other automotive industry players, financial and insurance companies in blockchain projects. Those projects are conducted at several phases of a vehicle's life cycle. For our study, we selected two projects that together cover all stages of a vehicle's life cycle: eXtended Compliance End to End Distributed (Xceed) project and Smart IoT Mobility (SIM) project. Figure 2 shows how the two projects provide a comprehensive overview of blockchain-based certification and data sharing around connected vehicles. The following subsections details both projects by illustrating the series of events covered by each of them. Besides, we

outline the main differences between the two projects (e.g., the nature of the collaboration, the project actors, the project phase).



**Figure 2: Illustration of the case study: the data certification of all the events concerning a vehicle's life cycle.**

### **3.1 Automotive Industry: a matter of certification of compliance information from design to production (Xceed Project)**

Xceed project is an inter-organisational collaborative project around connected vehicles involving Renault Group and its major automotive industry partners like Continental, Faurecia, Plastic Omnium, Saint-Gobain. The project aims to adopt a distributed ledger as a unique "source of truth" from vehicle design to production - XCEED project launched in 2019. A blockchain-based record-keeping would provide reliable information on each subcomponent that boosts regulatory conformity in the automotive industry. Moreover, trust among stakeholders seems to be another driver for blockchain adoption. The distributed ledger is seen as the basis for a trusted network for sharing data and information.

Our study considers the Xceed project to analyse blockchain's role in transforming existing relationships between industry actors and exploring this technology's role in creating new collaborations with new entrants in the industry. This study has relevance since, in September 2020, Renault Groupe officially releases press news about successful tests on the blockchain system deployed in collaboration with IBM: *"Testing at Renault's Douai plant was used to consolidate the value and performance that blockchain technology delivers for the automotive industry, with over one million documents archived and a speed of 500 transactions per second"*. Therefore, blockchain's industry-wide adoption is no longer seen as a potential long-term event.

To summarise, the XCEED project reflects an industry-wide collaboration about entering the "execution" phase.

### **3.2 Smart Mobility Services: a matter of digitalisation for data sharing about vehicles' life cycle (Smart IoT for Mobility project)**

SIM project is an interdisciplinary research project involving industrial and academic actors (combining different academic fields: management, economics, computer science, microelectronics and law). It started in 2017 and granted ANR funding in 2019. A multidisciplinary team composed of academics and industrial partners (Renault Software Lab and Symag) aims to develop a transdisciplinary approach to investigate the digitalised transaction between actors through smart contracts and develop a distributed infrastructure for connected vehicles' data sharing. Academic experts in law are exploring the legal context of smart contracts. Micro-electronics scholars are simulating these contracts at the scale of IoT sensors. Computer Scientists are establishing a more comprehensive computer language. Finally, economists and management researchers are studying the adoption and acceptability



of blockchain at end-users level; for that purpose, they need to understand the final supply's organisational architecture. All academics and industrial partners work together on several case studies, so-called events of a connected vehicle's lifecycle. Table 1 provides a set of examples of events to show blockchain benefits such as information asymmetry reduction, increased process objectivity, reduced need for trust in service providers and counterparties, identified by the project partners.

Event	Description
<b>Technical control</b>	Ecosystem players (e.g. car repair shops, vehicle owners) see all information about the vehicle before and after the technical repairation.
<b>Accident</b>	At the moment of a collision, all information about the driving behaviour and vehicle status is uploaded automatically. Information asymmetry between insurers and insurance companies and expert intervention in determining accident dynamics are reduced.
<b>Second-hand Sale</b>	The information asymmetry between seller and buyer is reduced by the availability of reliable information on the blockchain.

**Table 1: Examples of vehicle life cycle events and blockchain benefits**

This project provides a suitable environment to study BT's role in ensuring a trustworthy environment at the ecosystem level. We explore blockchain in an ongoing collaboration that aims to define its role across business and technical requirements.

