

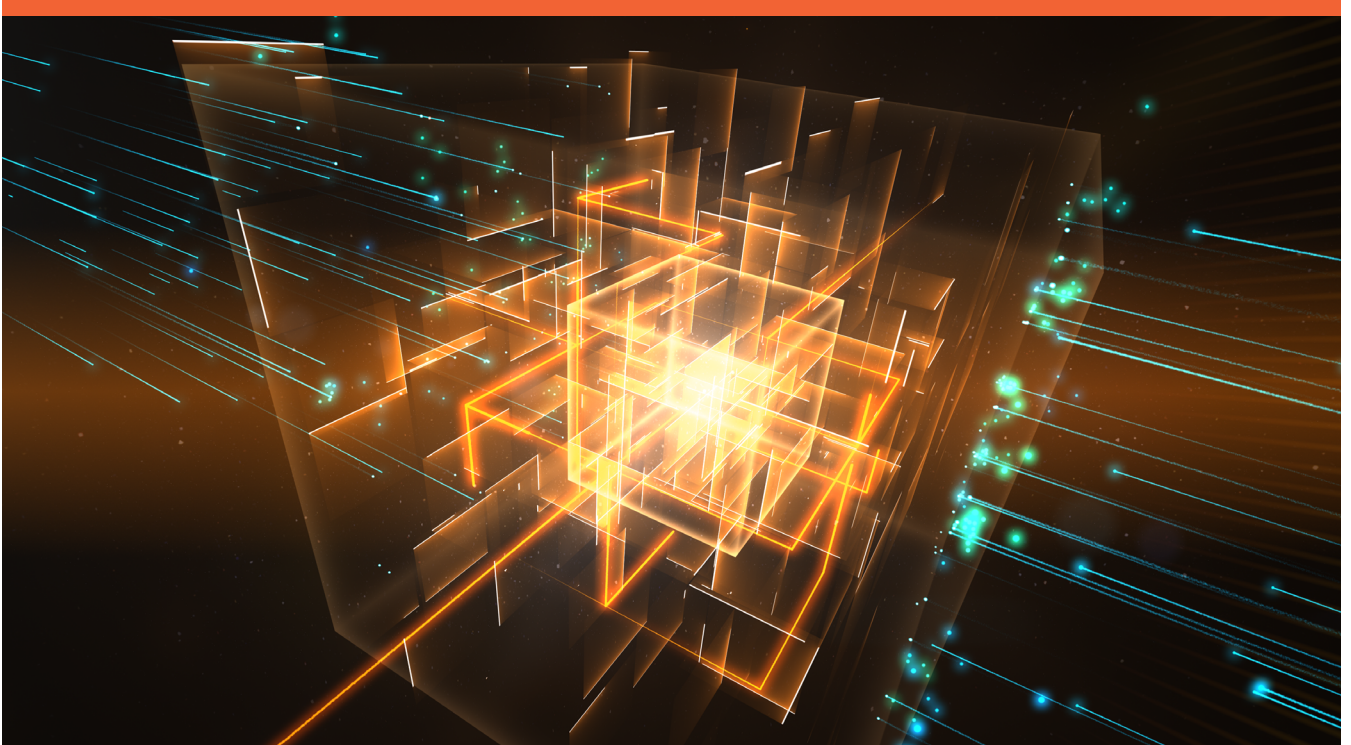


The Global Language of Business

GS1 Innovation

Putting blockchain to the test

Key findings from Germany's largest cross-company pilot project



Pallet exchange using blockchain. The project.

Around 35 companies from retail, industry, logistics, IT and science, together with start-ups and associations, came together in 2018 under the umbrella of GS1 Germany to put blockchain technology to the test - using real data, real employees and real supply chains. The pilot project focused on the pallet exchange process between retail, logistics and industry. There was one common goal: to find out more about blockchain and share knowledge.

