DLT-based Vehicle Identity Business Review

Mobility Open Blockchain Initiative
VID Working Group
July 2019

Contents:

Contributors

The Mobility Open Blockchain Initiative Vehicle Identity Working Group is a global, multi-stakeholder project working to co-design blockchain and distributed ledger technologies standards for connected mobility ecosystems. The project engages stakeholders across the chain: OEMs and other mobility industry players, technology solution providers, governmental and non-governmental entities. This report is based on numerous discussions, workshops, and research. Opinions expressed herein do not necessarily reflect the views of individual members.

Sincere thanks are extended to those who contributed their unique insights to this report.

Lead Authors
Lucy Hakobyan, Head of Program, MOBI
Arwen Smit, EMEA Lead, MOBI

Contributors
Joe Bannon, Vice President Strategy and Marketing, KAR Auction Services, Inc.
Todd Gehrke, Blockchain Solutions Architect, Luxoft
Alan Gordon, Technical Leader, Ford
Sebastien Henot, Manager of Business Innovation, Renault
Max Huang, Data Scientist, Celebri AI
Jim Mason, Foundry Director, DMX
Boris Polania, Lead Engineer, Honda

Commentators
Don Ho, Head of Business, Quantstamp
Matthew Jones, Blockchain Lead, IBM
Piyush Manocha, Senior Manager, Accenture
Richard Meszaros, Managing Director, Accenture

MOBI Executive Team and Contacts
Chris Ballinger, CEO
Lucy Hakobyan, Head of Program
Michael Vo, CTO
Contact: vid@dlt.mobi

Executive Summary

Blockchain and distributed ledger technologies (DLT) enable the digital transformation of the mobility industry. The foundation of all DLT-based activity is the DLT-based vehicle identity. Using shared ledger technologies for vehicle identities is a crucial building block for new mobility and transportation IoT ecosystems of the future. These ecosystems will disrupt the automotive and mobility sectors while changing the way business is conducted. Vehicle Identity (VID) is a tool that enables these ecosystems. VID supports dynamically defined multi-stakeholder, interoperable, mobility ecosystems, yielding increased transparency, coordination, and automation between the stakeholders.

DLT use cases that depend on a secure digital vehicle identity span from vehicle payments to supply chain to automotive financing to autonomous vehicle data marketplaces and many more. This document introduces a business review for the VID to accompany the technical standards created by the group.

MOBI VID Standards

A vehicle's identity, similar to a human's identity, begins at its birth. The 'Vehicle Birth Certificate' is the first 'link' in the full lifecycle of a vehicle, and is the first use case on which the MOBI VID Working Group has focused. The working group released its first technical standard, focused on the birth of the vehicle in July of 2019. Subsequent standards will build on this and complete the full lifecycle of VID, exploring use cases such as transfer of ownership, repairs, and end of vehicle life.

While the birth of the vehicle on blockchain use case itself already allows for benefits to be extracted such as automated vehicle tax computation based on, for example, fuel type, engine size, and production year, or collection of such by the government from a vehicle owner wallet, this document outlines business case potential for overall VID.

Under the MOBI VID proposed standards, VID is the digital identity of a unique vehicle providing the necessary bridge to the physical asset that allows vehicle owners, users, and the transportation IoT ecosystem to trust and verify the vehicle's identity. The VID exists because the physical vehicle exists; the vehicle can digitally interact in the IoT ecosystem because it has a VID. The physical vehicle and its VID are inextricably linked by the Vehicle Identification Number (VIN) imprinted on the vehicle. The VID can be

used to prove existence, manage access control, confirm product definition and ownership history, and track events in the life of a vehicle. As a result, it becomes the key that ties together the master records for the vehicle's history and usage data.

Blockchain and DLT open ecosystems for broader and more efficient collaboration. Stakeholders with relevant read and/or write permissions will be able to interact with the data stored on the tamper-evident decentralized ledger.

