

What added value does blockchain technology bring for your company?

5 case studies from German SMEs

incl.
checklist



In cooperation with blockchain expert
Prof. Dr Gilbert Fridgen



Blockchain solutions enhance security when companies exchange information: modern blockchain solutions make it possible for sensitive business-related data to be disseminated between companies and documented in a tangible and tamper-proof way.



Blockchain adds to the impetus of digitalisation: market leaders are launching growing numbers of blockchain solutions, creating pressure to innovate across industries.



Blockchain solutions also have strategic potential for small and medium-sized enterprises (SMEs): cross-company processes can be designed in a more flexible and cost-effective way and the door opened to new business models.



The potential varies greatly from one industry to the next: there are profitable ways of using blockchain solutions particularly in the logistics, consumer goods and automotive industries.

5D OF BLOCKCHAIN TECHNOLOGY

Disruption

Blockchain has the potential to fundamentally change the structure of processes in many industries

Democratisation

Blockchain helps prevent individual market participants from establishing a monopoly

Decimation

Blockchain reduces costs for transactions and IT infrastructure in the medium term

Data security

Modern blockchain solutions protect sensitive business-related data from tampering or being modified, providing a high level of data protection

Decentralisation

Modern blockchain solutions make it possible to run business logics decentrally

BLOCKCHAIN IS TRANSFORMING...



...logistics and supply chains



...consumer goods and transparency



...automotive industry and mobility



...engineering and the Internet of Things



...energy and smart grids

FACTS & FIGURES

>120

Blockchain start-ups in Germany

USD 20 BN

Global blockchain market volume by 2024

UP TO 10%

of global GDP will run through blockchain solutions by 2027 according to WEF estimates



➔	Why use blockchain?	4
➔	The view from different industries and use cases:	5
📦	Logistics	6
📦	Consumer goods	8
🚗	Automotive	10
🔧	Engineering	12
⚡	Energy	14
➔	Outlook: How will the technology develop?	16
➔	Checklist: What added value does the technology bring for your company?	17
➔	Additional information	18



WHY USE BLOCKCHAIN?



Secure digital technologies have a key role to play in the German economy. The COVID-19 pandemic is just the latest event highlighting the contribution information technologies make to efforts to coordinate actions, collect data accurately, facilitate the flow of information between organisations and ensure smooth processes. One of these technologies is known as blockchain: the added value it brings is particularly evident where cross-organisational cooperation is required.^[1] Companies in the logistics and consumer goods industries are already using such technologies to improve the efficiency and transparency of supply chains with great success. Yet blockchain solutions can also be increasingly found in the automotive industry, energy sector and mechanical engineering operations.^[2]

CROSS-ORGANISATIONAL COOPERATION

Using blockchain enables information to be shared between different companies in a targeted manner and kept resistant to tampering without the need to have a central operator. This means that the issue of data sovereignty is a key one when deciding to use blockchain solutions, as it is something that conventional IT solutions and platform approaches are generally unable to guarantee to a satisfactory extent. Modern blockchain solutions are used in particular to assist with cross-organisational processes, such as to ensure a controlled exchange of information about the status and flows of goods in international supply chains.^[3]

NEW CHALLENGES

At the same time, there are also significant challenges associated with the use of blockchain, not only in terms of technical aspects but also from a regulatory and organisational standpoint. For instance, innovative solutions are needed to process personal data using blockchain solutions in a way that complies with data protection regulations (GDPR). The decentralised nature of blockchain also means that new operating models with shared ownership and decision-making structures are required. Defining these is often a protracted undertaking, requiring a willingness on all sides to work together to find a solution.

INCREASINGLY RELEVANT – EVEN AMONG GERMAN SMES

Innovative solutions and approaches are emerging in a range of blockchain projects that address industry-specific challenges such as a lack of supply chain transparency. In most cases, these can also be applied to German SMEs.

The following study shines a light on current developments in five key industries in Germany: logistics, consumer goods, automotive, mechanical engineering and energy. We highlight key challenges and how blockchain solutions help address them. We also look at potential fields of applications that are under discussion and being tested, as well as industry-specific hurdles faced when introducing blockchain solutions. We use specific case studies to show how blockchain is already being used in the context of different potential fields of application.

IN PRACTICAL USE – TODAY

A clear picture is emerging in most industries: Large companies are increasingly turning to blockchain solutions to help streamline existing processes and how information is digitally exchanged. They are also putting pressure on their (SME) partner companies to use these blockchain solutions as well. At the same time, blockchain solutions have strategic potential for smaller partner companies in particular by having a democratising effect and counteracting the formation of monopolies.

Cross-company processes can be designed in a more flexible and cost-effective way and the door opened to new data-driven business models. This potential can only be realised, however, if the German SME partner companies acquire the relevant expertise and show a willingness to cooperate and innovate. Conditions that SMEs also need to hold their own when talking to large companies or IT service providers and to have their own needs incorporated when blockchain solutions are designed. This makes it imperative to actively address the potential benefits and obstacles.

HOW DO MODERN BLOCKCHAINS WORK?



A user would like to execute a transaction



The information about the transaction is combined with others to form a block



The block is sent to selected network participants (e.g. transaction partners)



Participants validate the block and the transaction



Block is attached to blockchain



Transaction is confirmed



WHEN?

The potential field of application is industry-specific and driven by the respective level of technological maturity, innovative pressure and the importance of having secure, tamper-proof information.



WHY?

There are various approaches to reducing costs or generating revenue, which include streamlining supply chains, production, stocks and control processes. Linking different market players through open platforms or creating added value for customers offer monetizable benefits – even if indirectly in some cases.

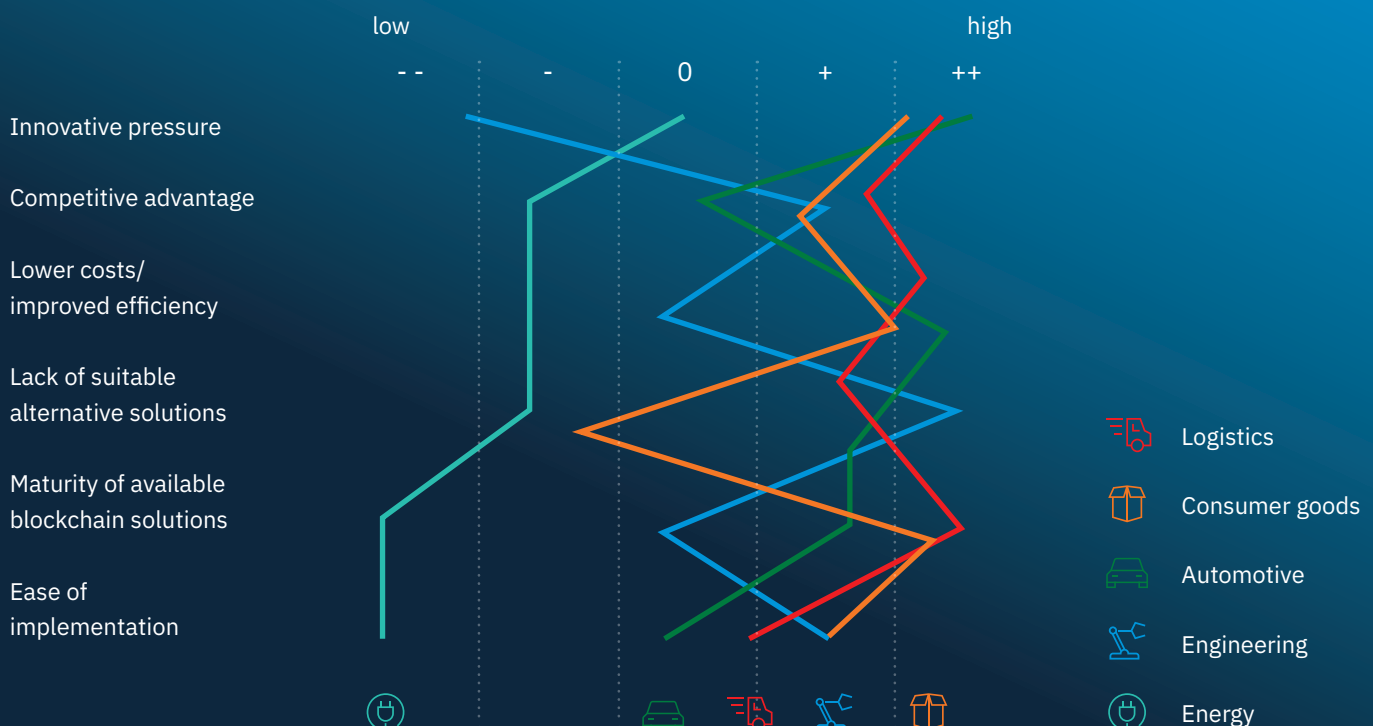


WHO?

There are profitable ways of using blockchain solutions particularly in the logistics, consumer goods and automotive industries.

The specific advantages offered by blockchain over existing digital solutions need to be evaluated on a case-by-case basis. It often makes sense to partially integrate it into software (which may already be in place). Consideration should also be given to the possibility of linking up with other new digital technologies such as the Internet of Things.

WHO BENEFITS THE MOST FROM BLOCKCHAIN SOLUTIONS? DEGREE OF MATURITY





Many logistics companies are increasingly turning to digital solutions to make the management of previously heavily paper-based processes more efficient and cost-effective. At the same time, these solutions are mostly implemented either within individual companies or involving a few companies at most, not across entire logistics chains.^[1] Blockchain solutions provide interesting starting points for leveraging the potential for digitalisation even across multiple companies, the focus being on logging process data and documents across organisational boundaries in a tamper-proof way. This enables transport processes to be optimised, the flexibility of inventories improved, and booking and accounting processes started automatically, allowing for cost savings working capital optimisation.^[2] Unlike conventional IT solutions, blockchain approaches do not require a central owner and operator, instead being capable of implementing shared ownership and operating models. Ownership and control of the process data and documents being exchanged, however, remain with the respective participants.^[3]

BLOCKCHAIN SOLUTIONS ARE ALREADY BEING USED WITH GREAT SUCCESS

TradeLens, a blockchain solution for managing processes and documents in the container shipping sector, has been around since 2018. Originally starting as a collaboration between IBM and Maersk, TradeLens is now used by over 150 globally active companies, including the world's five largest container shipping companies.^[4] TradeLens makes it possible to track shipping processes and share digital shipping documents in a dynamic way (see the detailed use case description for further information).^[5] Vinturas is a similar solution that exists for delivering vehicles to the end customer.^[6] Most other logistics solutions, on the other hand, focus predominantly on certain types of consumer goods where it is particularly important to ensure transparency, such as Food Trust, Everledger or Textile Genesis – see the chapter on the consumer goods industry.^[7]

THE BARRIERS TO LAUNCH ARE HIGH

Modern logistics chains are made up of a multi-layered and global network of participants. Connecting these participants to a common IT solution usually involves a considerable degree of organisational, contractual and regulatory complexity. This makes it all the more difficult

to define suitable governance frameworks – not least because having IT systems without a central operator and owner always raises the question of where the final decision-making power lies and how it is funded.^[2] In the case of TradeLens, for example, this authority lies with a separate legal entity comprising all partners who work jointly to further develop the technology.