Project objectives:

- To test blockchain technology based on the example of the pallet exchange process, using a standardised pallet note
- To digitalise the pallet note with the help of blockchain
- To establish a network of business partners to serve as an example of how pallet exchange can work
- To carry out a realistic practical test
- To confirm the necessary technical requirements
- To consider the qualitative benefits of the blockchain-based solution
- To gain insights and share knowledge

Duration of project:

- January to December 2018

Project design:

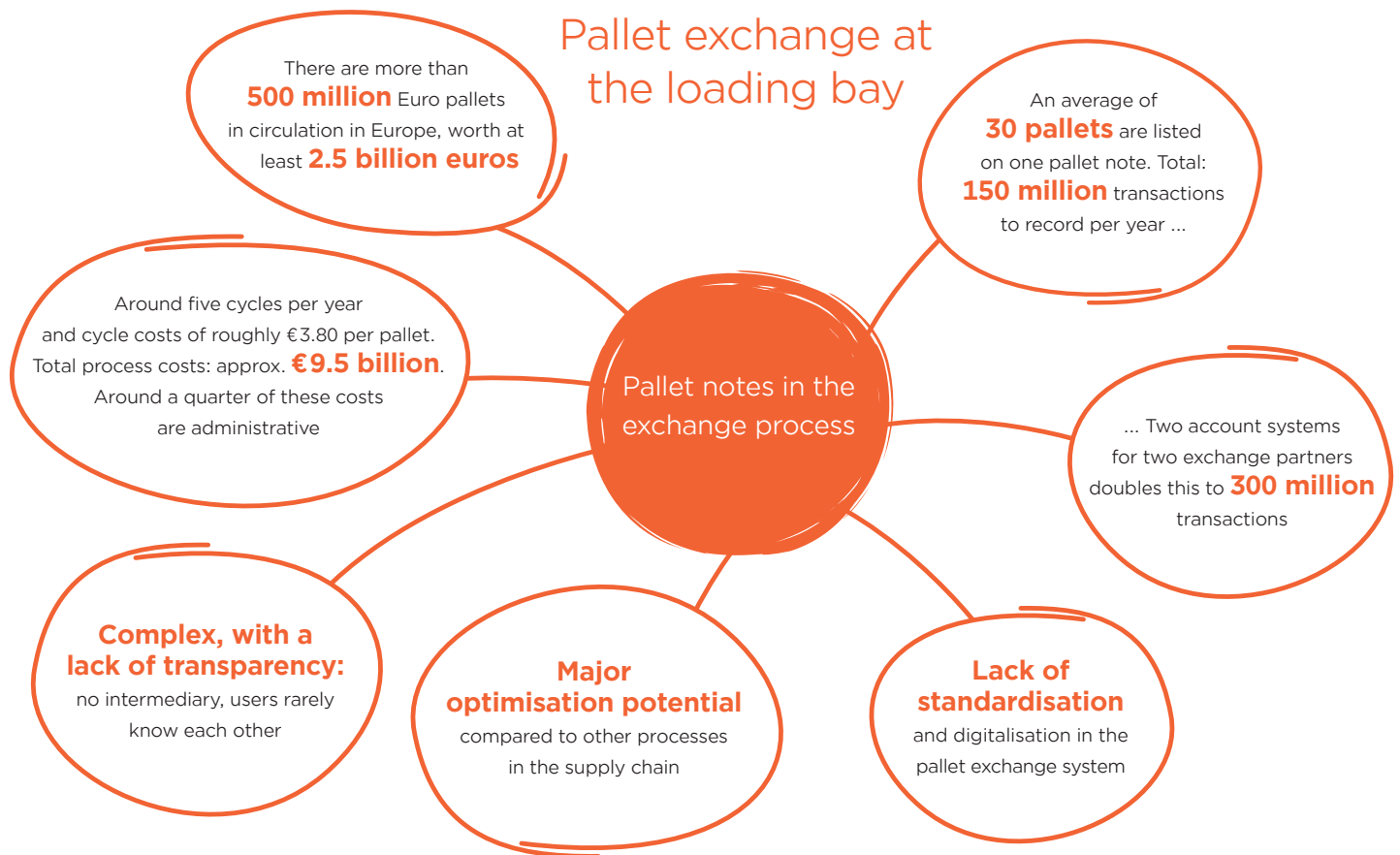
- Unbiased, goal-oriented, transparent, agile and iterative

Project phases:

- Use case development: definition of the Euro-pallet exchange process
- System architecture: concept definition of the technology design
- Governance: definition of rules for both the project and the future consortium
- Trial run: development of a simulation environment and prototype
- Field test: implementation of the pallet exchange process using blockchain - within a real supply chain environment (retailers, logistics, pooling service providers, industry)
- Evaluation: consolidation of findings and definition of recommended approaches for companies

Project participants





Why do we focus on the pallet note?