## 4. Research methodology

Case studies are commonly recognised as appropriate when the research question asks the "how" or "why" of a current set of events over which the researcher has little control (Yin, 2009). This research seeks to understand "how" BCT and its applications, such as smart contracts establish new logics of trust creation or transformation of pre-existed trusting relationships between ecosystem players. Hence, based on a multi-case theory-building approach, the following section first introduces our data collection based on participant and non-participant observations. Second, it describes the qualitative research design.

### 4.1 Data collection and interview process

The analysis of BCT's institutional role in reconfiguring the dynamics of smart mobility ecosystems (i.e. trust in technology and trust by technology) is based on a series of 6 semi-directive exploratory interviews, for a total of 7 hours and 55 minutes long of recording and 150 pages of transcript. We interviewed (and are still interviewing) blockchain experts from key organisations dealing with connected vehicles' data exploitation and valorisation. To ensure an illustrative sample, we interviewed employees at all carrier levels from R&D and Innovation departments of a French Original Equipment Manufacturers (OEMs), and a French Credit Group operating in Financial and Insurance Services. Table 2 provides an overview of the experts interviewed.

Date	Interviewed Experts	Position	Location	Duration
24th October 2019	Interviewee 1	Research Engineer	Company	1h15
	Interviewee 2	PhD Student		
27th November 2020	Interviewee 3	Chief Innovation Officer	Zoom	1h30
27th November 2020	Interviewee 4	X	Zoom	1h30
3rd December 2020	Interviewee 1	Research Engineer	Zoom	1h
2nd February 2021	Interviewee 5	X	Teams	1h
	Interviewee 6	X		
9th February 2021	Interviewee 2	PhD Student	Zoom	1h40

**Table 2: Semi-directive exploratory interviews**

Each blockchain expert has an overview of both projects "Xceed" and "SIM". An interview guide supported semi-directive interviews, structured around four main themes (Table 3).

<b>4 main themes:</b>
- General information about the interviewee (e.g., position, role, activities) and about the company (e.g., internal organisation, interest blockchain);
- Description of the internal and external innovation context in which they work on BT;
- Current technological, external and organisational factors affecting Blockchain investigation and adoption (e.g., current coordination between industrial partners);
- Future perspective on the role of the technology in promoting collaboration (focus on trust through technology).

**Table 3: Main themes of semi-directive interviews**

Primary data have been supplemented by secondary data, for which "multiple" data collection has been undertaken. Depending on the project or inter-organisational level analysed, different typologies of secondary data were collected. First, Symag and the Renault Software Lab are part of Smart IoT for Mobility. All experts interviewed are actively involved in the project, so the data collected in these exploratory interviews are combined with participant and non-participant observations (David, 1999). In total, the data collected during 8 multidisciplinary working meetings with researchers and industrialists, and 6 CoPil meetings attended by the authors. Both meetings were held from 3<sup>rd</sup> October 2017 to 31<sup>st</sup> December 2020, and the authors prepared detailed minutes. Second, for the purpose to expand our analysis about Renault inter-organisational blockchain activities and other projects around connected vehicles (e.g. Xceed), secondary data, such as official online news releases, public presentation slides and videos, and brief use case descriptions, was collected to complement primary sources collected throughout the series of semi-directive interviews. This empirical material helps us construct the evolution of blockchain-related activities and projects at the ecosystem level, and the role played by the technology.

## 4.2. Qualitative Content Analysis

In line with theory-building approaches, we develop 4 codes to organise the data: technology functionalities, benefits for coordination, institutional technology, and trust by technology. We used Nvivo (release 1.3.2) to code interviews and secondary data. Table 4 shows the coding system and gives a description and an example of each code.