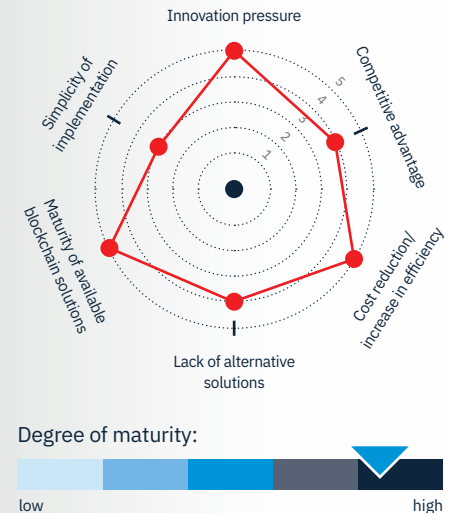
There are also major hurdles to overcome at the beginning from a technical standpoint. Blockchain solutions do not usually replace a company's existing system, instead offering a supplementary, cross-company system for storing and sharing business-relevant data. This means that blockchain solutions can be tailored to fit in with the company's existing systems. At the same time, however, technical industry standards (especially those relating to interfaces and data schemas) must be established in order to enable data from the different inventory systems to be shared.^[8]

IT IS IMPORTANT TO PICK THE RIGHT TIME

Blockchain solutions can add substantial value in the logistics industry, especially in those areas where concerns about confidentiality regarding data sovereignty and protection have so far prevented conventional IT solutions and platform approaches from being launched. This is particularly relevant in cases where data that allow conclusions to be drawn about trade secrets, for example, need to be shared between companies. At the same time, the barriers to implementation are particularly high here and the success of corresponding blockchain solutions depends to a large extent on the support of logistics heavyweights making substantial investments. All this means that there is no immediate pressure for German SMEs to act and innovate. It is instead possible to wait until the barriers to introduction are lower and the necessary standards become clearer. On the other hand, SMEs should not drag their heels too much and be late in joining blockchain initiatives. It becomes difficult, once solutions have gained a foothold, to actively shape standards and have one's own interests sufficiently accounted for. However, a major obstacle continues to be the extent to which participants in the industry are uninformed here (see chart "Industry attitude"). This means that, in order to evaluate the potential advantages for a company's own business model, it is necessary for interdisciplinary teams – with close links to existing digitalisation initiatives – to gather specific information and examine it in detail.

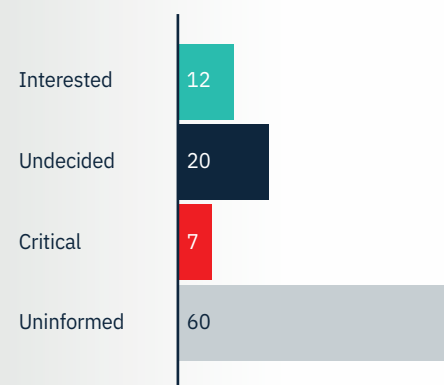
BLOCKCHAIN IN THE LOGISTICS SECTOR

1 (LOW) – 5 (HIGH)



INDUSTRY ATTITUDE TO BLOCKCHAIN SOLUTIONS

(% OF SURVEYED COMPANIES)



Source: Bitkom

FACTORS DRIVING THE INTRODUCTION OF BLOCKCHAIN IN THE LOGISTICS SECTOR:

- Digitalisation of paper-based processes
- Tamper-proof logging
- Cross-company exchange of data
- Cost-efficiency and liquidity optimisation



TradeLens is a blockchain solution developed jointly by IBM and Maersk, the world's largest container shipping company, to track previously paper-based process data and documents within logistics chains across companies in a more efficient and cost-effective way. Over 170 companies involved in the global logistics business currently use TradeLens, including four of the next five largest container shipping companies: MSC, CMA-CGM, ONE and Hapag-Lloyd. TradeLens has been available for use since 2018 and is supposed to be enhanced in a targeted manner over the next few years.^[10]

OUTDATED SYSTEMS CAUSE INEFFICIENCIES

When it comes to shipping logistics, blockchain solutions focus primarily on the two main challenges of the industry: the fact that it is heavily paper-based, meaning that the sharing of information is slow and prone to errors, and the lack of coordination between the various participants. These are serious challenges, as global supply chains generally comprise some 30 participants and over 200 coordination processes per shipment of goods.^[11] While a lot of data is already being digitally recorded, current systems do not ensure a timely and cost-efficient flow of information across organisational boundaries. This means that essential business-relevant information is often not available or not available quickly enough.^[12]

TRADELENS MAKES IT POSSIBLE TO DIGITALISE PAPER-BASED LOGISTICS PROCESSES

With TradeLens, specific paper-based logistics processes that unnecessarily slowed down the flow of information in the past can be digitalised. Specifically, the blockchain solution enables process-relevant trade documents and real-time information to be securely stored and exchanged, such as when milestones in delivery processes are reached or to use relevant sensor readings. These documents and information are permanently stored via a common data structure and made accessible to all the participants involved in the respective process.^[13]

OPTIMISING SUPPLY CHAINS IMPROVES VALUE CREATION

TradeLens also improves how sub-processes interact as well as the efficiency of the overall process. Specifically, certain sub-processes can be triggered automatically and tracked in a tamper-proof manner with the aid of business logics defined in the blockchain solution, making it possible to reduce safety stock levels, plan downstream operations better, identify problems, and easily review fees and surcharges. The blockchain solution optimises inefficiencies over the long term and increases the potential for savings to be made by everyone involved.^[14]

ADDED VALUE BEYOND THE MERE FLOW OF INFORMATION

After encountering some difficulties at the beginning due to a lack of willingness to cooperate, TradeLens is now having a sustainable, positive impact on the efficiency and costs of container logistics chains. The initial concerns about investing in blockchain, a technology that was still untested on this scale, have also been largely soothed following the success of the pilot phase.^[10] There are even shared ownership structures and a joint development model in place for the controversial governance framework instead of joint ventures. The service is provided by IBM for a fee.^[15]

Blockchain technology will therefore continue to be an integral part of TradeLens, further simplifying the paperless exchange of information and also gradually automating various tasks within the supply chain, including payment transactions. Automatically initiating and handling payment transactions in particular opens the door to having supply chains that are more time and cost-efficient.^[12,16]

PAYMENT MODEL:

Companies interested in TradeLens can currently choose between a pay-per-use or a subscription model, depending on their needs and size.^[17]

ADDED VALUE OF THE TRADELENS BLOCKCHAIN SOLUTION FOR VARIOUS PARTICIPANTS ALONG THE CONTAINER LOGISTICS SUPPLY CHAIN



Port/terminal operators

- Transparency and real-time access to information
- Improved cooperation and planning in ports/terminals

Shipping companies

- Cost savings for customer service
- Less incorrectly declared cargo

Authorities

- Sound risk assessment
- Improved exchange of information with less manual effort

Inland transport

- Improved planning and systems thanks to real-time access
- Shorter waiting times

Freight forwarders/freight owners

- Predictability thanks to optimised and transparent supply chains
- Verification of fees and surcharges
- Smaller safety stock levels

Carriers

- Improved integration
- Better tools for clearing customs
- Real-time access to supply chain data

Financial services

- Access to real-time information
- Tamper-proof logging of trade financing and insurance

CONSUMER GOODS INDUSTRY



About 50%^[1] of end customers and about 90%^[2] of retailers in the consumer goods industry demand transparency when it comes to product origin and safety. In order to be able to guarantee this transparency across countries and companies, there is a considerable need for digitalisation and networking. At the same time, conventional platforms only offer limited suitability as systems become highly dependent on platform operators, and information about product origin and safety can be retroactively changed.^[3] Blockchain solutions for the consumer goods industry address these very concerns. They enable the companies involved to have full control over how product information is distributed and to ensure it can be stored in a tamper-proof way, making it possible to verify product origin and safety at all times from company to company. This information can also be used in conjunction with jointly defined business rules to automate the settling of accounts between companies.^[4]

BLOCKCHAIN SOLUTIONS ARE ON THE RISE

IBM's Food Trust is already a fully functional blockchain solution for international trade in food and other sensitive consumer goods to log product data along the supply chain.^[4] Walmart, one of nine major Food Trust partners, uses this solution, for instance, to track the location and food safety of green vegetables in a tamper-proof manner.^[5] In addition to food safety, Food Trust also addresses the issue of waste prevention. Specifically, companies can use blockchain solutions to track the shelf lives of inventory along the supply chain, thereby enabling them to determine ones that are at risk of expiring.^[4]

A supplementary certification module provided by IBM also guarantees the origin and authenticity of products (more information is available in the detailed use case).

This certification module is also ideally suited to fair trade products and luxury goods, in addition to food items. For example, Farmer Connect uses it to show consumers the origin of their coffee beans^[6], and Everledger to monitor the digital fingerprint of diamonds transparently. Blockchain-based certification solutions can also be found in the pharmaceutical industry.^[7]

MediLedger, a pioneering US undertaking, was created, among other reasons, to monitor

compliance with the regulatory requirements of the Drug Supply Chain Security Act. In Germany, DHL is looking for a similar collaboration to keep track of drug serial numbers in order to prevent falsification.^[8]

THE HURDLES ARE MANAGEABLE

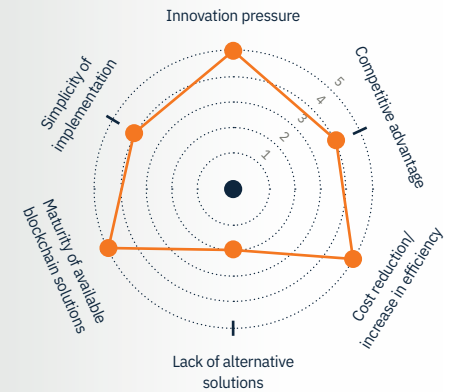
The hurdles for blockchain solutions to overcome in the consumer goods industry are manageable, as companies often have an organisational and technical infrastructure in place already to track the origin of products in order to, for example, qualify for certain quality seals. The effort to integrate blockchain solutions into these existing systems is also largely manageable. Moreover, no personal data is processed in most use cases.^[9]

UNDERSTANDING TRANSPARENCY AS MONETISABLE ADDED VALUE

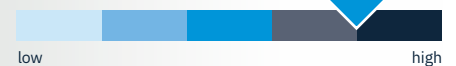
The added value of blockchain solutions comes to the fore particularly where companies want to log product information along the supply chain from the production site/day to the retailer in a transparent and tamper-proof manner. This means that blockchain solutions are ideal for sensitive product lines where transparency reduces losses or delivers specific added value for customers.^[10] Interesting opportunities arise for German SMEs, particularly when it comes to quality-certified end products, in that the origin and safety of their products can be credibly demonstrated. For many product sectors, including food or luxury goods, there are already networks available with viable blockchain solutions such as Food Trust, Everledger and Textile Genesis^[11] for SMEs to join. The extent to which joining these networks or even developing alternative solutions makes sense, however, must be decided on a case-by-case basis.