VID elevates the current best alternative, the VIN, in the following five areas:

1. While the vehicle's birth certificate (VBC) is immutable, by using the VID, other systems of record (i.e. ownership, vehicle history, etc.) are updatable and relatable back to the birth certificate. In other words, VBC is the immutable anchor for an extensible system enabled by VID. It is a building block for other services.
2. Similarly, information associated with the VID requires input from multiple stakeholders to remain relevant. Controlled coordination between these stakeholders is enabled by DLT where centralized solutions do not scale.
3. The DLT-based vehicle identity is both digital and standardized, making it machine-readable. This is essential for Vehicle to Vehicle (V2V) or Vehicle to Infrastructure (V2I) communication, as well as future extension into payments (digital currency accounts to establish secure transactions with the external world).
4. Importantly, the VID and its associated metadata are verifiable, reducing the risk of fraud and protecting data integrity.
5. Lastly, VID data is secured and stored in a decentralized infrastructure with permissioned user access. Multiple roles can be created, with designated read and write access. Making the vehicle identity dynamic makes the associated business cases for the vehicle also dynamic.

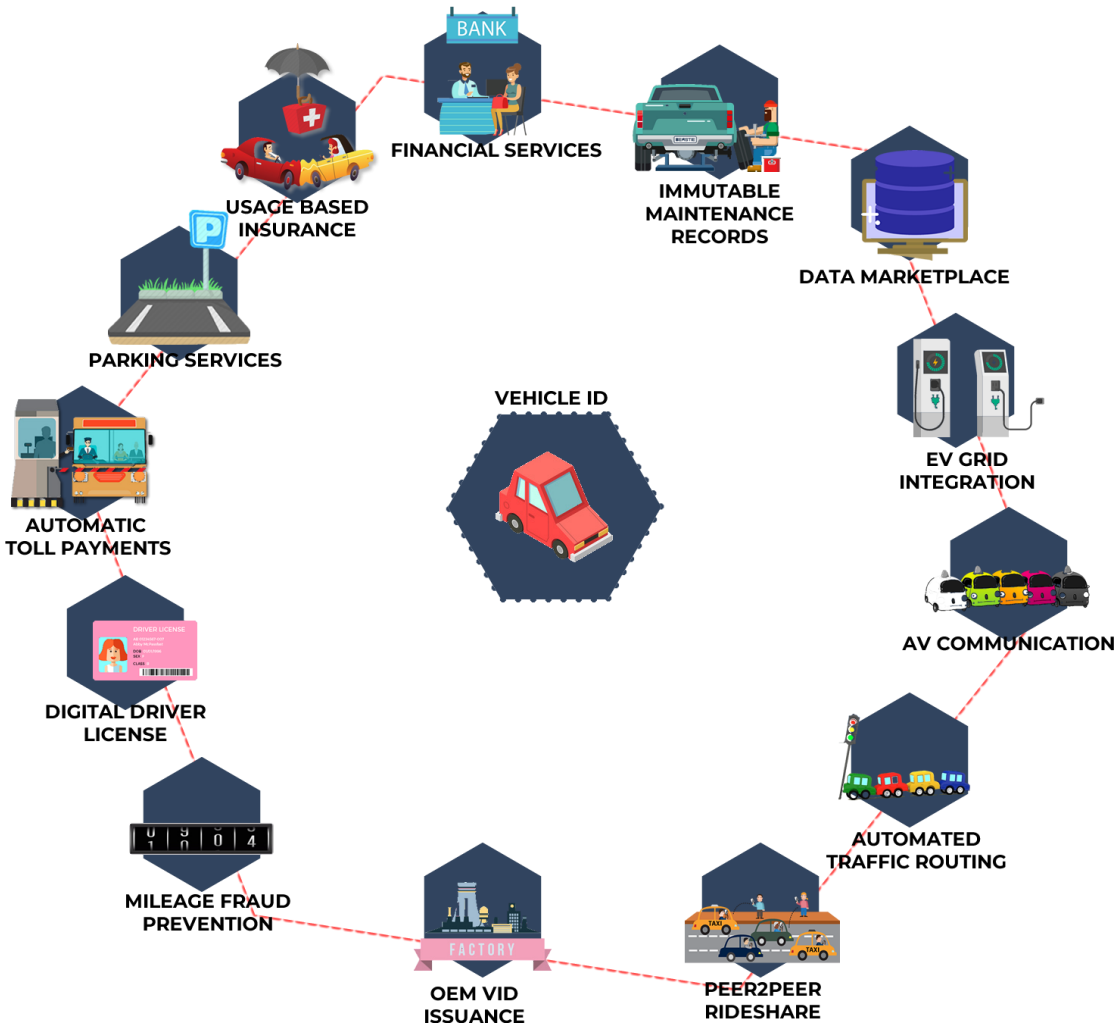


Figure 1: Mobility Ecosystem - VID Use Case Map

The VID value proposition will unlock a range of new services, roughly divided into four fields of business as demonstrated in Figure 2:

1. **Asset Visibility**
   (Expected implementation horizon: short-term | Expected pay-off: short/medium-term)
2. **Anchor for Additional Services**