Code	Description	Example
<b>Technology Functionalities</b>	Technological features affecting the ecosystem renewal	<i>"Both have the certainty that the message was well-mitted and received with an unmodified content."</i> Lyon Blockchain Stampede, Blockchain Technology Expert, Renault, 2020
<b>Benefits for coordination</b>	BT-based benefits at the ecosystem level	<i>"The objective is to be able to communicate automatically with partners for whom, how to say, the sharing, the remuneration would be at a blocking point"</i> . Research Engineer, Renault Software Lab, 2020
<b>Institutional Technology</b>	governance-related nature of the technology	<i>"(...) it's a tool that will facilitate the exchange of data in an operating mode with a governance that opens up our new use cases, that will automate certain things that require a lot of manual processes"</i> CIO Symag, 2020
<b>Trust by technology</b>	Interorganizational trust mediated by BT	<i>"It's a great tool for partners to trust each other"</i> Research Engineer, Renault Software Lab, 2020

**Table 4: Code scheme of our data analysis**

First, we started with a within-organisation (Renault, Symag) analysis to study organisational variables and the blockchain perspective. Second, we began with a within-case (Xceed and SIM projects) to investigate each variable and provide a project-based overview of BCT's role. Each case was analysed separately using the interview transcripts and secondary data (e.g., minutes, press releases). In conclusion, we made a cross-comparison analysis to process results. At all the steps, we synthesised the content for each code. The goal was to find similarities between the two cases and project players' perception to draw conclusions on BCT's role in providing trustworthiness on business collaboration and transactions.

## 5. Preliminary results

This section highlights preliminary results by focusing on BCT's trust-mediator role. More precisely, we identify what drives economic actors to participate in a blockchain-based ecosystem. First, we show how BCT differs from "traditional" technology by identifying its functionalities and related benefits for interorganizational collaborations and cooperation, demonstrating how the notion of institutional technology fits blockchain technology (subsection 5.1). Second, we recognise how blockchain technology's institutional role is perceived as the ability to generate or overcome inter-firm trust (subsection 5.2). To conclude, we show how traditional institutional structures are complementor to BCT decentralization to foster ecosystem reconfiguration adhesion.

### 5.1 BT as an Institutional technology

Primarily based on its functionalities, the blockchain is perceived as a new form of governance among ecosystem players. BCT features, such as decentralisation, transparency, immutability, and security foster collaboration at all the ecosystem levels (automotive industry or mobility services' ecosystem periphery). Therefore, the technology is not perceived as a "traditional" IT artefact but as an innovative option in transaction management (distributed, automated, and decentralised) for value exchanges between ecosystem players. This definition also includes the customer (e.g., driver, vehicle owners).

*"This **technology certifies all exchanges** by relying on the computer contribution of network members." Symag press release 2018*

*"For Groupe Renault, it has to be used as a **collaborative, multi-company digital tool** within the automotive sector." Renault press release 2020*

Because blockchain technology drives new forms of coordination at the ecosystem level, each player's relationship is evolving in terms of *partnership*. Interviewees identify the protocol run with a peer-to-peer network of servers, smart contracts self-execution, and consensus protocol as factors guaranteeing the profits sharing, responsibilities, and risks between ecosystem players. Therefore, Blockchain experts pointed out that blockchain technology also provides a technological basis for "*the automotive industry's competitiveness and operational excellence.*" Related benefits are also identified at the periphery level of the ecosystem in ensuring collaboration for smart mobility services (e.g., between insurance companies and OEMs).

To sum up, interviewed experts consider blockchain as a new environment for data sharing, principally allowing cost-cutting and new value creation. The distributed ledger is viewed as a generator of a unique procedure to share data between ecosystem actors. More precisely, experts pointed out that blockchain technology flatters the ecosystem network by providing objective data exchange governance. This positive perception is mainly based on each step of a transaction's potential automation, allowing

*"at the center of the value, you find trust within the ecosystem (industry) and outside of it you change from a customer supplier relationship to a partner relationship".*  
Presentation Lyon Blockchain Stampete, VP Blockchain, Renault, 2020

*"It's a tool that will facilitate the exchange of data in an operating mode with governance that opens up our new use cases".* CIO Symag 2020

accurate description and execution of agreements. Put differently, the distributed ledger helps economic actors to overcome information asymmetry characterising traditional deals between them. Moreover, experts underline that real-time data sharing provides the basis for an "ecosystem collective intelligence," providing reactivity in evaluating and adapting to future demands and needs.