BLOCKCHAIN IN THE CONSUMER GOODS INDUSTRY

1 (LOW) – 5 (HIGH)

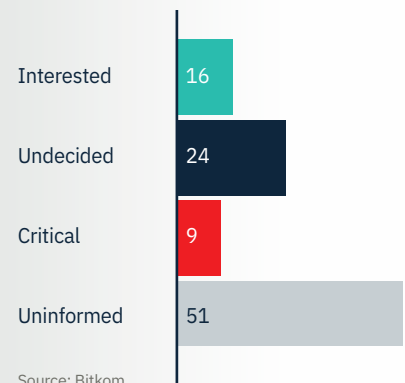


Degree of maturity:









INDUSTRY ATTITUDE TO BLOCKCHAIN SOLUTIONS

(% OF SURVEYED COMPANIES)



Source: Bitkom

FACTORS DRIVING THE INTRODUCTION OF BLOCKCHAIN IN THE FOOD INDUSTRY:

-  Avoiding foodborne illnesses
-  Reducing food fraud
-  Transparency (external)
-  Fulfilling regulatory requirements
-  Traceability (internal)
-  Food freshness/avoiding food wastage



Food Trust is a blockchain-based solution from IBM that was created in cooperation with nine major retail groups, including Walmart, Nestlé and Unilever. It enables retailers in the food industry in particular to improve transparency regarding product origin and safety within their food ecosystems. Food Trust was successfully piloted with its founding group Walmart, among others, and is now being used in live operations.^[10]

LACK OF TRANSPARENCY LEADS TO INEFFICIENCY AND PRODUCT LOSSES

Blockchain solutions in the food industry largely address two major problem areas: inefficiencies caused by lacking an overview of global and highly complex supply chains, as well as calls from consumers and retailers for more transparency in respect of product origin and safety.

Both of these are difficult to achieve with current systems and require an enormous amount of time if individual product data have to be retrieved from somewhere in the supply chain. This lack of overview can result in large quantities of products being lost, especially fresh produce, which spends around half of its shelf life in transit to retailers.^[11]

INEFFICIENCIES CAN BE REDUCED BY IMPROVING THE EXCHANGE OF INFORMATION

Food Trust sets store by a controlled exchange of product information between

participants along the supply chain to reduce inefficiencies. Using what is called a data entry and access module, they can provide each other with relevant information on the origin and condition of the food and keep track of it in a tamper-proof way. The trace function also provides access to selected process-relevant information such as the real-time location of food products, enabling companies to improve the coordination of their supply chains, identify products potentially at risk, improve efficiency over the long term, and leverage savings potentials.^[12]

TRANSPARENCY BOOSTS CONSUMER CONFIDENCE

It is important for many consumers and retailers to know where their food products come from and what steps they have gone through in the supply chain. Food Trust uses a blockchain-based certification module to transparently store relevant information and certificates on the blockchain. For example, retailers can use QR codes or smartphone apps to support promises made about the quality of the food supply chain and strengthen consumer trust in their product.^[13,14]

FOOD TRUST PURSUES A TARGETED GROWTH STRATEGY

Even the large retailers such as Carrefour and Walmart only use Food Trust for selected food products in their range at present. It is, however their medium-term goal to map their own product portfolio as comprehensively and as

transparently as possible (e.g. Carrefour by 2022). Moreover, Walmart clearly stipulates that its own suppliers (especially for lettuce and spinach produce) should also use Food Trust. IBM is also working hard on developing Food Trust in such a way as to promote food traceability on a broader scale.^[15]

PAYMENT MODEL:

Companies that want to actively use data as described above can choose between differently priced software-as-a-service options, depending on their requirements and company size. Suppliers, on the other hand, can enter data free of charge.^[16,17]

ADDED VALUE OF THE IBM FOOD TRUST BLOCKCHAIN SOLUTION FOR THE VARIOUS PARTICIPANTS ALONG THE FOOD SUPPLY CHAIN



Producers	Food manufacturers/CPGs	Wholesalers/distributors
<ul style="list-style-type: none"> Farms not the cause for shortages Good integration into the supply chain 	<ul style="list-style-type: none"> Establish trust between retailers, suppliers and consumers Automate the administration of certificates 	<ul style="list-style-type: none"> Targeted recalls Enables the internal exchange of data
Food logistics	Retailers	Consumers
<ul style="list-style-type: none"> Improving compliance Cutting manual processes 	<ul style="list-style-type: none"> Can guarantee food safety Targeted and swift recall campaigns 	<ul style="list-style-type: none"> Improved transparency Low risk of being a victim of food fraud
Certification bodies	Catering	Regulatory authorities
<ul style="list-style-type: none"> Less fraud with forged certificates Easier to renew existing certificates 	<ul style="list-style-type: none"> Food safety for customers guaranteed Cut food wastage 	<ul style="list-style-type: none"> Easier to trace contamination No unnecessary tests



The need for greater transparency in supply chains, the mobility revolution and the difficult environment for sharing services pose significant challenges for the automotive industry.^[1] Some of these challenges are currently being addressed through IoT-based applications such as smart manufacturing, which records business-critical data in large quantities along the supply chain.^[2] Blockchain solutions are a promising addition to these applications by enabling such data to be logged in a tamper-proof way and shared in controlled manner.^[3] Vehicle master data and identities as well as booking and accounting data can also be continuously tracked and passed on as required.^[4]

CAR MAKERS TAKE THE LEAD

Major automotive manufacturers (OEMs) are currently working on blockchain solutions that, specifically, enable the tracking of supply chains. BMW and Daimler, for example, are developing their own blockchain solutions to log the origin of construction/spare parts, the materials used for production and compliance with sustainability standards.^[4,5] BMW is planning something similar to track the life cycle of its vehicles. Specifically, the idea is to give end customers access to key information about the vehicle such as the number of previous owners, mileage, maintenance history or accidents using a blockchain-based app – without the risk of subsequent tampering. This would enable the entire vehicle history to be verified and presented on site during the sales talk.^[5] Daimler is also working on a solution within the scope of the Mobility Blockchain Platform that will sustainably optimise booking and billing processes for cross-provider mobility solutions and enable more time-saving congestion management.^[6]

INITIAL OBSTACLES NEED TO BE OVERCOME

Supply chains in the automotive industry include a large number of small and large companies, meaning that introducing any blockchain solutions will necessarily have organisational, contractual and antitrust complexities. Often, the technical conditions must first be created in order to be able to securely transfer data along the supply chain or to the vehicles into a blockchain solution.^[5,6] To this end, it makes sense to agree in advance on industry standards for interfaces and data schemas in order to enable widespread use and to keep the investment risk low for individual com-

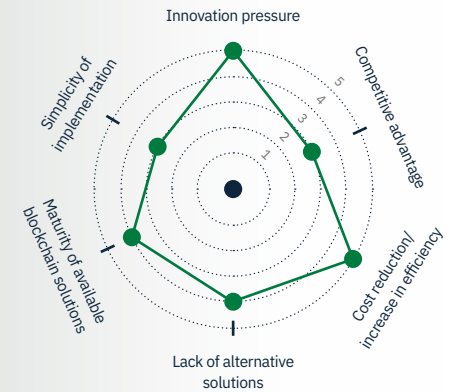
panies.^[4,7] These standards could be promoted through relevant initiatives, such as the Mobility Open Blockchain Initiative MOBI,^[7] or through existing associations such as the German Association of the Automotive Industry (VDA). Moreover, another important factor to consider here is how to protect sensitive and personal data in a way that complies with GDPR, especially when tracing vehicle histories and booking and billing processes for mobility solutions. Personal data processed in such contexts must be stored in a way that it can also be erased.^[3] Yet while ensuring data security, vehicle safety must not be neglected either. Blockchain-based applications, which, for example, enable vehicles to be unlocked when a rental agreement has been signed need to be protected against misuse and not be susceptible to errors.

GETTING INVOLVED IS WORTH IT

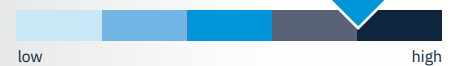
In order to achieve the greatest possible degree of transparency in respect of where and how automotive parts are manufactured, the large OEMs are exerting growing pressure on their SME partners to use their blockchain solutions. At the same time, these blockchain solutions also open the door to interesting ways of strengthening data sovereignty, standardising the data exchange across the industry and making collaboration more efficient and flexible for suppliers. Using these solutions in corresponding software-as-a-service models comes with comparatively low investment risks for German SMEs, making it more than worthwhile to create the organisational and technical conditions needed to integrate these blockchain solutions into internal business processes. Initial studies also put the cumulative willingness of end customers to pay for blockchain solutions in the automotive sector at up to € 104 billion worldwide by 2030 – meaning that substantial financial added value can also be expected.^[8]

BLOCKCHAIN IN THE AUTOMOTIVE INDUSTRY

1 (NIEDRIG) – 5 (HOCH)

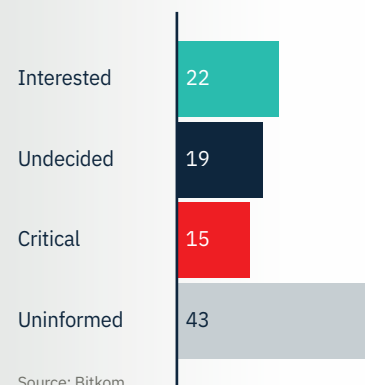


Degree of maturity:






INDUSTRY ATTITUDE TO BLOCKCHAIN SOLUTIONS

(% OF SURVEYED COMPANIES)



Source: Bitkom

FACTORS DRIVING THE INTRODUCTION OF BLOCKCHAIN IN THE AUTOMOTIVE INDUSTRY:

-  Greater transparency and protection against forgeries in the supply chain (original equipment and repairs)
-  Tamper-proof collection of data throughout the entire life cycle (used cars)
-  Customised communication (e.g. booking, billing)

CASE STUDY – CAR WALLET



The Car Wallet is a solution provided by the blockchain start-up Riddle&Code to enable secure communication with on-board vehicle systems. The Car Wallet solution was developed in the Mobility Blockchain Factory initiated by Daimler Mobility, in which four other blockchain start-ups in addition to Riddle&Code are currently involved.

^[10] The second generation of the solution has been available since May 2020 and is currently being used in particular within the scope of Daimler’s Mobility Blockchain Platform. It is, however, also compatible with various makes of other manufacturers.^[11]

SECURE DATA TRANSMISSION IS ESSENTIAL FOR BLOCKCHAIN SOLUTIONS

The Car Wallet addresses a key challenge of integrating (autonomous) vehicles into smart mobility concepts in general and blockchain solutions in particular: secure communication with on-board vehicle systems across providers. What this needs is for the communication modules to be secured against unauthorised access and, on the other hand, for information to be transmitted securely and its authenticity to be verified.

Current telematics solutions installed in vehicles are only able to meet these requirements to a certain extent, offering only limited security against tampering and being highly provider-specific.^[12]

CAR WALLET ENABLES ENCRYPTED AND AUTHENTICATED DATA TRANSMISSION

At the heart of the Car Wallet solution is a crypto chip, which enables a tamper-proof vehicle identity to be generated. The crypto chip is located in a hardware module that can be connected to the vehicle’s on-board system via existing interfaces. Data is then accessed from the vehicle’s on-board system using common protocols, which can then be encrypted, authenticated and signed using the vehicle identity before the wallet’s additional software components transfer them to the blockchain protocol of choice. The target blockchain can be freely selected depending on the application in question.