   (Expected implementation horizon: short-term | Expected pay-off: medium-term)
3. **Data Provenance**
   (Expected implementation horizon: medium-term | Expected pay-off: medium-term)
4. **Autonomous Economic Agents**
   (Expected implementation horizon: medium/long-term | Expected pay-off: long-term)

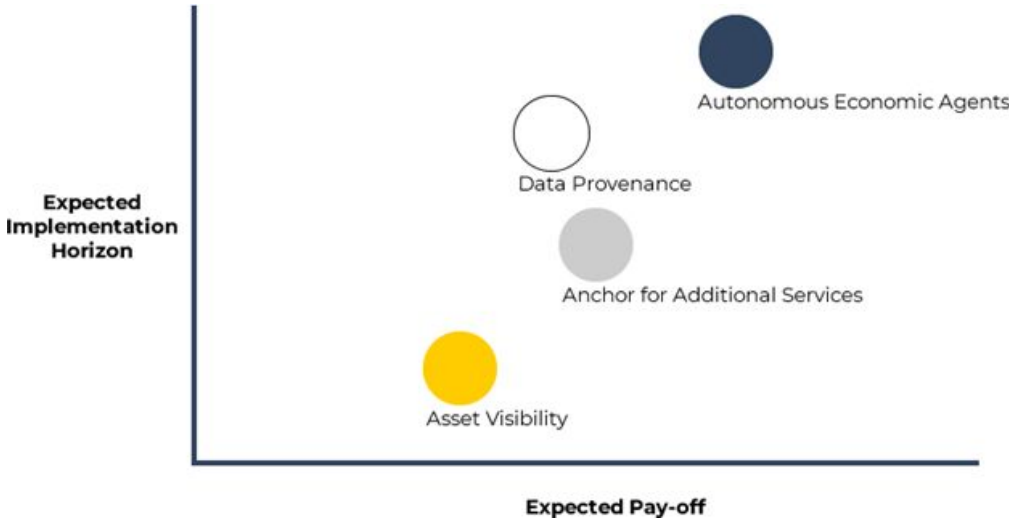


Figure 2: VID Value services

Next, we will elaborate on these four ways with a higher concentration on the more immediate area of Asset Visibility. The unique peer to peer nature of DLTs requires industry-wide collaboration and therefore, adoption by the ecosystem as a whole in order to showcase quantifiable business benefits. While it is early to estimate and

quantify such benefits, in our review we demonstrate the value that DLT-based vehicle identity can bring to businesses with significant pain points and large markets.

Asset Visibility

Current vehicle identity mechanisms, such as VINs, are highly manual, insufficient, and static. Furthermore, the current isolated identity systems, with both public and private records, often include repetitive or incorrect data and are not interoperable. This results in redundancy and high frictional costs for reconciliation, verification, registration, and transfer.

For example, the static data on the VIN and the fragmented information across many systems allow for thieves of vehicles to easily replace VIN number plates on similar vehicles, sell them back on marketplaces, and create vehicle clones. A DLT-based VID that is dynamic, yet with immutable data, and linked to various stakeholders' data inputs is prone to such cloning because all inputs from across the ecosystem would need to be cloned.