The open pallet exchange system is a heavily discussed topic today among retailers, logistic companies and industrial players. This system is renowned for its non-digital nature. Virtually the whole system is paper-based – characterised by forms to be filled out by hand and manual operations – which leads to inefficiencies and high costs. These are perfect conditions for putting blockchain to the test. A lack of transparency is also prevalent. The pilot project concentrated on a specific variation on the existing load carrier exchange – in other words, a system that involves parties who rarely know one another and where there are no standardised rules, rights or obligations. And there is no intermediary, who monitors the exchange process.

The project team wanted to find out: can blockchain put an end to the paper pushing?



Findings and insights at a glance.

Besides putting blockchain thoroughly through its paces, there was one specific issue that participants wanted to focus on. Can blockchain put an end to the paper-based pallet exchange process? The answer is yes, albeit under certain conditions.

✓ The blockchain-based pallet exchange process successfully implemented

The project demonstrated that the blockchain-based solution is able to provide a digital copy of the pallet note. Today's open pallet exchange process can also be mapped using blockchain.

✓ Prototype introduced

The development and adoption of the prototype by project participants went well, thanks to the consistently user-centric, agile approach. Users confirmed good operational functionality at the front end, as well as user-friendliness, comprehensibility and clarity.



Lesson learned: According to project participants, additional functionalities would be a good idea. For example, the possibility to save preferred exchange partners, attach photos, integrate other load carriers and use the app with different web browsers. These ideas confirm that the application responds to an actual need.

✓ Realistic test conditions established

Together, project participants conducted the largest, practical, cross-company blockchain test in Germany:

- Establishment of a decentralised network comprising 13 external nodes belonging to different project participants
- 17 participants in the practical test, with a total of 20 different warehouse locations
- Real supply-chain relationships
- Test carried out using real goods, real pallets, real employees, real loading bays, real lorries and real data

✓ The practical test was a success

Participants not only tested blockchain in actual day-to-day operations, but also tested the overall capacity of the solution:

- Practical test: implementation and mapping of almost 600 real exchange transactions among 17 partners over the course of two weeks
- Stress test: 3,600 exchange transactions carried out per hour (approx. 90,000 exchange transactions per day)
- Necessary hard disk space is manageable: approx. 10 MB for every 1,000 exchange transactions (- with 3,600 transactions per hour: 200 GB per year)

One prototype – three components:

1. A mobile application for people who exchange pallets at the loading bay. In other words, warehouse employees, factory workers and lorry drivers.

2. A pallet portal for employees involved in processing forms. This lists all their company's transactions, as well as providing an overview of the current pallet balance.

3. Blockchain based on MultiChain technology for IT managers: the gathering and storage of all data regarding transactions and amendments.

For further information about this topic, please see www.gs1.de/blockchain-blog

- Some participants experienced teething problems when they started using the app
- No major technical problems encountered in operations
- Smaller problems (typical of prototypes); reliability needs to be improved for future implementation
- Most problems were infrastructure-related, e.g. poor network connection



Lesson learned: The growing volume of data. The longer a system is in operation and the more participants involved, the higher the number of transactions and, consequently, the greater the volume of data. This means that storage capacity needs to expand at the same rate - and indefinitely! Solutions for archiving old data need to be considered.

Lesson learned: Increase performance and speed. Saving transaction data took a little too long.

✓ Qualitative benefits confirmed

The test revealed that a blockchain-based solution can work across different sectors. Most participants would like to continue using the mobile app:

- Improved efficiency in back office (simplified reconciliation of accounts, automatic balance calculation)
- Simplification of loading bay operations and everyday tasks
- Many supply chain partnerships improved and became stronger as a result of close collaboration - blockchain served as a catalyst for cooperation

✓ Insights gained and knowledge transfer guaranteed

Participating companies increased knowledge across all levels. They learnt about blockchain, their company's internal processes, their supply chain partners, the open pallet exchange system and new collaboration models.

Knowledge transfer within the user community is ensured with the project blog (www.gs1.de/blockchain-blog), numerous appearances at specialist conferences and published articles.

All the paper work has been digitalised. So, what happens next?

Specific conditions are required if blockchain is to be exploited to its full potential in the open pallet exchange system.