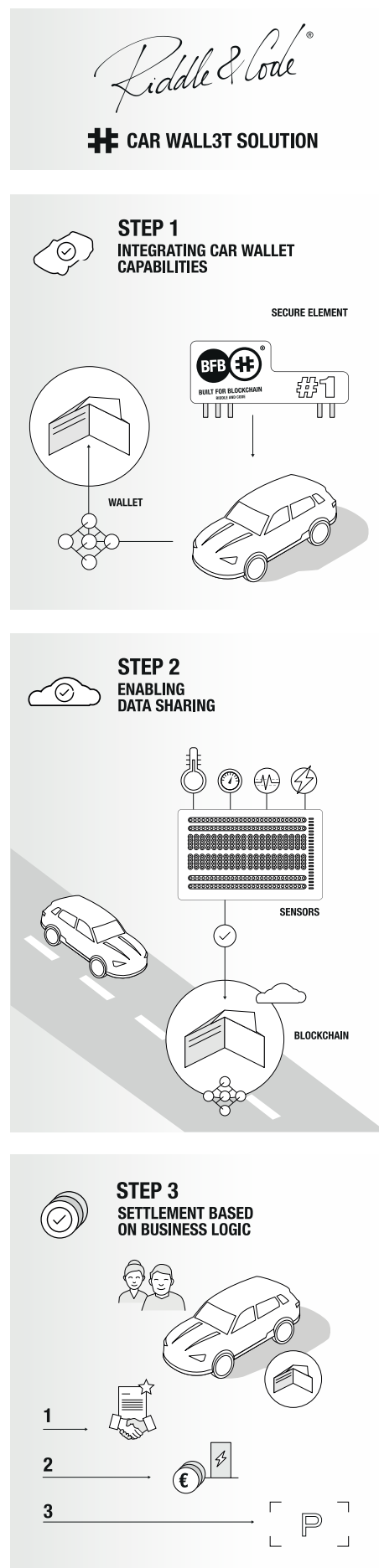
CAR WALLET IS CURRENTLY BEING TESTED WITHIN DAIMLER’S MOBILITY BLOCKCHAIN PLATFORM

The second generation of the Car Wallet has been available as a retrofit model in the form of an OBD dongle since May 2020 and it is currently being tested and further developed within the Mobility Blockchain Platform. The Car Wallet is specifically linked to the platform’s blockchain component, serving as a tamper-proof system for managing booking and billing processes as well as for matching the customer ID, the vehicle ID used by the wallet and a corporate ID for operators of mobility services.^[13,14]

The Car Wallet also enables data to flow securely from blockchain solutions to on-board vehicle systems, meaning that rental vehicles could be unlocked by a non-provider-dependent app after the renter has been successfully verified and the fee paid.^[15] The Car Wallet can also be used at any time for direct V2X transactions, i.e. vehicle transactions with various other IT systems.^[11]

PAYMENT MODEL:

The payment model for the Car Wallet solution has not yet been finalised, but there are ideas to employ a combined model of selling the hardware module and a licensing model with recurring payments to use the software. A transaction-based pay-per-use model is also a potential solution.^[16]





Industry 4.0 and the Industrial Internet of Things are increasingly moving value creation in mechanical engineering from the actual machine (hardware) to software and data, see Andersch mechanical engineering study.^[1] While, for many German SMEs, this shift translates into the need for major investment and digitalisation drives,^[2] it also comes with significant opportunity and potential for innovation. It is possible to detect improper use and maintenance needs at an early stage, e.g. through predictive maintenance models, and to improve the availability and reliability of machinery.^[3] Digital service approaches also open the door to new business models, such as equipment-as-a-service (EaaS) models, in which machines are leased instead of being sold.^[4] This makes the EaaS provider responsible for maintenance, service, repairs and spare parts, resulting in steady cash flows and cementing customer ties. In return, end customers avoid having to make considerable investments and can pass on some of the operational risk to the provider. Blockchain solutions offer a wide variety of ways of linking up with these digitalisation approaches, the primary focus being on the tamper-proof logging of usage and status data. These records can be used for billing purposes as well as for monitoring with a view to determining residual values and resolving warranty and guarantee claims.^[5]

EARLY BLOCKCHAIN SOLUTIONS ARE ALREADY BEING USED SUCCESSFULLY

The current focus is squarely on blockchain-based EaaS solutions. For example, Bosch has already tested a blockchain solution to log the use of retrofitted hydraulic units in drilling equipment. Logging such data makes it possible, in turn, to bill for machine power used in a more automatic and dynamic way.^[6] Various German equipment manufacturers such as Bosch and ZF are also working on blockchain solutions for handling payments between machines. Referred to as economy-of-things solutions, they put machines at the centre of everything and enable them to act in an economically autonomous way.^[7,8]

THE BARRIERS TO IMPLEMENTATION ARE MANAGEABLE

Offering additional digital services requires the customer to have a high level of digitali-

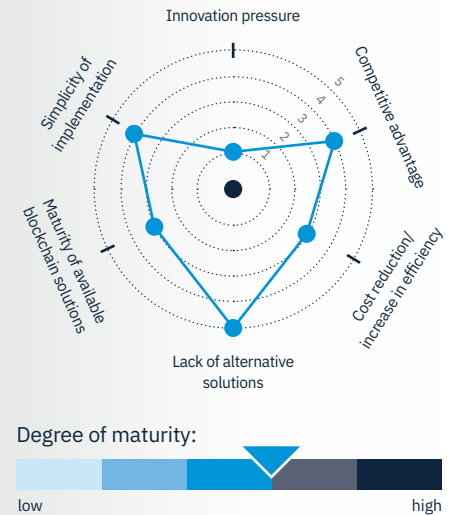
sation and the engineering company to have considerable technological expertise. Strict data privacy rules and customer concerns about companies sharing data with each other are often cited as further barriers impeding the widespread use of the technology. However, many blockchain use cases in mechanical engineering involve a reasonably small number of partners, which in turn means that organisational and contractual complexity is usually manageable. It is normally the case too that no personal data are processed. Adherence to strict security guidelines for installing additional software on machinery can be ensured through structures in which data are only logged in the blockchain in a secure cloud environment after being encrypted rather than in the machine itself. Combining this with IoT approaches also means that scalability requirements can be reduced by storing most status and usage data in the cloud and only writing selected data to the blockchain as well.^[9]

BLOCKCHAIN SOLUTIONS CAN CREATE COMPETITIVE ADVANTAGES

Blockchain solutions offer significant added value in mechanical engineering where various partners want to log machine usage and status data in a tamper-proof way. For German SMEs, this creates opportunities particularly in the field of EaaS models. In a difficult and volatile market environment that fluctuates heavily depending on the current order situation, these models have the potential to provide a significant competitive advantage as they allow customers to have substantial flexibility with low capital commitment. The provider also is closer to the customer and knows their precise needs, which results in not insignificant amount of cross-selling and upselling potential. At the same time, using blockchain technologies requires an increased willingness to innovate and move beyond the status quo.

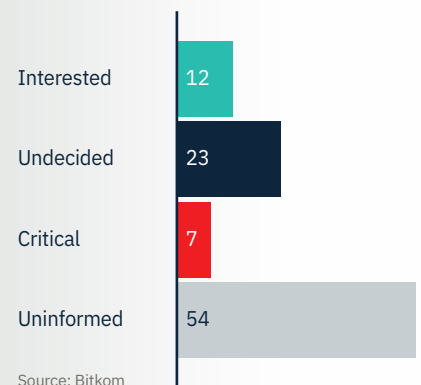
BLOCKCHAIN IN ENGINEERING

1 (LOW) – 5 (HIGH)



INDUSTRY ATTITUDE TO BLOCKCHAIN SOLUTIONS

(% OF SURVEYED COMPANIES)



FACTORS DRIVING THE INTRODUCTION OF BLOCKCHAIN IN ENGINEERING:

- Supporting new products and business models such as predictive maintenance and equipment-as-a-service
- Tamper-proof logging



The blockchain-based software from ZkSystems is designed to enable machinery and equipment manufacturers to offer leasing models for industrial equipment in addition to traditional sales models. Such pay-per-use and equipment-as-a-service business models are often costly and require machine usage to be reliably logged. ZkSystems' software solution uses blockchain technology to securely record usage data and make it available for billing purposes. The cloud infrastructure required here is provided by IT specialist Oracle, with SAP also being actively involved in work to further develop the platform.^[11]

SERVICE-BASED BUSINESS MODEL OFFERS CONSIDERABLE POTENTIAL

According to surveys conducted by the European Commission, machine builders adopting service-based business models see annual revenue growth of between five and ten percent and generate up to 50 percent of their revenue with leasing models.^[12] There is also potential to generate revenue from data-based services: by evaluating the data collected, engineering companies can offer their customers additional services such as predictive maintenance and performance-

related guarantees. Customers, on the other hand, benefit from optimised cash flows thanks to low investment costs, greater flexibility and reduced operational risks.^[13]

BLOCKCHAIN ENABLES SCALABLE EAAS MODEL

The high volume of data arising in connection with Industrial Internet of Things (IIoT) applications poses a major challenge when it comes to recording machine usage via blockchain. The innovative infrastructure created by the Berlin start-up can handle up to 5,000 transactions per second – enabling the software to be used extensively even in large machinery pools.^[14] The blockchain-based software made by ZkSystems is currently being tested by, among others, Fraunhofer Institute for Production Systems and Design Technology in the I4KMU research project funded by the Federal Ministry of Education and Research (BMBF). This test involves the recording of sensor data produced by a milling machine belonging to DMG Mori.^[15]

Blockchain-based EaaS models remain few and far between in real-life settings at present, largely because of the high barriers to entry posed by existing solutions. It is with

this in mind that ZkSystems aims to reach a point where integration with common IT systems for resource planning and automatic payment management is a seamless process, enabling users to record and bill machine usage effortlessly and thereby making it easier to penetrate the EaaS segment. For example, users of Oracle products are able to seamlessly integrate the solution into their existing systems.

THE LONG-TERM AIM IS AN ECONOMY OF THINGS

Looking ahead to the future, ZkSystems wants to provide technological solutions for machine-to-machine communication and create the conditions for complex IIoT concepts. In the longer term, the founding team expects machines to become independent users of EaaS models that are able, for instance, to negotiate conditions and book services. Again, ZkSystems sees this potential in blockchain technology – although developments have not progressed beyond the conceptual stage at present.^[16]

ZkSystems





Germany's energy system is becoming increasingly fragmented and complex as the decentralised generation of electricity gains traction. On top of this comes the fact that many residential and commercial customers are now meeting at least part of their electricity needs themselves, only falling back on the electricity grid to compensate for shortfalls or surpluses. This new environment is forcing producers and consumers to rethink their traditional relationship with each other, and also shifting the focus of market structures more towards decentralisation.^[1] According to the German Energy Agency (DENA), the transformation of the energy system will not be possible without decentralisation and digitalisation^[2] Blockchain solutions offer a way to map such market structures from a technical standpoint. Having a way of logging and storing data that is tamper-proof makes it possible, for instance, to monitor compliance with feed-in and withdrawal obligations, automate billing processes and enforce bans on the reselling of energy.^[1]

MANY BLOCKCHAIN PROJECTS ARE STILL IN THEIR INFANCY

Blockchain solutions are currently being considered in particular for regional applications such as peer-to-peer trading, EE certificates and collaborative energy storage systems, with trials being conducted by individual grid operators and public utility companies.^[1,3,4] There is also promising potential for eRoaming applications (charging e-vehicles irrespective of the provider), benefiting both large charging station providers and providers of e-mobility services.^[5]

Most of these applications are currently still at the conceptual or proof-of-concept stage. One of the few productive systems is the Open Charging Network of the Share&Charge Foundation and an application of Sonnen GmbH designed to commercialise the capacities of virtual storage power plants. These two systems presently use blockchain technology for just a small part of the overall solution, specifically for identity and access management (Share&Charge) and to track and bill storage transactions (Sonnen GmbH).