Asset visibility is also crucial while transporting vehicles. Shipping a vehicle from a factory to a dealership can take weeks, even months, depending on the origin and destination. For the entity financing these operations, this corresponds to a very high capital immobilization, and for the insurer, a greater risk of loss or damage. While transportation times cannot be reduced simply by creating a digital twin for a vehicle, gains can be made each time the vehicles switch hands in a transportation chain. The VID will increase transparency, thus reduce paperwork, lead times, and costs. This innovation, combined with the traceability offered by decentralized ledger technology, will allow every participant to participate in a single, shared ledger of information regarding the vehicles. This is especially relevant for transactions between stakeholders that do not share a centralized database.

VID enables the extension of benefits for the mobility industry. A tamper-evident record of vehicle identity, starting with the vehicle's birth, has a strong potential to reduce fraud (cost of erroneous information) and auditing cost (cost of trust) in the short-term with quality assurance. In the medium-term, this plays out on an organizational level (i.e. track and trace) as well as an individual level (i.e. transfer of ownership of a used asset).

According to the National Highway Traffic Safety Administration, more than 450,000 vehicles are sold each year with false odometer readings resulting in more than $1 billion in losses annually.[1] The transparent and verifiable vehicle history records enabled by blockchain can help prevent fraudulent and false readings and reduce such losses. In a report, recently issued by the European Parliament[2], blockchain is identified and highlighted as a solution to odometer tampering. Besides the occasional transmissions and recordings of odometer reading to blockchain, another way to validate the mileage is the comparison of multiple sources of odometer data, like GPS mileage tracking and the odometer itself. Linking such data to the corresponding VID with the appropriate certifications will be fundamental to this process.

Parts tracking, on the other hand, will be key for warranty and recall management resulting in more efficient, accurate, and, importantly, safer mobility. The impact of recalls on businesses include not only short-term costs associated with operational replacements, which in 2016 grew to $22 billion[3], but also long-term effects of loss of consumer trust in the brand and reduced residual values. According to one study, for example, the vehicles affected by Takata airbags saw a greater decline in residual values than vehicles not under the airbag recall.[4] While manufacturers have substantially improved the reporting of parts internally, industry-wide, shared parts tracking as part of a consortium effort that incorporates both quality and authenticity data has the potential to reduce recalls and warranty claims and increase consumer trust.

Another extension of the VID includes visibility on real-time fleet value: from the custody of the title that is key for fleet management, especially in cross border cases, to the management of service and maintenance, to financing and payments. DLT birth certificates overlayed by data from IoT devices, parts, and history of events, such as repairs or maintenance, on each of these devices will create a digital twin of a vehicle with a live snapshot of its condition and state. This provides more accurate estimates of residual values and resale value calculation. The asset visibility that VID provides is especially applicable for asset-based operators such as dealers, resellers, car auctions, fleet managers, banks, and others. Furthermore, VIDs and distributed ledgers also open up the possibility for simplified and faster digital escrows for vehicle ownership transfers that today are often avoided due to high costs.

For VID to be useful, it requires a minimum viable ecosystem, for which there are two requirements: standards must be open (publically available and collaborative efforts) and interoperable (DLT and application-agnostic). Furthermore, if the ecosystem is designed to be interoperable, VID can be overlaid with visibility on infrastructure (i.e.

roads, toll booths, EV grid), further improving asset visibility. VID can also be enriched by means of other protocols, for example, proof of location. Greater visibility paves the way for greater monetization. Blockchain is one of the three major technologies that disrupt mobility along with IoT and A.I. Proof of location is a perfect example of an IoT and blockchain-enabled case — overlayed GPS can provide time-stamped locations. The convergence merges IoT to capture data, blockchain to coordinate stakeholders, and A.I. to extract insights.