Besides enabling the digitalisation of pallet notes, blockchain establishes - under certain conditions (see p. 6 to 9) - a good basis for generating high added value and genuine synergetic effects for the open pallet exchange system. These include the circular swap, the prevention of empty runs and a minute-by-minute settlement of balances. In this particular project, blockchain created a framework that enabled the exchange of data between partners - providing clear added value already! However, the true potential of blockchain can only be exploited in combination with other technologies, such as the mobile solution used in the pilot project. Participants concluded that a pallet exchange can still work from a technical point of view without blockchain. However, distributed ledger technology (a generic term describing geographically dispersed databases such as blockchain) helps to break down reservations on a politico-organisational level (in terms of decentralised data, data ownership).

For further information about this topic, please see www.gs1.de/blockchain-blog.





The most important tips for your own blockchain projects

Blockchain is a hot topic being discussed across different sectors. However, distributed ledger technology is rarely tested on an inter-company level and still raises many questions.

At the end of the day, blockchain means much more than just implementing the technology. Blockchain also calls for a paradigm shift.

01 First the use case, then the technology

Before launching your own pilot blockchain project, it is vital to ascertain whether this database technology really makes sense for the use case in question. Although blockchain is not an end in itself, the technology can act as an enabler for optimising business processes. It's a good idea to ask a few questions. What added value can blockchain bring? Why should this solution be used, instead of any other? Processes and procedures always need to be defined and described in advance.

02 Blockchain is not plug and play

Every blockchain is unique and contains different features. Firstly, a suitable solution needs to be designed for every specific use case, before being implemented on a technical level. Processes and procedures always need to be defined beforehand. It is essential to agree on a common denominator and adapt the different processes and terminology accordingly. Furthermore, user-centric development is often associated with high costs. Developers need to listen to the future users, identify their needs and find a common 'language' between use case and technology. This groundwork is critical for developing a suitable solution that delivers the desired benefits.



"Our project sees us working together on tomorrow's economic structure: transparent and decentralised."

***Guntram Sauermann,
member of the board,
Gärtnerei Ulenburg eG***

03 IT doesn't need to be the cost driver

Even non-IT people can manage to install a MultiChain node within a day. The monthly costs for hosting it in a cloud are reasonable: over the course of the project, GS1 Germany ran a node on Amazon Web Services for roughly € 100 per month. The cost of fully managed hosting using the SAP Cloud Platform is around €450 per month. As a general rule, IT costs can vary dramatically and depend, for example, on the choice of blockchain technology or the company's in-house IT structure. Whatever the circumstances, one node isn't much use on its own. Other requirements include connectivity, business processes, suitable interfaces and shared standards. The true costs of blockchain are hidden outside the technology - for example, costs involved in reaching an agreement with the other blockchain

participants and the design of the front end. As a general rule of thumb, companies that do more than run just one node – for example, those that design their own implementation or co-develop – should allow for one or two developers in their budget. Process managers and UX designers will be needed as well.

04 Availability and quality of data forms the foundation

Blockchain is not a remedy for insufficient data. No data, no blockchain. And if the data is of poor quality, incorrect or incomplete, blockchain cannot be expected to create added value.

05 Trial run before launching in the business

Blockchain is not a mature technology yet and is still raising many questions. Before a business starts using blockchain in its operations, it firstly needs to gain practical experience by means of a proof of concept or pilot project.

06 Using existing systems to add value

Blockchain creates synergies and added value when it is connected to existing, well-established systems and solutions. These include, for example, GS1 standards for data identification and exchange, as well as ERP systems and inventory control systems. Agreeing to use these types of standards reduces the project duration significantly. It is a good idea to design the system so that it can either be expanded at a later stage or adapted to existing systems. Lastly, don't forget to consider the types of data that should be shared with and used by business partners!

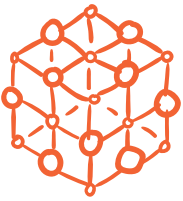
07 Governance is more complex than technology

Technological questions, such as which blockchain technology to choose, are usually easier to solve than the 'peripheral' issues. The latter include how to establish a network of companies, determine rules of participation, define read/write permissions and finance the network, as well as issues concerning general governance. Before starting technical programming, it is vital to consider – and agree on – which players are allowed to participate in the blockchain and on what terms.



“The concept behind the application has clearly and considerably proven the potential to significantly optimise an out-dated, cumbersome and inefficient process. It is key that the process of implementation is kept as simple as possible, if the solution is to be widely accepted.”