NUMEROUS BARRIERS BLOCKING THE PATH TO BROADER USE

Many blockchain projects face major challenges in the energy sector given the exacting demands of ensuring scalability and delivering real-time information. A lack of compatibility with numerous individual systems in place also often turns out to be a major barrier.

Many blockchain solutions use what are called "tokens" for billing transactions, although how they should be treated under the law has not yet been determined. Moreover, a strict regulatory framework and centralised energy systems make it difficult to take advantage of the added value offered by blockchain solutions. It is also difficult in many B2C cases to manage data protection requirements, in particular the data subject's right to erasure.

Furthermore many blockchain projects in the energy sector stall because there is a lack of technical expertise or very little strategic importance is attached to the projects. Benchmarks are also missing for how to design and structure governance frameworks under company law with a view to combining the unique features of blockchain solutions with the classic roles and regulatory responsibilities in the energy system.

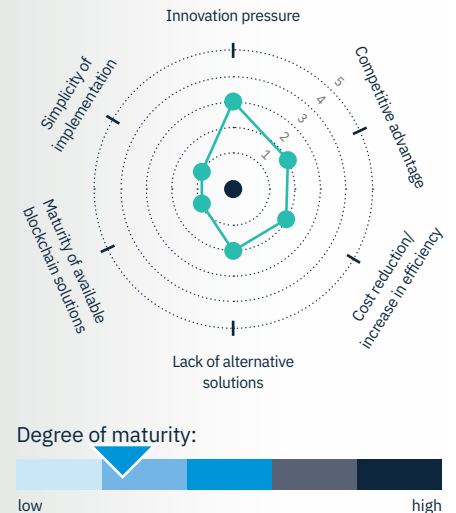
CREATING REQUIREMENTS IS A PRIORITY

Although the highly dynamic and ever-evolving energy sector appears on the face of it to be the perfect setting for trialling blockchain technology, it actually plays a rather minor role given the substantial barriers in the way of implementing such solutions. It is unlikely that even big players such as RWE and E.ON will feel an urgent need to innovate in the immediate future.

That being said, there are definitely application niches in which it may well make sense to use blockchain technology in certain constellations. There may also be potential to be found in combining such solutions with other digital technologies such as artificial intelligence and the Internet of Things (IoT). Developing knowledge and expertise here through innovative research and development projects with research institutions and other market participants can have a correspondingly positive effect on efforts to draw up common standards and governance frameworks as well as on overall competitiveness in the medium term.

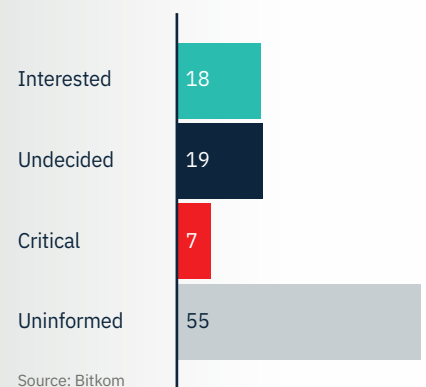
BLOCKCHAIN IN THE ENERGY INDUSTRY

1 (LOW) – 5 (HIGH)



ATTITUDE OF THE INDUSTRY TO BLOCKCHAIN SOLUTIONS

(% OF SURVEYED COMPANIES)



FACTORS DRIVING THE INTRODUCTION OF BLOCKCHAIN IN THE ENERGY SECTOR:

-  Decentralisation
-  Monitoring of feed-in and withdrawal obligations
-  Automated billing
-  Barriers are currently very high

CASE STUDY – OPEN CHARGING NETWORK (OCN)



The Open Charging Network (OCN) is a solution developed by the Share&Charge Foundation, in collaboration with major industry partners such as EDF, EVBox, Innogy, Wallbe and Volkswagen Financial Services, that contains blockchain elements. It enables e-vehicles of any make or belonging to any specific charging network to be charged. The OCN simplifies digital communication between charging point operators, e-mobility providers and other market participants,^[7] and it is currently being tested by a number of different energy companies.^[8]

POOR CHARGING INFRASTRUCTURE HINDERS THE SPREAD OF E-VEHICLES

The OCN focuses on one of the main challenges facing e-mobility: a fragmented charging infrastructure caused by the existence of many different charging point operators.^[9]

Current eRoaming providers such as Hubjet and ladenetz.de are working to address this issue of fragmentation by pursuing centralised platform approaches.^[10] However, these approaches only enable eRoaming in the respective platform ecosystem, not for e-charging stations to be used without restrictions and regardless of the provider analogous to conventional filling stations.^[9]

PROVIDERS AND USERS BENEFIT FROM OPEN EROAMING

The Open Charging Network is an open communication solution for charging point operators and providers of e-mobility services, being based on the widely used Open Charge Point Interface (OCPI 2.2).^[8] It uses a blockchain component to register

the systems of charging point operators and e-mobility service providers connected to the OCN and to enable the bilateral exchange of information and billing processes. The open approach taken by the OCN also allows charging point operators and e-mobility service providers who are not members of the same platform ecosystem to communicate with each other. Owners of electric vehicles in particular benefit from this platform-independent approach in that they have more charging points available to them and the eRoaming fees are lower. Yet the benefits to charging point operators and e-mobility services providers are also apparent, such as being able to enlarge their customer base and to share information in a simplified way.^[11]

THE OCN MUST FIRST SHOW WHAT IT CAN DO

While OCN is currently still at the testing phase, initial trial runs with e.g. ElaadNL, a partnership initiative of the Dutch network operators, have already had some success.^[8] The Share&Charge Foundation is also working hard to further develop the Open Charging Network. The aim is that, in the future, it should also be possible to use the OCN with systems that do not have an explicit OCPI 2.2 interface. The plan is also for additional interfaces to be created, such as for apps, and to enable token-based billing transactions.

PAYMENT MODEL:

The Open Charging Network is being developed by the Share&Charge Foundation under an open source licence and can be used free of charge.

WHAT IT OFFERS: THE 5CS OF THE OCN



CONNECTION

Simple connection



CONTRACTING

eRoaming contracts



CERTIFICATES

Green Charging



CHARTS

Smart Charge Analyse



CLEARING

Instant Payment & Settlement

OPEN CHARGING NETWORK



A number of blockchain solutions, such as Food Trust and TradeLens, are already enjoying considerable success in productive operation, helping improve efficiency and facilitating the secure exchange of documents and process data along the supply chain. There are also a growing number of promising solutions and potential applications in the automotive industry and mechanical engineering sector. Yet, despite all the well-founded optimism in blockchain technology, it must be seen in the broader context of digitalisation. After all, there are many other technologies for a range of different applications that are already successfully established on the market.

CAREFUL CONSIDERATION MUST BE GIVEN TO THE USE OF BLOCKCHAIN SOLUTIONS

What this means is that there is no one-answer-fits-all to the question of whether German SMEs should invest in developing blockchain solutions. The fact that there are often substantial challenges to face means that various factors must be evaluated on an industry and company-specific basis to mitigate the risk of making bad investments.

Blockchain solutions are well suited to use cases in which information is to be shared and kept for use across companies and where concerns about confidentiality and data sovereignty speak against conventional IT solutions or platform models. Yet implementing blockchain solutions requires novel technical expertise along with the readiness to rethink operating and ownership models together with IT service providers, competitors and customers.

SMEs SHOULD WAIT FOR THE RIGHT MOMENT

Many large companies are currently working on their own blockchain solutions and will in future pressure their (SME) partner companies to adopt these very solutions. Adapting too early carries the risk of individual systems that later fail to gain widespread acceptance becoming too deeply rooted in a company's organisational and technical structure. Conversely, arriving too late may result in there being virtually no way to make adjustments to the blockchain solution and that the company's own systems and processes then need to be converted at considerable expense and with a lot of work.

What this means is that SMEs should first determine the extent to which blockchain technology can help them in their efforts to digitalise. This is where the blockchain checklist comes in. If an initial evaluation clearly indicates that a blockchain solution makes sense, the next step worth taking is to develop expertise within the company, as collaborative ownership and development models in particular bring with them a whole host of legal and organisational challenges, such as the need to comply with GDPR requirements.

CHOOSING THE RIGHT PARTNER IS KEY

As expected, the majority of German SMEs will not have the necessary technical expertise from the outset to implement blockchain solutions by themselves, which means that external solutions should be considered to begin with. The technical conditions for ensuring that data can be exchanged in a safe and standardised way via a blockchain solution also need to be created. This can be a very expensive undertaking,

so choosing the right IT service provider is very important here. While blockchain start-ups are often attractive as they come with lower costs, established IT service providers usually have solutions that are better tailored to the needs of SMEs. Many large IT service providers in particular offer cloud-based models, known as "Blockchain as a Service (BaaS)" services. The advantages offered by these models are plain to see: while also being quick to implement, the associated investment risks can be mitigated thanks to the pay-per-use principle, which enables billing for services on the basis of actual use.

If having a blockchain solution seems to be strategically advantageous, SMEs should consider developing the relevant in-house IT expertise over the mid-to-long term with a view to reducing their reliance on external service providers and thereby creating the flexibility needed for future projects.

BLOCKCHAIN SOLUTIONS REQUIRE A WILLINGNESS TO INNOVATE

A core condition for using blockchain solutions to begin with is a general willingness to embrace digital innovation and disruption.

"As is typical of the German spirit, many family businesses remain focused on security, without losing sight of the opportunities. It's more about evolution than disruption. Yet these businesses need to take greater risks to become more agile and maybe even more radically innovative."

Mike Zöller, Andersch

This assessment suitably reflects the approach being taken by German SMEs, as a study conducted by WHU – Otto Beisheim School of Management in cooperation with Andersch shows.^[1] Security traditionally plays a greater role here than innovation, as family businesses dominate the German SME landscape. Yet German SMEs cannot ignore radical innovations forever, when considering the progress being made in digitalisation at many different levels around the world.

BLOCKCHAIN CHECKLIST



The following blockchain checklist is intended to help in the process to decide the extent to which blockchain technology may be suitable for the particular application in question. The more questions are answered with “yes”, the likelier it is that there is potential for blockchain to be used for this application in a company.

Functional questions		Applicable [yes/no]
1	Processes between companies and/or machines should be more transparent	
2	Selected documents and/or data need to be stored in a tamper-proof way	
3	It should be possible to launch selected subprocesses automatically	
4	Information should be shared between companies and/or machines in a way that is faster, securer and more efficient	
5	Being able to check factors quickly and easily is very important	
6	Each individual company and/or machine should retain data sovereignty and responsibility, with no (digital) central department being created.	
7	Compliance with statutory requirements should be securely tracked.	
Technical questions		Applicable [yes/no]
8	A shared data basis is needed	
9	Several companies and/or machines are authorised to read and write	
10	The amounts of data processed are relatively small and there are low real-time requirements	
11	Having a high degree of redundancy and being fail-safe are desired	
12	It should be possible to map company-specific features and variants	
13	Being able to operate and further develop the system together is desired	
14	Establishing a connection to existing systems is feasible with reasonable effort	



ABOUT THE AUTHORS



DOROTHÉE FRITSCH

Dorothee Fritsch is director of the Markets & Strategy division at FTI-Andersch.