Anchor for Additional Services

While the main benefit for 'asset visibility' is transparency, the main benefit for any 'additional services' is coordination. The VID will function as an anchor for additional services, using VID to track, add to an asset, and enable transactions involving the asset—specifically, reflecting 'real status,' setting permission levels, accepting payments, and adding business logic. In new mobility, coordination is paramount.

According to McKinsey, "consumer mobility behavior is changing, leading to up to one out of ten cars sold in 2030 potentially being a shared vehicle and the subsequent rise of a market for fit-for-purpose mobility solutions."[5] In fact, Accenture estimates that revenues from mobility services will hit ~$1.35 trillion—with profits reaching as much as $248 billion.[6] Services for new mobility are lacking, most notably contextual insurance - usage-based insurance (UBI), a market that is estimated to hit $107 billion by 2024.[7] UBI aims to empower insurance companies to develop insurance schemes based on driving behavior data captured from on-vehicle telematics. This technology redefines insurance to a per user per vehicle model. Because the VID can 'talk' to telematics, its human driver, and infrastructure, an integrated ecosystem can be layered by bespoke business logic.

The next wave of consolidation in mobility is sharing the same vehicle for different services. Without VID coordination for multi-use assets, utilization is not possible at any major scale. In a case like P2P rideshare, for example, vehicle owners and users may be able to transact without the need for third parties. This is possible with the help of a verified vehicle identity, user identity, and smart contracts that outline the terms of any engagement between the parties. Ultimately, all tokenization use cases revolving around the vehicle are also dependent on VID.

Future mobility services require a clear methodology and standardization. To this end, additional MOBI working groups are creating standards for Insurance, Data Exchange,

and Electric Vehicle Charging. Additional working groups are planned for the near future.

Data Provenance

A connected car is projected to upload 25 gigabytes of data per hour, according to McKinsey's research.[8]There is a cost to basing business decisions on erroneous data, as well as data visibility gaps. On average across the board, poor data quality amounted to $15 million annual financial costs in 2019.[9] Provenance, or proof of origin, of vehicle data, is essential for direct and indirect business cases. Direct business cases include fraud prevention, data quality for data science (poor quality data input always produces faulty output), and ADAS systems. Indirect business cases include secondary data markets. McKinsey has predicted that the entire market for monetizing vehicle data could be worth as much as $750 billion by 2030.[10] 32 of 44 car brands currently offer some form of vehicle-to-vehicle communication devices in their 2018 models, illustrating that data collection is already commonplace for the automotive industry. DLT-enabled vehicle identities can validate requests and ensure there is trust in the communications between vehicles.

With the importance of data, data accuracy, integrity, and security, the MOBI Autonomous Vehicle Data Marketplace (AVDM) Working Group is launching in Q2 to ensure collaboration and standardization in moving this industry forward.

Autonomous Economic Agents

The combination of VID and the ability to accept and conduct payments will transform vehicles into autonomous economic agents, with far-reaching consequences. V2V transactions include negotiating right of way or platooning. V2I transactions include electric vehicle to grid payments or toll-roads. EVs can not only connect to charging stations by validating their identity but also pay for the charging. Vehicles can request and receive payments for their usage in shared environments. One adoption contingency is wallet adoption speed. Some industry players are already providing wallets in smartphones such as Samsung. Exploring use cases like tokenized carbon credits, vehicle to grid storage, and other ancillary services, the MOBI Electric Vehicle Grid Integration (EVGI) Working Group launched in Q2 2019 will address standardization in driving this ecosystem forward.