Sven Lameyer, Global Key Account Manager FTL, DHL Freight GmbH (Euronet)



08 The challenge of a business partner network

A critical number of market players are required to create a real, geographically dispersed, consortium blockchain. However, uniting all participants from a specific sector, community or value-added chain into a blockchain network is a challenge in itself. Who is setting up the network? Are those setting up the network neutral parties? Do they have an economic interest in the operation of a network, or do they have a dominant position in the market?

09 Transparency: a blessing or a curse?

Blockchain creates transparency by ensuring immutability of the shared data. As far as the pilot project was concerned, the entire exchange history between two business partners was made transparent. This is the only way that the two partners can keep track of each other's balances. But do people really want transparency? Even in the case of less sensitive and politically delicate data – such as pallet account balances and exchange transactions – there is still a certain amount of sensitivity with regard to data transparency, data protection, privacy or competition-related information. Blockchain also entails consideration regarding what and how much information a company wishes to divulge.



“The pilot project showed us that blockchain technology can be used for the digitalisation of our pallet exchange process. Blockchain has become more tangible for us. We’re now excited about the next phase, which introduces the complex issue of governance in this new peer-to-peer business partner network.”

Anja Nienaber, SC Acceleration Manager, Beiersdorf AG

10 No paradigm shift without change

The decentralised peer-to-peer nature of blockchain technology means that companies need to rethink their B2B relationships. For many companies, these technologies usually entail completely new organisational structures, processes and power relationships and create new principles for dealing with business partners. Blockchain is based on a different approach to collaboration than the one that most sectors are familiar with today. Are these changes welcome? And how fast can such a cultural change be implemented?

11 Openness – a blockchain principle

Openness is different from transparency, which relates to data being available to all parties. Instead, it has much more to do with being open-minded in terms of different data formats, interfaces and approaches to processes. In order to use a blockchain properly and exploit its potential, companies need to adopt an open mindset on both an organisational and technological level. For example, in terms of an open data format in a B2B consortium, companies need to agree on and use a common solution. Companies must also be open with regard to interaction points, as these require shared interfaces. Openness also means that the data is decentralised (distributed ledger) and every participant has the opportunity to work with their own blockchain node. Data transparency can be restricted for specific exchange partners, if required – as in the case of sensitive transaction data, for example. However, other information – such as surplus pallets and pallets needed – can be visible for all members of the business partner network. Whatever happens, if there is no transparency on the technological level, blockchain cannot create any real added value. However, corporate guidelines often continue to create a barrier to openness today.

12 Using intermediaries as germ cells for B2B networks

A great deal of trust is required during the establishment of multi-company blockchain consortia, which may bring together in a network competitors and companies, that don't know each other and have no common business. A neutral authority may be helpful, especially in the beginning. An independent third party helps to manage the sensitive and lengthy negotiation and coordination processes between participants, and to balance interests while establishing shared governance in accordance with blockchain principles.



“Blockchain technology can be used to optimise the handling of pallets at the loading bay. However, to take full advantage of this technology, all partners in the supply chain need to achieve transparency.”

Christoph Siawrys, Transport Logistics Administrator, dm-drogerie markt GmbH + Co. KG

13 Trust comes before blockchain and digitalisation

The fears that come with the introduction of a new technology should not be underestimated. Works councils fear for jobs, managers fear for data ownership and operational users have more trust in paper than they do in a digital app. Even blockchain can't automatically instil trust among business partners. Often, trust can only be the outcome of human relationships and habits. In fact, people still tend to be sceptical about technological solutions, even today. This is why employee training is key. The application's end users need to understand the new technology and its added value, otherwise, the mobile device will stay in the drawer and notes will continue to be filled out by hand.

14 Network coverage is critical

Digitalisation cannot work without a nationwide, high-performance network – and neither can blockchain solutions. However, Germany's mobile networks still have several gaps at present. Furthermore, certain buildings – such as logistics premises – are built with lots of steel and concrete, which creates reception problems inside. This is why Wi-Fi is widely used, although this usually only provides external parties with limited Internet access.

One prerequisite is that everyone has the same access to the Internet. Companies that want to use a blockchain with business partners need to ensure there is easy Internet access on-site.



“In less than twelve months, we developed a solution that will put an end to decades' worth of paper pushing. This shows that blockchain can drive digitalisation in fields that, until now, have seemed difficult to digitalise.”