She is an expert in market and competition analyses for restructuring reports, independent business reviews and plausibility reviews of plans. Her main areas of expertise include conducting analyses on strategic (re)alignment and safeguarding the ability of companies to remain competitive in the long term.

She has extensive industry experience, particularly in the automotive, mechanical engineering, consumer goods, retail, fashion, furniture, logistics, print, renewable energies and service sectors.

She also specialises in the topic of digitalisation (Internet of Things/IoT) and assesses the digital maturity of a company (digital readiness). She is the co-author of the Andersch digitalisation studies.

Before joining Andersch in 2012, she worked in the advisory department of one of the world's leading auditing firms for four years.



PROF. DR. GILBERT FRIDGEN

Prof. Dr Gilbert Fridgen is one of the leading experts in the field of blockchain.

As head of the Financial Services and Cross-Organizational Digital Transformations Research Group (FINATRAX), he analyses the transformative impact of digital technologies on organisations as well as on the relationship between organisations. His particular focus is on potentially disruptive technologies such as blockchain, artificial intelligence, the Internet of Things or quantum computing, with his research addressing digital business models, strategy and risk management in the area of IT transformation, IT and regulation, as well as the design of innovative digital solutions.

He frequently publishes in journals and conference proceedings in the fields of management, IT and engineering. He has also edited conference proceedings stemming from the most important German, European and international conferences of information systems, as well as being an active reviewer for various scientific journals.

From 2013 to 2019, he was appointed Associate Professor for Information Systems and Sustainable IT Management at the University of Bayreuth, Deputy Director of the Fraunhofer Project Group Business & Information Systems Engineering, and Deputy Director of the Research Center Finance & Information Management. It is in this role that he also founded the Fraunhofer Blockchain Lab.



ALEXANDER RIEGER

Alexander Rieger is a member of the FINATRAX Research Group at the SnT, the Interdisciplinary Centre for Security, Reliability and Trust at the University of Luxembourg.

He leads the scientific advisory team of the blockchain project of Germany's Federal Office for Migration and Refugees and acts as advisor to the European Blockchain Partnership and various public sector partners in Germany and Luxembourg.

Prior to joining the SnT, he was the operational head of the Fraunhofer Blockchain Lab. He has also worked in industry and consulting for several years.

His research interests cover innovative digital technologies such as blockchain and digital identities, specifically their strategic implications and application.

The following individuals were also involved in preparing the study: Tamara Roth und Richard Einhorn



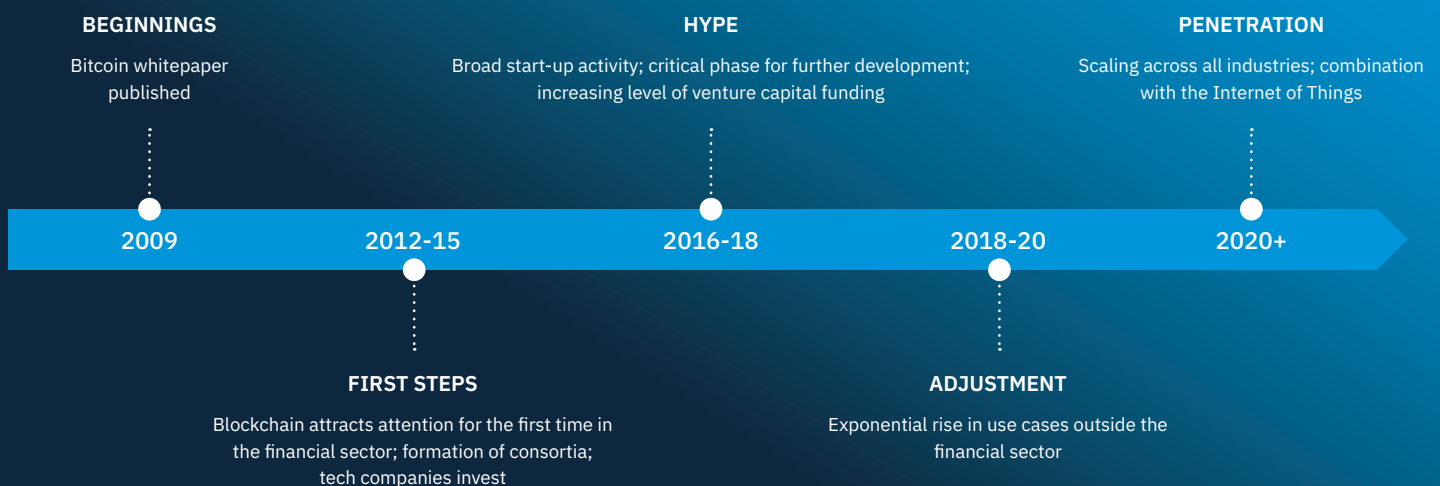
WHY USE BLOCKCHAIN?

- [1] Redaktionsnetzwerk Deutschland (2020). Digitalisierung der Wirtschaft: Mit der Blockchain gegen die Corona-Krise. <https://www.rnd.de/wirtschaft/digitalisierung-der-wirtschaft-mit-der-blockchain-gegen-die-corona-krise-LO-WI4QZPZWQWHFHPN2L4JD6LL4.html> (zuletzt aufgerufen am 24.04.2020).
- [2] Bitkom eV (2019). Blockchain in Deutschland – Einsatz, Potenziale, Herausforderungen. https://www.bitkom.org/sites/default/files/2019-06/190613_bitkom_studie_blockchain_2019_0.pdf (zuletzt aufgerufen am 24.04.2020).
- [3] Fridgen, G., Guggenberger N., Hoeren T., Prinz, W., & Urbach, N. (2018). Chancen und Herausforderungen von DLT (Blockchain) in Mobilität und Logistik. Fraunhofer-Institut für Angewandte Informationstechnik FIT. https://www.bmvi.de/SharedDocs/DE/Anlage/DG/blockchain-gutachten.pdf?__blob=publicationFile. (zuletzt aufgerufen am 31.03.2020).

OUTLOOK AND CHECKLIST

- [1] Wiedeler, C., Kammerlander, N., Zöller, M. (2019). Internes Corporate Venturing (ICV) in Familienunternehmen: Eine explorative Studie über die organische Erschließung neuer und digitaler Geschäftsfelder in deutschen Familienunternehmen. Vallendar: WHU, Institut für Familienunternehmen. Online verfügbar unter: <https://www.andersch-ag.de/de/knowledge-leadership#der-deutsche-mittelstand-innovativer-als-gedacht> (zuletzt aufgerufen am 21.06.2020).
- [2] Schlatt, V., Schweizer, A., Urbach, N., and Fridgen, G. (2016). Blockchain: Grundlagen, Anwendungen und Potenziale. Projektgruppe Wirtschaftsinformatik des Fraunhofer-Instituts für Angewandte Informationstechnik FIT. https://www.fit.fraunhofer.de/content/dam/fit/de/documents/Blockchain_WhitePaper_Grundlagen-Anwendungen-Potentiale.pdf (zuletzt aufgerufen am 24.04.2020).
- [3] Blockchain-Initiative Energie (2018). Entscheidungsbaum Blockchain: Anwendungsbeschreibung. <https://blockchain-initiative.de/uncategorized/entscheidungsbaum-blockchain-anwendungsbeschreibung/> (zuletzt aufgerufen am 24.04.2020).
- [4] Kemmere, T. (2018). Brauche ich eine Blockchain? <https://ov-software.de/brauche-ich-eine-blockchain/> (zuletzt aufgerufen am 24.04.2020).
- [5] Pedersen, A., Risius, M., & Beck, R. (2019). Blockchain Decision Path: When to Use Blockchains? Which blockchains do you mean? MIS Quarterly Executive, 18(2).

DEVELOPMENT OF BLOCKCHAIN TECHNOLOGY





General classification	Name	Field of application	Degree of maturity
	TradeLens	Container logistics	5
Specific classification	Challenges addressed	Drivers/beneficiaries	Added value
	<ul style="list-style-type: none"> Lack of technical industry standards 	<ul style="list-style-type: none"> Leaders: Large container logistics companies such as Maersk, MSC, CMA-CGM in cooperation with IT service provider IBM Followers: Medium-sized and smaller (logistics) companies (including Kerry Logistics, CN Rail, Southway Group and also banks and insurance companies), over 600 port/terminal operators and relevant (customs) authorities 	<ul style="list-style-type: none"> Transparency and traceability of goods shipments Paperless flow of information Supply chain efficiency Promoting cooperation across the logistics chain
Barriers to implementation and approaches	Key barrier(s) to implementation	Selected approaches	
	<ul style="list-style-type: none"> Lack of technical industry standards 	<ul style="list-style-type: none"> Large logistics companies create de facto industry standards (e.g. DCSA – Digital Container Shipping Association) and smaller companies follow 	

SOURCES

- [1] IGZ Ingenieurgesellschaft für logistische Informationssysteme mbH (2020). Blockchains in der Logistik. Potenziale und mögliche Use Cases. <https://www.igz.com/blog/blockchains-in-der-logistik/> (zuletzt aufgerufen am 31.03.2020).
- [2] Fridgen, G., Guggenberger, N., Hoeren, T., Prinz, W., & Urbach, N. (2018). Chancen und Herausforderungen von DLT (Blockchain) in Mobilität und Logistik. Fraunhofer-Institut für Angewandte Informationstechnik FIT. https://www.bmvi.de/SharedDocs/DE/Anlage/DG/blockchain-gutachten.pdf?__blob=publicationFile. (zuletzt aufgerufen am 31.03.2020).
- [3] Tijan, E., Aksentijevic, S., Ivanic, K., & Jardas, M. (2019). Blockchain Technology Implementation in Logistics. *Sustainability*, 11 (4), 1185-1198.
- [4] Ledger Insights (2019). COSCO, CMA CGM, Hapag-Lloyd join blockchain shipping network GSBN. <https://www.ledgerinsights.com/blockchain-global-shipping-business-network-gsbn-cargosmart-cosco-cma-cgm-hapagloyd/> (zuletzt aufgerufen am 15.04.2020).
- [5] Jensen, T, Hedman, J, & Henningsson, S. (2019). How TradeLens delivers business value with blockchain technology. *MIS Quarterly Executive*, 18(4), 221-243.
- [6] Vinturas (2020). Supply chain visibility and the access to digital documents. <https://www.vinturas.com/what-we-do/our-digital-platform> (zuletzt aufgerufen am 02.04.2020).
- [7] Brett, C. (2020). WEF launches self-service Blockchain track and trace platform. <https://www.enterprisetimes.co.uk/2020/02/07/wef-launches-self-service-blockchain-track-and-trace-platform/> (zuletzt aufgerufen am 08.04.2020).
- [8] Ubiquitous Marketplace System, Inc. (2017). Ubims. 3D supply chain process system. <http://www.ubims.com/> (zuletzt aufgerufen am 31.03.2020).
- [9] Bitkom eV (2019). Blockchain in Deutschland – Einsatz, Potenziale, Herausforderungen. https://www.bitkom.org/sites/default/files/2019-06/190613_bitkom_studie_blockchain_2019_0.pdf (zuletzt aufgerufen am 14.04.2020).
- [10] Jensen, T., Hedman, J., & Henningsson, S. (2019). How TradeLens delivers business value with blockchain technology. *MIS Quarterly Executive*, 18(4), 221-243.
- [11] TradeLens (2020). Smarter logistics with more reliable data. <https://www.tradelens.com/ecosystem/shippers-and-cargo-owners> (zuletzt aufgerufen am 08.04.2020).
- [12] TradeLens (2019). TradeLens-Blockchain in der Logistik. <https://transportrecht.org/wp-content/uploads/TradeLens-Blockchain.pdf> (zuletzt aufgerufen am 08.04.2020).
- [13] TradeLens (2019). TradeLens-Überblick. <https://www.ibm.com/downloads/cas/1ZVRWXPG> (zuletzt aufgerufen am 08.04.2020).
- [14] TradeLens (2020). TradeLens for BCOs. <https://tradelens-web-assets.s3.us.cloud-object-storage.appdomain.cloud/TradeLens-for-BCOs.pdf> (zuletzt aufgerufen am 08.04.2020).
- [15] Vaske, H. (2019). IBM erklärt seine Blockchain-Strategie. <https://www.computerwoche.de/a/ibm-erklaert-seine-blockchain-strategie,3547257,2> (zuletzt aufgerufen am 14.04.2020).
- [16] Kadia, P. (2019). The Success Story of TradeLens. <https://business-blockchainhq.com/business-blockchain-news/the-success-story-of-tradelens/> (zuletzt aufgerufen am 08.04.2020).
- [17] IBM Service Description (2018). TradeLens. [https://www-03.ibm.com/software/sla/slabd.nsf/8bd55c6b9fa8039c86256c6800578854/10f530929ce9e9c386258307004818e5/\\$FILE/i126-8178-01_09-2018_en_US.pdf](https://www-03.ibm.com/software/sla/slabd.nsf/8bd55c6b9fa8039c86256c6800578854/10f530929ce9e9c386258307004818e5/$FILE/i126-8178-01_09-2018_en_US.pdf) (zuletzt aufgerufen am 14.04.2020).