### **5.1.1 Blockchain functionalities and benefits for inter-organisational collaboration and cooperation**

IS research and other fields such as computer science and digital law have already highlighted the disruptive nature of blockchain by listing various functionalities and related benefits for organisations, customers, and, more in general, for data sharing and transactions (e.g., Beck *et al.* 2016, Mathews *et al.* 2017). Our primary analysis provides a list of blockchain and smart contract characteristics with positive spillovers on inter-organisational collaboration and cooperation. Table 5 shows the relationship between blockchain's specific features and related benefits for the ecosystem.

<b>Decentralisation and encrypted modes to foster data control and confidentiality</b>	<i>"The decentralised nature of blockchain technology allows each party to maintain control and confidentiality of their data, without intrusion, while enhancing security and privacy" News release Renault Group, 10th September 2020</i>
<b>The immutable nature of blockchain and the traceability provide data integrity to ensure authentication and avoid fraudulent/opportunistic practices Albrecht (2018). As a result, services and products quality improves</b>	<i>"Both have the certainty that the message was well-mitted and received with an unmodified content." Lyon Blockchain Stampede, Blockchain Technology Expert, Renault, 2020</i>  <i>"the quality of everything that was supplied was much improved because we know that it is traced, that it can be seen as unchangeable, etc. So clearly the technology is improving the quality." Research Engineer, Renault Software Lab 2020.</i>
<b>Data Availability (transparency) enhancing reactivity and efficiency at the ecosystem level</b>	<i>"It allows for better reactivity in exchanges, with data available in real-time and greater efficiency within a network that is no longer centralised but distributed." News release Renault Group, 10th September 2020</i>
<b>Access Permission to allow data exchange in a secure way</b>	<i>"They (consortium blockchains) require access permission of our participants, yet they allow companies with different interests to exchange securely." Lyon Blockchain Stampede, Blockchain Technology Expert, Renault, 2020</i>
<b>Technological compatibility to facilitate the adoption by several players</b>	<i>"you get reactivity in implementation of blockchain as it is not very intrusive in the information system of each company." Lyon Blockchain Stampede, VP Blockchain, Renault, 2020</i>

**Table 5: blockchain functionalities and related benefits at the ecosystem level**

Table 5 shows BCT's direct influence and smart contracts' specific characteristics on the connected vehicle ecosystem renewal. For instance, **traceability** of transactions and data access seems to play a crucial role. BCT ensures a detailed register for data storing, data treatment, and data sharing. Above all, traceability generates a reputation effect among economic actors. For example, at the supply chain level *"it influences the relations between suppliers, the fact that everything is traced and that everyone is aware of it on both sides"* Research Engineer, Renault Software Lab 2020. Secondly, traceability also provides a solution for regulation conformity, such as GDPR.

Moreover, we found that BCT's ability to ensure **data and transaction governance by design** is also perceived by ecosystem actors as a getaway from the present ecosystem configuration. Reactivity and efficiency are the two main benefits highlighted by interviewees. Both projects - Xceed and SIM - adopt the blockchain to renew communication and collaboration practices relying on technology design. *"The objective is to manage communication in an automatic way for partners for whom the sharing and the compensation would be at a blocking point"* Renault Software Lab, Research Engineer 2020.

To sum up, blockchain design enhances the ecosystem renewal by bringing new opportunities based on cost-cutting procedures and inter-organisational efficiencies. Therefore, the institutional role of BCT is mainly based on design propriety. Since the IS literature pointed out the importance of **security, privacy, and data integrity** issues for trust in IoT-based transactions, these constructs may be considered "indirect" factors affecting the trust between ecosystem actors. More research is necessary on this point.

## 5.2 Trust by BT: the mediator role of BCT in the ecosystem renewal phase

In the previous subsection (5.1), we show how the blockchain's design influences the interest of the ecosystem actors to renew the ecosystem dynamics. This subsection demonstrates how BCT is perceived

*"The blockchain aims to create a network of trust between OEMs and vehicle manufacturers to share compliance information" News release Renault Group, 10th September 2020*

as a trust-mediator providing trust among ecosystem players. In this case, the technology design is the primary trust construct emphasised by interviewed experts.

