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# 360° Vehicle Life Cycle Management with Blockchain Technology

## Executive Summary

Blockchain technology will disrupt, transform and innovate the current way we conduct business. Smart contracts will drive process automatization and absolute digitalisation will take over. Blockchain technology constitutes the bridge for a new Economy of Things (EoT) based on digital tokens. New business models in the automotive industry will emerge and create a "Mobility as a Service" (MaaS) standard. Decentralised applications (DApps) will be the means to its end. Time to get ready for blockchain mobility by just click & drive.

## Introduction

Blockchain and Bitcoin are all the rage. The objective is to present an overview of blockchain technology, its developments, lay out the need for a legal framework, outline the oppor-

tunities and challenges including practical and possible new business models with a focus on the automotive business environment.

## Blockchain and the future of mobility

"He who has insight can understand. He who has perspective can make decisions. And he who has vision knows how to lead," says Peter Amendt (2019). I identified four concrete scenarios for the future of mobility: Optimized mobility, mixed mobility, individual mobility and, last but not least, Mobility as a Service (MaaS) by click & drive (Figure 1).

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## Mobility experiences' scenarios: Click & drive

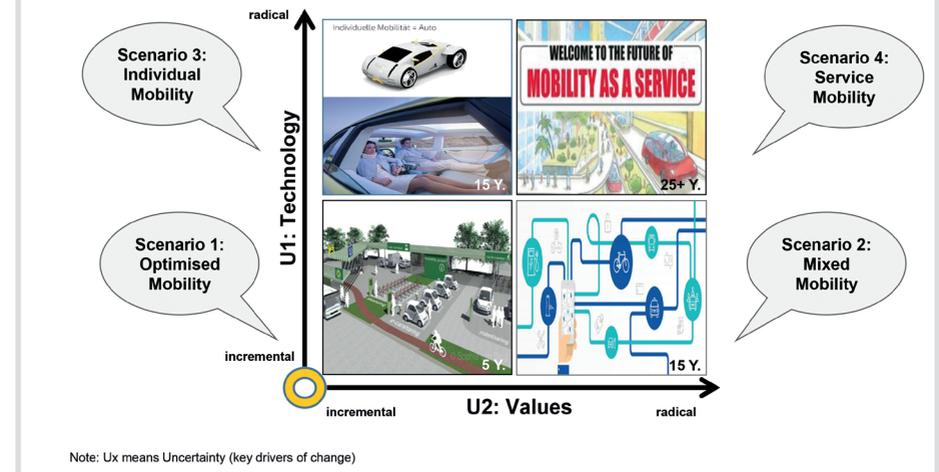


Figure 1

In the coming years, disruptive and innovative developments will lead to different levels of mobility for each individual. One will literally experience this. In addition to autonomous vehicles, one of the key drivers is the blockchain technology development, which has a major impact on the future look of mobility and allows new business models and processes to emerge. In the meantime, everyone is talking about blockchain. But blockchain is not Bitcoin, a cryptocurrency that consumes a lot of energy<sup>1</sup> for security reasons. They are distinct but connected concepts, since Bitcoin is just one use case, of blockchain technology. What exactly is blockchain and which kind of applications will be there in the automotive sector? Simply put and according to Ben Taylor (2017), it was

Yuji Ijiri that presented the concept of triple bookkeeping. In a highly automated way, this approach can be used and applied for blockchain (Frommelt 2019a).

## Blockchain easily explained

According to Marco Iansiti and Karim R. Lakhani (2017), "Blockchain is an open, distributed ledger<sup>2</sup> that can record transactions between two parties efficiently and in a verifiable and permanent way." Blockchain stores information decentrally in blocks that are logged to each other in a chronological order metaphorically generating a *chain of blocks*, hence, blockchain. Each blockchain data owner involved ensures that the data is

<sup>1</sup> According to Cambridge Bitcoin Energy Consumption Index (CBECI), Bitcoin usage is estimated at 78TWh that is equivalent to Belgium in 2019 (Cbeci.org, 2019).