Apostolos Couvaras, Manager Corporate Network Innovation, Lekkerland AG & Co. KG

16 Internet of Things (IoT) reinforces the potential of blockchain

The future combination of blockchain with the Internet of Things (IoT) – for example, smart, serialised pallets in the case of the pallet exchange process – could generate significant added value for existing processes. For this to work, however, decisions need to be made to make the necessary changes – for example, to load carrier management in the logistics industry – irrespective of blockchain.

Getting to grips with blockchain

You can find in-depth insights and findings from the work of the project team on our blockchain blog, including governance, identity management and systems architecture.



Would you like to find out more about specific topics and project findings?

You can find these articles – and many others – online at www.gs1.de/blockchain-blog

Process analysis: design thinking led to a collaborative solution



The project resulted in a shared pallet exchange process that was developed by employees from different companies. These companies were using a diverse range of exchange processes, from a "letterbox" solution to a customised extension of the company's ERP system. The project team managed to employ the right method to arrive at a shared solution.

Read more here

Governance: reaching a charter for a blockchain consortium



A consortium blockchain network must agree on rules from the outset. A trivial question is "Who can decide what, and when?" A somewhat harder issue is "How should decisions be made?" This could be, for example, a "no-code" or "no-people" decision, i.e. people and committees, versus smart contracts. Which data should be visible to whom? What is allowed, what is not allowed and what do people want? There are many questions and a lot of unknown territory. There's no point searching for an example of established best practice here.

Read more here

Eric Stettiner, Director and Expert in Enterprise Architecture, PwC Deutschland
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(GS1) standards used in the blockchain



Standards range from pallet identification to data exchange in the blockchain.

Which key standards did project participants agree upon? How have they actually been integrated in the blockchain solution? What data do blockchain transactions contain? And how can it be used to feed data into the pallet accounts of participating exchange partners? *Read more here*

Dr Ralph Tröger, Senior Manager Identification/Data Carrier, GS1 Germany GmbH,
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The right system: blockchain technology and architecture



Blockchain projects are springing up like mushrooms. However, there has never been a real, decentralised, private blockchain network in practice. Until the project participants went ahead and created one. We report on the technology used and the architecture of the pilot solution, and provide insights into the findings of the practical test. *Read more here.*

**Thomas Uhde, Director Blockchain
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Blockchain: yes or no? Technological approaches for the future



The million-dollar question: How much blockchain does a single use case require? This was just one of the questions that project participants debated before, during and after the practical test. Different technological approaches could be adopted if the project were to continue and go live. *Read more here.*

Identity management in blockchain projects: experience and future prospects



Blockchain implies a shift from explicit trust in individual business partners to implicit trust in mathematics. However, participants in private networks must be able to rely on the identities of all other stakeholders. *Read more here.*

**Anne Wunsch, Junior Manager Logistics + Supply Chain Management,
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The ultimate practical challenge: test findings from real life



A total of 17 project participants put the pallet exchange app through its paces at 20 different warehouse locations in Germany and Austria over a period of roughly two weeks, testing it in real, day-to-day operations. Their insights and experience help in the design and implementation of their own blockchain projects. *Read more here.*

**Dirk Freda, Head of Competence Center Supply Chain Management,
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Peer to peer: when network coverage becomes a showstopper



Blockchain means peer-to-peer transactions. A peer-to-peer system implies a network comprised of parties with equal rights. Pallet exchange is one such system, involving transactions between exchange partners with equal rights. One of the prerequisites for this is that all parties have the same access to the Internet. This can still not be guaranteed everywhere today. *Read more here.*



Would you like to find out more about blockchain, or do you have questions about the project?

Regina Haas-Hamann, Head of Innovation at GS1 Germany remains at your disposal, either by email (regina.haas@gs1.de) or by phone (+49 (0)221 94714 115).



We are continuing the blockchain initiative! Would you like to be part of it?

Dirk Freda, Head of Competence Center Supply Chain Management at GS1 Germany looks forward to hearing from you, either by email (dirk.freda@gs1.de) or by phone (+49 (0)221 94714 430).

Keep up to date!

You can read about the experiences of the project participants in our blockchain blog at www.gs1.de/blockchain-blog.

Further information about GS1 Germany's innovation projects and blockchain can be found online at www.gs1-germany.de/innovation and www.gs1-germany.de/blockchain.

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