General classification	Name	Field of application	Degree of maturity
	IBM Food Trust	Food supply chains	5
Specific classification	Challenges addressed	Drivers/beneficiaries	Added value
	<ul style="list-style-type: none"> Regulatory and organisational complexity along food supply chains 	<ul style="list-style-type: none"> Leaders: Various large retailers (Walmart, Unilever, Nestlé) in cooperation with the IT service provider IBM Followers: Retailers including large ones such as Albertson, Avril Group (currently more than 200 companies around the world) 	<ul style="list-style-type: none"> Food transparency and traceability in respect of origin, safety and authenticity Improving supply chain efficiency
Barriers to implementation and approaches	Barrier to implementation	Selected approaches	
	<ul style="list-style-type: none"> Provisioning and operating costs along the supply chain Veracity of data entered 	<ul style="list-style-type: none"> SaaS model with costs scaled by company size/scope of services; free for suppliers to use Creating incentives through tamper-proof storage 	

QUELLENANGABEN

- [1] SpecPage (2020). Die Bedeutung von Transparenz bei Produktinformationen für Konsumenten. <https://www.specpage.com/de/transparenz-produktinformationen/> (zuletzt aufgerufen am 14.04.2020).
- [2] Marketing-Börse (2020). Mehr Transparenz bei Lebensmitteln durch Digitalisierung. <https://www.marketing-boerse.de/news/details/1913-mehr-transparenz-bei-lebensmitteln-durch-digitalisierung/155345> (zuletzt aufgerufen am 14.04.2020).
- [3] Sachdev, D. (2019). Enabling data democracy in supply chain using blockchain and IoT. *Journal of Management*, 6(1), 66-83.
- [4] IBM Food Trust. (2018). Focus on supply chain efficiencies. <https://www.ibm.com/downloads/cas/LR8VR8YV> (zuletzt aufgerufen am 31.03.2020).
- [5] The Linux Foundation (2020). How Walmart brought unprecedented transparency to the food supply chain with Hyperledger Fabric. <https://www.hyperledger.org/resources/publications/walmart-case-study> (zuletzt aufgerufen am 31.03.2020).
- [6] Wolfson, R. (2020). IBM and Fair Trade Initiative Demo Blockchain-Based Coffee Tracking App. <https://cointelegraph.com/news/ibm-and-fair-trade-initiative-demo-blockchain-based-coffee-tracking-app> (zuletzt aufgerufen am 14.04.2020).
- [7] DHL Customer Solutions & Innovation (2018). Blockchain in Logistics. Perspectives on the upcoming impact of blockchain technology and use cases for the logistics industry. <https://www.dhl.com/content/dam/dhl/global/core/documents/pdf/glo-core-blockchain-trend-report.pdf> (zuletzt aufgerufen am 31.03.2020).
- [8] Mattke, J., Hund, A., Maier, C., & Weitzel, T. (2019). How an enterprise blockchain application in the U.S. pharmaceuticals supply chain is saving lives. *MIS Quarterly Executive*, 18(4), 246-261.
- [9] Montecchi, M., Plangger, K., & Etter, M. (2019). It's real, trust me! Establishing supply chain provenance using blockchain. *Business Horizons*, 62(3), 283-293.
- [10] Morris, N. (2019). Uploading data to IBM's Food Trust blockchain is free. <https://www.ledgerinsights.com/ibm-food-trust-blockchain-cost-food-traceability/> (zuletzt aufgerufen am 04.04.2020).
- [11] IBM Food Trust (2018). Onboarding-Übersicht. <https://www.ibm.com/downloads/cas/R9DGQEKY> (zuletzt aufgerufen am 04.04.2020).
- [12] IBM Food Trust. (2018). Focus on supply chain efficiencies. <https://www.ibm.com/downloads/cas/LR8VR8YV> (zuletzt aufgerufen am 06.04.2020).
- [13] IBM Food Trust (2018). Focus on brand trust. <https://www.ibm.com/downloads/cas/JDKYEK5> (zuletzt aufgerufen am 04.04.2020).
- [14] IBM Food Trust (2018). Focus on food safety. <https://www.ibm.com/downloads/cas/ZN9EWKRQ> (zuletzt aufgerufen am 06.04.2020).
- [15] Loosbroek, -van S. (2019). 10 Blockchain projects in the Agri & Food industry that you should keep an eye on. <https://www.cegeka.com/en/be/blog/10-blockchain-projects-in-the-agri-food-industry-that-you-should-keep-an-eye-on> (zuletzt aufgerufen am 06.04.2020).
- [16] IBM News Room (2018). IBM Food Trust expands Blockchain network to foster a safer, more transparent and efficient global food system. <https://newsroom.ibm.com/2018-10-08-IBM-Food-Trust-Expands-Blockchain-Network-to-Foster-a-Safer-More-Transparent-and-Efficient-Global-Food-System-1> (zuletzt aufgerufen am 06.04.2020).
- [17] IBM Blockchain (2018). Transforming the Global Food System with IBM Food Trust. <https://de.slideshare.net/ShekharJyotiDas/ibm-food-trust-135209293> (zuletzt aufgerufen am 14.04.2020).



General classification	Name	Field of application	Degree of maturity
	Car Wallet	Mobility Services	3
Specific classification	Challenges addressed	Drivers/beneficiaries	Added value
	<ul style="list-style-type: none"> Insecure communication with on-board vehicle systems 	<ul style="list-style-type: none"> Leaders: Daimler together with the startups Riddle&Code, evan.network, Helix ID 51nodes and Spherity 	<ul style="list-style-type: none"> Sharing vehicle data between different systems in a secure and authenticated way to improve aspects such as user-friendliness and efficiency
Barriers to implementation and approaches	Barrier to implementation	Selected approaches	
	<ul style="list-style-type: none"> Lengthy development cycles, security of existing vehicle interfaces 	<ul style="list-style-type: none"> Easy-to-add retrofitting option 	

QUELLENANGABEN

- [1] Rogaischus, A. IBM THINK Blog DACH. Blockchain in der Automobilindustrie. <https://www.ibm.com/de-de/blogs/think/2017/07/11/blockchain-automobilindustrie/> (zuletzt aufgerufen am 31.03.2020).
- [2] Fridgen, G., Guggenberger N., Hoeren T., Prinz, W., & Urbach, N. (2018). Chancen und Herausforderungen von DLT (Blockchain) in Mobilität und Logistik. Fraunhofer-Institut für Angewandte Informationstechnik FIT. https://www.bmvi.de/SharedDocs/DE/Anlage/DG/blockchain-gutachten.pdf?__blob=publicationFile. (zuletzt aufgerufen am 31.03.2020).
- [3] BMW AG (2020). Wie die Blockchain Autofahrern helfen kann. <https://www.bmw.com/de/innovation/blockchain-automobilindustrie.html> (zuletzt aufgerufen am 31.03.2020).
- [4] Daimler Mobility AG (2020). Blockchain-Pilotprojekt macht CO2-Emissionen transparent. <https://www.daimler.com/nachhaltigkeit/ressourcen/blockchain-pilotprojekt-lieferkette.html> (zuletzt aufgerufen am 31.03.2020).
- [5] Daimler Mobility AG (2020). Partnerschaft auf Augenhöhe Die Mobility Blockchain Plattform. <https://www.daimler-mobility.com/de/unternehmen/news/projekt-blockchain-mobility-platform/> (zuletzt aufgerufen am 31.03.2020).
- [6] Ayres, G. IBM Blockchain Blog (2020). Is standardization the missing link in automotive blockchain? <https://www.ibm.com/blogs/blockchain/2019/07/is-standardization-the-missing-link-in-automotive-blockchain/> (zuletzt aufgerufen am 31.03.2020).
- [7] Schiller, K. (2019). MOBI | Blockchain-Initiative führender Automobilunternehmen. <https://blockchainwelt.de/mobi-mobility-open-blockchain-initiative-fuehrender-automobilunternehmen/> (zuletzt aufgerufen am 22.04.2020).
- [8] Simon Kucher & Partners (2018). Blockchain in der Automobilindustrie: Marktpotenzial von über 100 Mrd. Euro im Jahr 2030. <https://www.simonkucher.com/de/about/media-center/blockchain-der-automobilindustrie-marktpotenzial-von-ueber-100-mrd-euro-im-jahr-2030> (zuletzt aufgerufen am 22.04.2020).
- [9] Bitkom eV (2019). Blockchain in Deutschland – Einsatz, Potenziale, Herausforderungen. https://www.bitkom.org/sites/default/files/2019-06/190613_bitkom_studie_blockchain_2019_0.pdf (zuletzt aufgerufen am 14.04.2020).
- [10] Riddle & Code (2019). Riddle & Code führt gemeinsam mit Daimler Mobility und den anderen beteiligten Unternehmen die Hardware Car Wallet im Rahmen der Mobility Blockchain Plattform ein. https://static1.squarespace.com/static/58f7bc39bebaf94498d25bf/t/5d3579a87a6681000106b255/1563785644583/CarWallet_RIDDLE%26CODE_PR_Deutsch.pdf (zuletzt aufgerufen am 16.04.2020).
- [11] Interview mit Riddle&Code (2020)
- [12] Riddle&Code (2020). Car Wallet Solution. <https://www.riddleandcode.com/use-case-n16> (zuletzt aufgerufen am 16.04.2020).
- [13] Ledger Insights (2020). Daimler develops blockchain car wallet. <https://www.ledgerinsights.com/daimler-develops-blockchain-car-wallet/> (zuletzt aufgerufen am 16.04.2020).
- [14] Wallstreet Online (2019). Riddle&Code führt gemeinsam mit Daimler Hardware Car Wallet ein. <https://www.wallstreet-online.de/nachricht/11618635-riddle-code-fuehrt-gemeinsam-daimler-hardware-wallet> (zuletzt aufgerufen am 16.04.2020).
- [15] Haslwanter, C. (2019). Hardware-Based Blockchain Car Wallets To Enable Future Mobility Solutions. <https://medium.com/riddle-code/hardware-based-blockchain-car-wallets-to-enable-future-mobility-solutions-11532964c6d6> (zuletzt aufgerufen am 27.04.2020).
- [16] Kuhn, D. (2019). Daimler to Produce Crypto Hard Wallet for Automotive Industry. <https://www.coindesk.com/daimler-partners-with-riddle-code-to-produce-automotive-hard-wallet> (zuletzt aufgerufen am 17.04.2020).