<sup>2</sup> Distributed ledger is a digital database having many shared copies that are spread across multiple nodes. The information is updated from the ledger that stores it and, after their validation, is transmitted to all other nodes automatically (Shrier, 2020). This improves transparency. In this vein, distributed ledgers have no central data storage and do not necessarily need proof of work. This offers better scaling options. Distributed ledger technology (DLT) also facilitates increased back-office efficiency and process automation.

correct. “With blockchain, we can imagine a world in which contracts are embedded in digital code and stored in transparent, shared databases, where they are protected from deletion, tampering, and revision. In this world every agreement, every process, every task, and every payment would have a digital record and signature that could be identified, validated, stored, and shared. Intermediaries like lawyers, brokers, and bankers might no longer be necessary. Individuals, organisations, machines, and algorithms would freely transact and interact with one another with little friction” (Iansiti and Lakhani, 2017). Moreover, a transaction register provides for transparency and clarity of the process. The legitimisation against the blockchain is done with a private key or in other words a cryptographic key, the so-called token. It is known only to the authorised party and, in my opinion, this represents one of the greatest risks. If the digital key, i.e. token<sup>3</sup> is lost, indeed everything is lost forever (possessions, assets, ownership rights, etc.). This can, however, be prevented by additional security measures and through newly emerging service providers. Blockchain with its distributed ledger technology (DLT) enables one to work in a decentralised and democratised way. This development has the potential to make new business models emerge and to disrupt the current status quo of conducting business (Frommelt, 2019a).

## Blockchain prerequisite and new legal framework in the Principality of Liechtenstein

The prerequisite for blockchain becoming socially acceptable is a comprehensive and enforceable legislation that provides legal certainty in the settlement of transactions.

Thus, a token economy with smart contracts can arise. The Principality of Liechtenstein, as a pioneer, has most recently created new legislation and acts to ensure that companies, consumers and citizens receive the necessary legal framework to conduct business in a safe and sound environment.

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## The Token Container Model and its Trustworthy Technology

At the Center for European Policy Studies in Brussels, Thomas Dünser (2019), an Expert of financial innovation at the Ministry of Presidential Affairs and Finance, presented the cornerstones of the innovative Liechtenstein concept for a regulation of the token economy, the so called *Token Container Model*. He also explained the new players that are introduced through the legislation/the Blockchain Act, as well as roles, mechanisms and technology that will be defined: Examples of new players introduced, mechanisms and roles are: Trustworthy Technology (TT), Token issuer, Token generator, Physical validator, TT Protector, TT Verifying Authority, etc.

It is important to note that in the area of due diligence law and its obligations, compliance with international standards (e.g. know your customer (KYC)) and effective monitoring for anti-money laundering (AML) is ensured. An adapted due diligence law and corporate law to transfer value also constitutes an integral part of the new Act. On 3 October 2019, the Liechtenstein Parliament passed the Act

with entry into force on 1 January 2020. The Liechtenstein (2019) Blockchain Act with the notion of the Token Container Model and its Trustworthy Technology approach has the potential to become the legal international golden standard of conducting business in the blockchain.

## General Data Protection Regulation (GDPR) for privacy and security

The GDPR that was put into effect on 25 May 2018 by the European Union (EU) is currently “the toughest privacy and security law in the world. GDPR (2020) will levy harsh fines against those who violate its privacy and security standards, with penalties reaching into the tens of millions of euros”. It is the combination of the new Liechtenstein Blockchain Act together with the GDPR that will ensure a robust business environment with clearly defined rules and responsibilities where commerce and innovation can grow and thrive

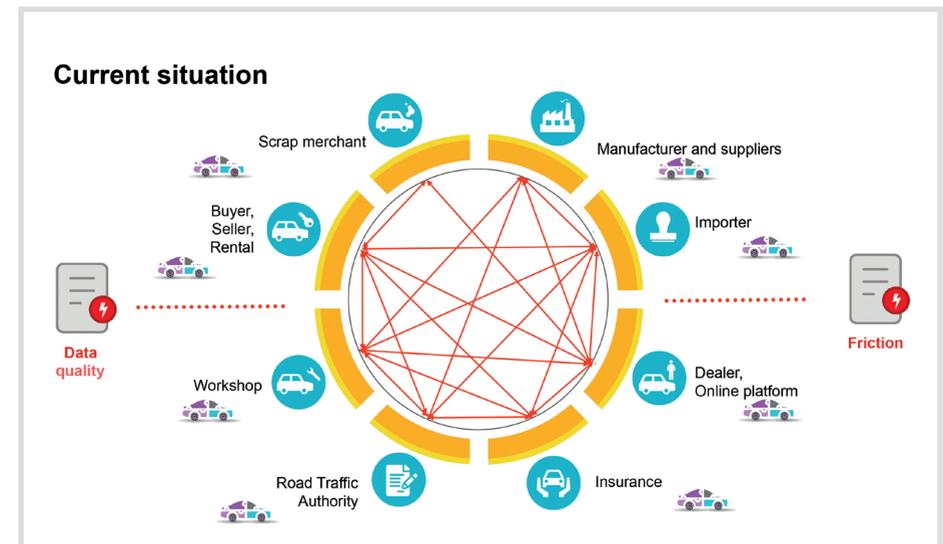
within the EU. Closing the loop, the Financial Market Authority (FMA) Liechtenstein is the regulatory body for licensing, admission and supervision of financial service providers as well as for ensuring compliance.