The following trust constructs refer to blockchain characteristics already emphasised in the previous section and **directly** associated by interviewees with trust improvement at the ecosystem level.

*"If there is information that comes up that is considered **reliable**, there are a lot of cases where they (the partners) are not going to be obliged to involve experts (trusted third parties), they are going to be able to trust the feedback that is given so there are a number of smart contracts that will **automate** actions and operations"* CIO 2020

**Automation** plays a crucial role in BCT's institutional perception in ensuring trust between economic actors. For instance, smart contracts' self-execution is seen as a vector of reliability and security for data sharing. Put differently, this application of blockchain provides a technological process that ensures the immutability of information and

transaction conditions. As a result, interviewees underline the potential replacement of traditional trusted third parties.

**Data availability** refers to the availability of a copy of the blockchain for each network's peer (node). BCT provides distributed access to information. This functionality not only improves trust and reactivity among ecosystem actors it also enables players to respond to the present uncertainty regulatory environment. Respondents mentioned that the regulatory system seems to evolve to force them to share data.

*"There are regulatory changes which mean that more and more, in order to promote competition between players, players are led to share data, (...) we want to have more and more confidence and the best way to have confidence is to tell ourselves that we have access to information"* CIO, 2020

**Data certification and security** refer to information immutability once it is encrypted in the blockchain system. This ability of the ledger to stay unchangeable allows partners to reduce the need for third parties to generate trust between them.

Werback (2018a) highlights BCT's role in ensuring interpersonal trust. In this subsection, we extend the notion of trust mediation at the inter-organisational level. Our results demonstrate how BCT allows ecosystem actors to trust each-other by removing the uncertainty of parties' actions. This institutional technology incentivises the ecosystem renewal by fulfilling the role of trust-mediator technology.

*"But when you work with external companies, when you need to **certify information** in a trustworthy mode without a third-party certification (...) blockchain is now the really ideal solution"* Presentation Lyon Blockchain Stampede, VP Blockchain, Renault, 2020

*"Secure and certified network exchanges between partner companies or between members of an ecosystem"*. News Release, Renault Groupe, 14th May 2020

### **5.3 Institutional-based trust: the role of structural assurance components in BCT conception, adoption, and intention to trust.**

Our analysis also highlights the positive role of structural assurance components in interviewees' reflections. Structural assurance refers to beliefs that the success of a technology outcome is related to the presence of supportive conditions and equipment (Mcknight *et al.* 1998). Rather than perceiving BCT as a unique institutional structure enabling ecosystem transactions and inter-organisational trust, results point out the complementarity of blockchain institutional features with traditional legal, physical, and contractual arrangements. Interviewees perceive that blockchain-based transactions are likely to be successful thanks to

supporting situations and structures. These findings are in line with Werbach 2018b. Despite the hype around blockchain's disruptive nature, we found a persistent attachment to traditional structures and competencies.

*"It's a tool that will facilitate the exchange of data in an operating mode with a governance system that opens up our new use cases, that will automate certain things that require a lot of manual processes, but that won't take away any know-how"* CIO, 2020

The *role of lawyers and business departments* is perceived as crucial in two critical phases: (i) the conception of the blockchain system or a smart contract, *"there will always be lawyers, and commercial services that will agree on an outline, at least perhaps to activate or not to activate such and such an offer"* CIO, 2020; (ii) and the handling of potential problems encountered at the end of the automated process, *"(...) even with automated processes you can find cases where the automation will fail, so it won't prevent at some point maybe to go back to what happened in an automated way."* CIO, 2020. On the same line, *consortium agreements and traditional contracts* are also considered necessary to construct the BT network and the collaboration determination.

*"I imagine is that a lot of things are going to be written in the constitution of the consortium that is going to create the blockchain because the blockchain, in the beginning, is a consortium, so there is an agreement between the parties, (...), then it will be smart contracts-based governed, no doubt by templates that will have been previously validated on both sides (...)"* Research Engineer, 2020

Interviewees also highlight the interdependence of the blockchain-based ecosystem mediation's success with other technologies creating the basis for blockchain usage. Interviewees emphasised that *5G technology's appearance* ensures real-time data sharing with connected vehicle sensors.