General classification	Name	Field of application	Degree of maturity
	ZKSystems	Equipment-as-a-Service	2
Specific classification	Challenges addressed	Drivers/beneficiaries	Added value
	<ul style="list-style-type: none"> Issue with trust when leasing machinery 	<ul style="list-style-type: none"> IT providers: Oracle, SAP Customers: engineering companies (e.g. Bosch and Siemens) and users (industrial companies) 	<ul style="list-style-type: none"> Seamless integration into existing systems Actual machine use recorded in a reliable, validated and resource-saving way
Barriers to implementation and approaches	Barrier to implementation	Selected approaches	
	<ul style="list-style-type: none"> Establishing interfaces with models existing 	<ul style="list-style-type: none"> Scalable platform business model 	

QUELLENANGABEN

- [1] Andersch AG (2015). Paradigmenwechsel im deutschen Maschinen- und Anlagenbau. http://maschinenbau.andersch-ag.de/downloads/Studie_Andersch.pdf (zuletzt aufgerufen am 21.06.2020).
- [2] Bley, S. (2018). Industrie 4.0 & IoT im Maschinen- und Anlagenbau. Kritische Erfolgsfaktoren. https://www.vdma.org/documents/106096/26011063/EY_Industrie%204.0_Event%20Maschinenfabrik%20Reinhausen%20042018_1523354298992.pdf/598697b8-a0eb-cb92-fca4-697b956766c4 (zuletzt aufgerufen am 04.06.2020).
- [3] Robert Bosch Manufacturing Solutions GmbH (2020). Nexeed Industrial Application System. Predictive Maintenance für maximale Maschinenverfügbarkeit. https://www.bosch-connected-industry.com/connected-manufacturing/maschinenbetreiber/production-performance/predictive-maintenance/?gclid=CjwKCAjwg6b0BRBMEiwAnd1_SE2xXG-KvmlisDTAhQxrX1CrW08uJnuEdMT6HHDjyrpZ-dtHnicEAsxoCczwQAvD_BwE (zuletzt aufgerufen am 04.04.2020).
- [4] ZKSystems (2020). Equipment-as-a-Service für führende Maschinenbauer. <https://zksystems.io/> (zuletzt aufgerufen am 04.04.2020).
- [5] Sandner, P. (2018). Mit Blockchain auf dem Weg zur Smart Maintenance. <https://medium.com/@philippsandner/mit-blockchain-auf-dem-weg-zur-smart-maintenance-3e53625b4244> (zuletzt aufgerufen am 04.04.2020).
- [6] Robert Bosch Manufacturing Solutions GmbH (2020). Economy of Things – neue Technologie, neues Geschäft. <https://www.bosch.com/de/forschung/know-how/erfolgsgeschichten/economy-of-things-neue-technologie-neues-geschaeft/> (zuletzt aufgerufen am 04.04.2020).
- [7] Vogel Communications Group (2020). Den echten Verbrauch einer Leihmaschine mittels Blockchain erfassen. <https://www.industry-of-things.de/amp/den-echten-verbrauch-einer-leihmaschine-mittels-blockchain-erfassen-a-884045/> (zuletzt aufgerufen am 04.04.2020).
- [8] ZF Car eWallet GmbH (2020). Say hello to the first automotive Blockchain. <https://car-ewallet.de/> (zuletzt aufgerufen am 04.04.2020).
- [9] Fridgen, G., Guggenberger N., Hoeren T., Prinz, W., & Urbach, N. (2018). Chancen und Herausforderungen von DLT (Blockchain) in Mobilität und Logistik. Fraunhofer-Institut für Angewandte Informationstechnik FIT. https://www.bmvi.de/SharedDocs/DE/Anlage/DG/blockchain-gutachten.pdf?__blob=publicationFile. (zuletzt aufgerufen am 20.04.2020).
- [10] Bitkom eV (2019). Blockchain in Deutschland – Einsatz, Potenziale, Herausforderungen. https://www.bitkom.org/sites/default/files/2019-06/190613_bitkom_studie_blockchain_2019_0.pdf (zuletzt aufgerufen am 14.04.2020).
- [11] ZKSystems (2020). Kunden und Partner. <http://zksystems.io/> (zuletzt aufgerufen am 23.06.2020).
- [12] Bednar-Brandt, M. (2019). Den echten Verbrauch einer Leihmaschine erfassen. <https://www.maschinenmarkt.vogel.de/den-echten-verbrauch-einer-leihmaschine-erfassen-a-879781/> (zuletzt aufgerufen am 23.06.2020).
- [13] L. Probs, L. Frideres und B. Cambier (2016). „Servitisation pay-per-use“. Business Innovation Observatory, European Commission. <https://ec.europa.eu/docsroom/documents/16594/attachments/1/translations/en/renditions/native> (zuletzt aufgerufen am 23.06.2020).
- [14] Romanenko, P. (2019). Industrial Machines that Can Be Offered through an Equipment-as-a-Service Model. <https://medium.com/zksystems/industrial-machines-that-can-be-offered-through-an-equipment-as-a-service-model-bc90740b7333> (zuletzt aufgerufen am 23.06.2020).
- [15] Deutsche Welle (2019). Vernetzung: Startups und Maschinenbauer. <https://www.dw.com/de/vernetzung-startups-und-maschinenbauer/av-50275472> (zuletzt aufgerufen 23.06.2020).



General classification	Name	Field of application	Degree of maturity
	Open Charging Network (OCN)	eRoaming	3
Specific classification	Challenges addressed	Drivers/beneficiaries	Added value
	<ul style="list-style-type: none"> Fragmentation of the current charging infrastructure 	<ul style="list-style-type: none"> Leaders: Share&Charge Foundation Followers: Energy providers such as ElaadNL und Innogy, charging point operators and e-vehicle manufacturers 	<ul style="list-style-type: none"> eRoaming for any provider and platform
Barriers to implementation and approaches	Barrier to implementation	Selected approaches	
	<ul style="list-style-type: none"> Fierce competition from established eRoaming platform operators 	<ul style="list-style-type: none"> Open solution architecture and open source approach 	

QUELLENANGABEN

- [1] VDI/VDE Innovation + Technik GmbH (2020). Dezentrale Systeme für lokalen Energiehandel und Stromspeicherbewirtschaftung in der Community. https://www.digitale-technologien.de/DT/Redaktion/DE/Downloads/Publikation/SSW_Energiewende_getrieben_durch_Blockchain.pdf?__blob=publicationFile&v=15 (zuletzt aufgerufen am 28.03.2020).
- [2] Dena Multi-Stakeholder-Studie (2019). Blockchain in der integrierten Energiewende. https://www.dena.de/fileadmin/dena/Publikationen/PDFs/2019/dena-Studie_Blockchain_Integrierte_Energiewende_DE4.pdf (zuletzt aufgerufen am 03.06.2020).
- [3] Sonnen GmbH (2020). Speichern statt abregeln - Virtuelles Kraftwerk von sonnen sichert sauberen Windstrom, der sonst verloren wäre. <https://sonnen.de/presse/virtuelles-kraftwerk-von-sonnen-sichert-sauberen-windstrom/> (zuletzt aufgerufen am 28.03.2020).
- [4] Fridgen, G., Guggenberger N., Hoeren T., Prinz, W., & Urbach, N. (2018). Chancen und Herausforderungen von DLT (Blockchain) in Mobilität und Logistik. Fraunhofer-Institut für Angewandte Informationstechnik FIT. https://www.bmvi.de/SharedDocs/DE/Anlage/DG/blockchain-gutachten.pdf?__blob=publicationFile. (zuletzt aufgerufen am 20.04.2020).
- [5] Share&Charge (2020). Open Charging Network. <https://shareandcharge.atlassian.net/wiki/spaces/OCN/overview?homepageId=265257095> (zuletzt aufgerufen am 28.03.2020).
- [6] Bitkom eV (2019). Blockchain in Deutschland – Einsatz, Potentiale, Herausforderungen. https://www.bitkom.org/sites/default/files/2019-06/190613_bitkom_studie_blockchain_2019_0.pdf (zuletzt aufgerufen am 14.04.2020).
- [7] Schaal, S. (2020). Share&Charge kündigt Open Charging Network an. <https://www.electrive.net/2020/03/03/sharecharge-kuendigt-open-charging-network-an/> (zuletzt aufgerufen am 17.04.2020).
- [8] OCPI (2020). Connecting made easier with new Open Charging Network (OCN) <https://ocpi-protocol.org/connecting-made-easier-with-new-open-charging-network-ocn/> (zuletzt aufgerufen am 27.04.2020).
- [9] Fridgen, G., Guggenberger N., Hoeren T., Prinz, W., & Urbach, N. (2018). Chancen und Herausforderungen von DLT (Blockchain) in Mobilität und Logistik. Fraunhofer-Institut für Angewandte Informationstechnik FIT. https://www.bmvi.de/SharedDocs/DE/Anlage/DG/blockchain-gutachten.pdf?__blob=publicationFile. (zuletzt aufgerufen am 17.04.2020).
- [10] Autohaus.de (2019). Ladenetz: Charge4Europe und Hubeject schließen Kooperation <https://www.autohaus.de/nachrichten/ladenetz-charge4europe-und-hubeject-schliessen-kooperation-2447435.html> (zuletzt aufgerufen am 20.04.2020).
- [11] Share&Charge (2019). Tokens Module. https://github.com/ocpi/ocpi/blob/master/mod_tokens.asciidoc (zuletzt aufgerufen am 18.04.2020).



DOROTHÉE FRITSCH

Direktorin

fritsch@andersch-ag.de

+49 160 90658014



Frankfurt am Main • Düsseldorf • Hamburg • Berlin

ABOUT FTI-ANDERSCH:

FTI-Andersch is the leading restructuring consulting firm in the German-speaking region.

FTI-Andersch supports its clients with the development and implementation of viable future/performance and restructuring concepts. FTI-Andersch is consulted when companies face operating or financial challenges – or far earlier, to align business model, organisational structure and processes with future developments. One of the key focus areas is developing independent expert reports as a basis for decisions regarding planned refinancing.

The client base comprises SMEs as well as corporations with international activities. FTI-Andersch is part of the global FTI Consulting Group (NYSE: FCN) with more than 5,500 employees.

www.andersch-ag.de