## New business models and managing the vehicle life cycle in the blockchain

Having the necessary prerequisites, new business models will emerge and disrupt the status quo. Digitalisation takes over in its fullest extent and the blockchain technology is building the bridge for an Economy of Things (EoT) (IBM, 2020; Institute of Business Value) based on digital tokens.

New and relevant business models are currently being developed in the automotive sector, such as the Swiss Cardossier (2019) project that considers the entire vehicle ecosystem (Figure 2) in a holistic way. Accord-

Figure 2



<sup>3</sup>Token have a few functions in the context of blockchain: i) to grant access through a cryptographic key, ii) to hold the legal rights of asset ownership, iii) to transfer value by trading assets or claims (digital security) or iv) as method of payment inside an ecosystem. “The disposal of the token results in the disposal over the rights” (Naegle,law, 2019). The commercialisation of the tokenised assets, claims and/or other absolute and relative rights leads to the new token economy.

ding to Dr. Martin Sprenger, President of the Cardossier Association, the application is a digital dossier on a blockchain basis where all relevant information about the entire lifecycle of a vehicle is stored in a traceable and secure manner involving the stakeholders and actors that are given and granted access.

*“The application is a digital dossier on a blockchain basis in which all relevant information about the entire lifecycle of a vehicle can be stored in a traceable and secure manner”.*

In the various phases of a vehicle’s life, numerous events and circumstances play their role. What is more, the following actors are involved: vehicle manufacturers, suppliers, importers, dealers, buyers, owners and sellers, insurers, rental, financing and leasing companies, several garages/workshops and also the Road Traffic Authorities (RTA). Not to forget the scrap merchants that, at the end of a car’s lifecycle, ensure that the different parts

of the vehicle are disposed into the relevant recycling channels. This innovative concept based on open-source Corda R3 blockchain platform allows for all relevant and necessary business transactions to be conducted within a permissioned blockchain and among the actors on a “peer-to-peer basis” (P2P) in the most efficient and effective way (Figure 3). Cardossier enables transactions between identifiable parties, not only with privacy and legal certainty, but also in co-existence of participants along the same ecosystem.

DApps that connect users and providers directly will emerge. Some practical examples and use cases for DApps of the Liechtenstein National Road Office (NRO) are: driving license, vehicle registration document (from the manufacturer’s Certificate of Conformity (CoC)) or the international motor insurance certificate (Green Card) to be safely available in the blockchain. Figure 4 illustrates its blockchain strategy (National Road Office, 2019).