*"The car needs to be able to access a network at all times to be able to send the data to be certified, and so with the emergence of 5G, we're going to be able to resolve some of these constraints, it's going to allow better connectivity, better responsiveness, and so we should be able to set up these use cases".* Interviewee 1, 2020

Moreover, they underline the role played by *IoT systems* reliability. The latter shows the context-dependency of BT's success. BT ensures the reliability and immutability of information and transactions from when data are stored in the ledger. Therefore, IoT systems' trustworthiness is crucial for providing reliable data collection.

## 6. Discussion and Conclusion

In line with institutional approaches (Alen *et al.* 2020), this paper showed how BCT could determine a distributed governance for both networking and verification costs (Catalini & Gans 2016). Our results also share the definition of BCT as a "trust-free system" (see Beck *et al.* 2016). BCT is perceived as an institutional technology providing logics and rules for intermediation between ecosystem actors. We found that at the vehicle connected ecosystem level, the decentralised and automatic protocol is perceived as a "gateway" from interorganizational trust by guaranteeing the success of transactions. We assist to a shift from interorganizational trust to BCT as a trust-mediator (Bodò 2020). Transaction certainty is provided by technological functionalities. Yet, this study shows that interviewees perceived this BCT mediation as not sufficient to provide a trustworthy ecosystem environment. Structural assurance seems to be essential to ensure the intention of ecosystem players to participate in ecosystem renewal. We underline the complementarity of institutional technology to traditional institutional structures allowing to manage competition/cooperation tension during the renewal phase.

Our results also underline a context-dependency of BCT which is mainly pointed out when interviewees list present constraints in implementing this distributed system at the ecosystem level. Three main types of requirements for implementation have emerged: (i) technological (performance, scalability, volatility, and robustness), (ii) organisational (organisational openness to strategic positioning changes, and top management reluctance), and "interorganizational" (BCT value determination). These factors majorly refer to the association of BCT to IoT systems (connected vehicles), and the intention to implement the BCT with peripheral ecosystem actors (insurance companies, banks, peer to peer applications). Therefore, these constraints have principally emerged during discussion about the SIM project. The low level of understanding and the perceived immaturity of BT are the major factors affecting the slowing ecosystem renewal based on decentralisation. Second, a fully BCT-based system requires a disruptive shift from traditional ecosystem practices to technology-based ones. Consistently, at the theoretical level, the paper contributes to the literature on BCT adoption. In particular, it shows a persistent attachment to traditional social- and regulatory-based procedures which is mainly due to technological, organisational and interorganizational inhibitors. The trust-mediating role of the BCT is enabled by the presence of traditional modes of organization that provide a bridge between current ecosystem dynamics and the disruptive potential of the BCT as an institutional technology. From a practical perspective, the article highlights a "hybrid mode" combining benefits of BCT and traditional organizing mechanisms. This "hybrid mode" of coordination provides a way for companies that are still facing technological, organizational, and interorganizational inhibitors.

Our preliminary results also demonstrate that our interview themes and coding systems provide a fruitful basis for investigating the trust-mediator role of BCT in ecosystem dynamics. In addition, combining primary data with secondary data from public publications and presentations allows us to have a more complete analysis.

Because of the limited sample of interviewees so far, this paper does not aim to develop a full theoretical contribution on the institutional role of BCT in mediating trust by providing an interorganizational trust-free system for transactions and data sharing. Yet, we consider contributing to the understanding of the socio-technical dynamics around BCT by providing an overview at the ecosystem level. For further research, we will supplement our data collection with other primary data with a more robust qualitative analysis. We also consider extending this analysis to business departments, interviewing non-technical work profiles.

Another limitation refers to the decision of not focusing on the perception of trustworthiness of blockchain technology (trust in technology). However, this analysis shows technology functionalities that interviewed experts have emphasised in ensuring trust by technology. Future research is required to analyse the role of trust in technology in ongoing ecosystem renewal phase.



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