Conclusion

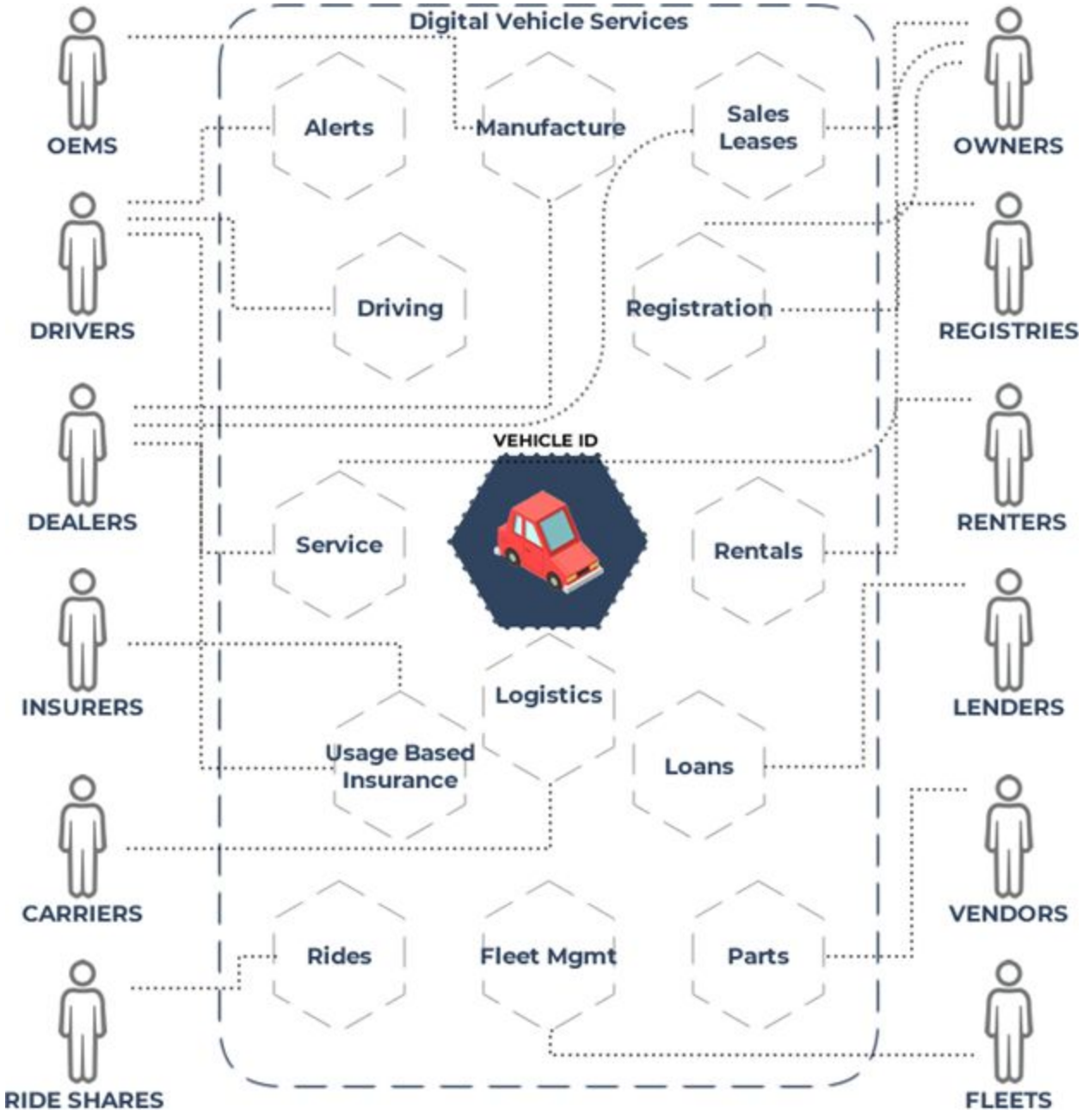
Existing costs in mobility such as cost of auditing (i.e. third-party intermediaries, time cost, resource cost, reconciliation cost), the cost of trust (i.e. redundancy), the cost of basing business decisions on no or erroneous information (i.e. model accuracy), and the cost of inaction (what if competitors get it right first) are exceptionally high. DLT has the potential to economize on these. Multi-year investment patterns into the future of mobility all point to the inevitability of a solution to assess the provenance of and enable extended interaction capabilities for assets. An analysis by BCG found that, since 2013, venture capital investors have poured approximately $300 million into startup companies offering blockchain solutions relevant to transport and logistics.[11]