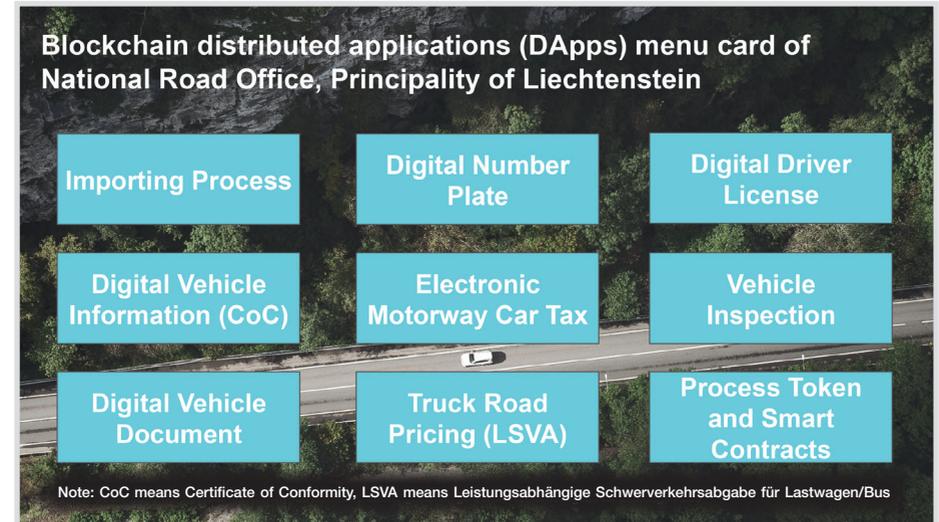
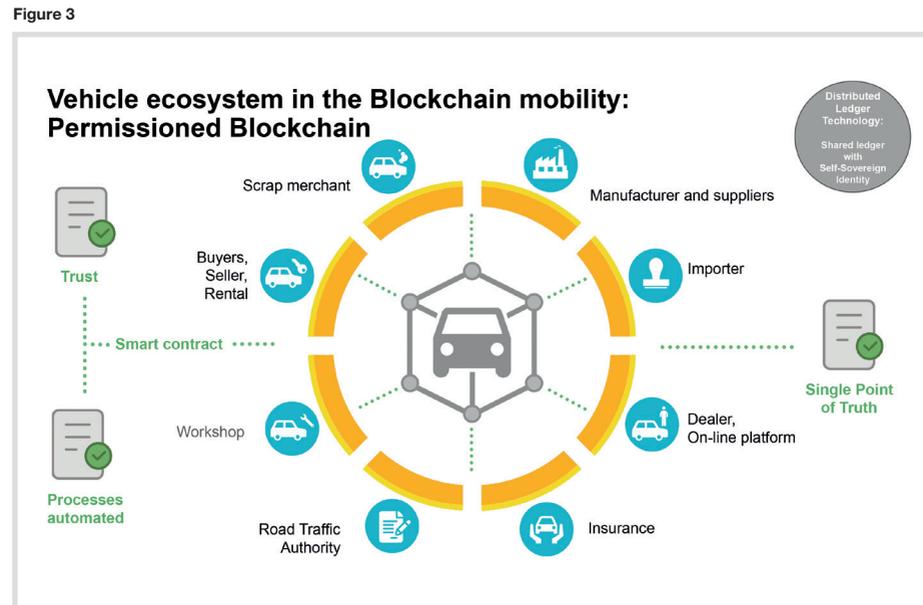


Figure 4

Such new services can also lead to decentralised identity (DID) management that simplifies the process of issuing legal personal documents. As Daniel Buchner from Microsoft explains, the Identity Overlay Network (ION) developed in conjunction with the Decentralized Identity Foundation is evolving fast and becoming a new DID protocol (Forbes, 2019). Other promising options for DID management are the purpose-built Hyperledger Indy and ID2020 (Oxford, 2019). Remo Glauser (2019) notes that Cardossier amalgamates DID with the notion of self-sovereign identity (SSI) by removing the trusted third-party and giving identity control to the car data owner per se. Cardossier enforces all data protection rights according to GDPR for the ecosystem participants, e.g. the one that enters data also controls and manages it. It is important to note that the Data Protection Committee of Cardossier is supervising and protecting the code of conduct for all its ecosystem’s members and participants. Finally, it is all about trust “for and in” the vehicle ecosystem.

## Blockchain mobility DApps, buying a fast lane pass and concierge James

There will be a variety of new DApps (Oxford, 2019) for different types (e.g. market place State of the DApps) of mobility wants and needs: whether for buying or selling a vehicle, i.e. asset management or self-driving in a safe and most economical mode. Be it for paying a city toll or buying a *fast lane pass* on the motorway. For instance, in the future one might be able to communicate and negotiate with all the vehicles on the road via a secure blockchain protocol, so that for a certain price that is agreed to pay, vehicles can then be overtaken in order to have unrestricted travel. In the end, oneself pays for driving faster and the economic value is to arrive in less time at the chosen destination.

It is argued that the blockchain technology will also support autonomous driving with many convenient services, whether in the form of entertainment in the car, for planning

the cheapest purchases in the vicinity of the vehicle or simply for finding a pleasant accommodation or lovely restaurant in a beautiful setting. In other words, the car will act as concierge. Instead of Alexa or Siri, this could be James. On top of Internet of Things (IoT), a new EoT is transforming our world in a profound way. Through data or asset tokenisation and smart contracts at the touch of a button, i.e. *click & drive*, your blockchain DApp not only creates MaaS, but also increases the security of its transactions.

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## A new electronic person taking full responsibility

Since the passenger in the future is only going to be *human cargo*, autonomous driving will presumably require a new responsible person (Frommelt, 2018). It is advocated that a new legal concept and approach will be created: *After the natural person* (people) and the *legal person* (corporation), most probably there will be an *electronic person* (self-decisive electronic system), that will take full responsibility and liability. In other words, a kind of new law object or legal personhood could be created that is responsible and liable. It is argued that a natural (r)evolution in policy and law making is under way too (Frommelt, 2019b).

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As Thomas Klindt (2018) notes: “Our legal system needs a third legal person that can

be held liable”. Additionally, “electronic persons show similarities with corporations, in the sense that they are both means for their owners (shareholders) to achieve a particular purpose”, says Stefen De Schrijver (2018). According to Andreas M. Antonopoulos (2019), bestselling author and one of the world-leading experts on Bitcoin and blockchain ecosystem, the use of this technology can also contribute to the further *democratisation for citizens* in all areas of life.

## Challenges and risks that need to be addressed and managed

Of course, there are more challenges ahead, such as the transition to autonomous vehicles driving on the roads, namely the management of mixed traffic (both traditional and autonomous vehicles driving simultaneously). Moreover, what happens if a car gets out of control and how could it be stopped? What is the Police able to do? But also other risks need to be considered such as cybercrime, ethics and the protection of life with loads of autonomous vehicles on the road. This triggers significant questions with regards to insurance, responsibility and liability. From a blockchain technology perspective, interoperability, scalability, network governance, token transfer across blockchains and blockchain-enabled interfaces into legacy systems still needs particular attention (Frommelt, 2019b). In addition, a new Corporate Governance management mode with a *distributed culture* mindset (Figure 5) needs to be considered in order to manage the strategic and operative level for blockchain. A standard Information Technology (IT) Governance will not be enough anymore. It is postulated that blockchain technology will require additional governance (Figure 5, Corporate Governance Matrix): i) Blockchain Governance to manage *new technology* and ii) Platform Governance to manage *new business models* (Frommelt, 2019c).

## Corporate Governance in the Blockchain with a distributed culture mindset

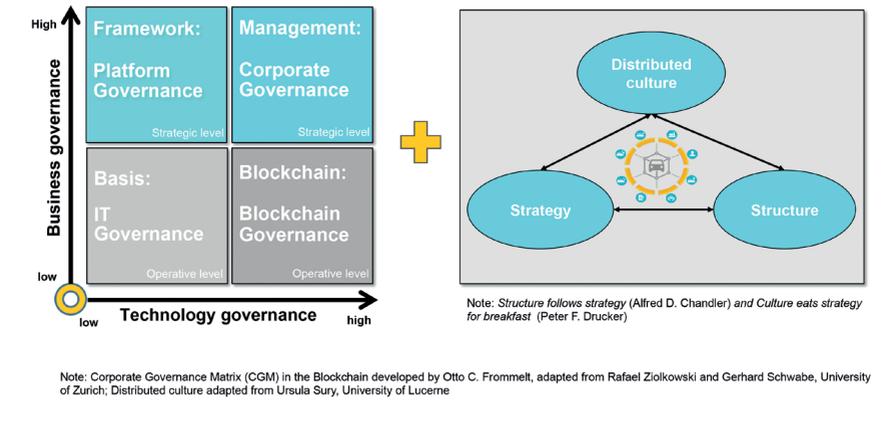


Figure 5

What is more, David Shrier (2020) asks: “What if we shaped a *distributed society* where we can see multiple governments and their citizens coming together in new and unexpected ways, around shared issues or concerns, with blockchain and blockchain-like governance mechanism providing a means of accessing the collective intelligence of millions or billions, and directing outcomes on a global scale?” It is argued that for all these particular cases, pragmatic answers and practical solutions need to be developed and implemented.

## Building bridges, blockchain technology and disruption of how we conduct business

I would like to conclude with the words of Stephan Karpischek, co-founder of Ethersic: “Once you have understood what blockchain is, you can no longer sleep at night” (Schnürer, 2019). My metaphor is: “Each blockchain that

is created can be seen like an individual small bridge and your token is the key to cross that bridge you own, until you pass the key on or sell it to someone else, i.e. transfer value” (Frommelt, 2019b).

In summary, blockchain technology with its tokens, smart contracts, DIDs and DApps will not only democratise how business is conducted, but also revolutionise governmental administrations, markets and its industries. You can become your own banker, importer, notary, dealmaker and so forth. Hence, today’s intermediaries might not be needed any longer. “Absolut(e) digitalisation takes over and the blockchain technology constitutes the bridge for a new EoT with digital tokens” (Frommelt, 2019b). In this vein, a paradigm shift will take place by creating trust and flexibility in the blockchain universe and it is hoped that we will enjoy many new and exciting mobility experiences in the future to come, i.e. just click & drive. ■