With respect to VID, there are four cost categories: infrastructure development (one-off), bulk onboarding of assets (one-off) and de-fleeting assets, maintenance (ongoing), and operations (ongoing). Defensible VID business cases span fleet operations, sale of vehicles, mobility services, ecosystem services (i.e. insurance, predictive maintenance), supply chain, data markets, smart cities, traffic management, and more. DLT-based vehicle identity will enable optimization of supply chain elements from allowing vehicles to meet sustainability goals to achieving proper liability & accountability in the supply chain for cases like recalls, increasing trust, aiding fraud prevention, opening opportunities for data analytics with new insights to reshape business strategies and potentially, even, unlocking new business values. Electric vehicles need to communicate with the grid. Autonomous vehicles need to communicate with infrastructure and each other. Proper identification is crucial for interactions of connected cars within multi-person, multi-use mobility services. The potential upsides to new services, optimization, competitive advantage, and R&D know-how enabled by blockchain and DLT are undeniable. Ultimately, DLT allows for future mobility ecosystems to be faster, more efficient, more secure, more affordable, and greener.

Adoption contingencies include cross-sector willingness to jointly innovate. As the Web 2.0 model revolved around platform plays, the Web 3.0 model revolves around *infrastructure plays* with *a minimum viable community*. This is the raison d'etre for MOBI. If the infrastructure for VID is trusted and shared, this will unlock interactions across P2P, B2B, M2M, and other combinations of actors, transforming mobility at large. Using shared ledger technology for vehicle identities is a crucial building block for new mobility ecosystems and the MOBI technical standard for VID allows for industry implementation and adoption.

Appendix:

Figure 3: VID use case map



References

1. National Highway Traffic Safety Administration, *Odometer Fraud*, Retrieved (6.18.19): https://www.nhtsa.gov/equipment/odometer-fraud
2. European Parliament, Research for TRAN Committee - *Odometer Tampering: measures to prevent it* (7.15.19) https://www.europarl.europa.eu/RegData/etudes/STUD/2017/602012/IPOL_STU(2017)602012_EN.pdf
3. Automotive News, *Automotive Recall Bill grew 26% to $22billion in 2016, study says.* Retrieved (6.18.19) https://www.autonews.com/article/20180130/RETAIL05/180139974/auto-recall-bill-grew-26-to-22-billion-in-2016-study-says
4. Auto Remarketing, *Takata Airbag Recall Effect on Used Pricing*, Retrieved (6.18.19) https://www.autoremarketing.com/trends/takata-airbag-recall-effect-on-used-pricing
5. McKinsey&Company, *Automotive revolution – perspective towards 2030*, Retrieved (6.18.19) *https://www.mckinsey.com/~/media/mckinsey/industries/high%20tech/our%20insights/disruptive%20trends%20that%20will%20transform%20the%20auto%20industry/auto%202030%20report%20jan%202016.ashx*
6. Accenture, *Mobility as a Service*, Retrieved (6.18.19) https://www.accenture.com/_acnmedia/PDF-71/Accenture-Mobility-Service.pdf
7. Global Market Insights, *Usage-based Insurance Market to hit $107bn by 2024: Global Market Insights, Inc.* Retrieved (6.18.19) https://www.globenewswire.com/news-release/2018/12/03/1660531/0/en/Usage-based-Insurance-Market-to-hit-107bn-by-2024-Global-Market-Insights-Inc.html
8. McKinsey&Company, *What is driving the connected car*, Retrieved (6.18.19) *https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/whats-driving-the-connected-car* Retrieved (6.18.19)
9. *Gartner, How to stop data quality undermining your business*, Retrieved (6.18.19) https://www.gartner.com/smarterwithgartner/how-to-stop-data-quality-undermining-your-business/
10. Consumer Reports, *Who owns the data your car collects*, Retrieved (6.18.19) https://www.consumerreports.org/automotive-technology/who-owns-the-data-your-car-collects/
11. BCG, *Resolving the Blockchain Paradox in Transportation & Logistics*, Retrieved (6.18.19) https://www.bcg.com/en-gb/publications/2019/resolving-blockchain-paradox-transportation-logistics.aspx