INATBA REPORT

by the INDUSTRIAL BLOCKCHAIN TASK FORCE

EU Consortia in Focus: Exploring Global Trends in Industrial Blockchain Projects

July 2024

INATBA

International Association
for Trusted Blockchain Applications

Authors

Co–Chairs of the Industrial Blockchain Task Force

Sebastian Becker, INATBA Board Member and thebrainbehind GmbH, Germany

Izzat-Begum B. Rajan, INATBA Board Member and CEO Imani Partners, France

Members of the Industrial Blockchain Task Force

Constantin von Alten, MHP – A Porsche Company, Germany

Ismael Arribas, Kunfud, Spain

Natalie Avram, IOTA Foundation, Germany

Alex Bausch, 2Tokens, The Netherlands

Manuel Beckert, INATBA, Germany

David Collett, SEKAI, Switzerland

Åsa Dahlborn, IOTA Foundation

Igor Dunayev, Blockchain Ukraine, Ukraine

Simon Engel, SAP, Germany

Marianna Faraldi, Tecnoalimenti

Tan Gürpinar, INATBA Academic Advisory Board, Quinnipiac University and Fraunhofer Institute of Material Flow and Logistics, USA

Daniel Heinen, Bundesblock, Germany

Laura Kajtazi, IOTA Foundation, Germany

Achim Klein, 51Nodes, Germany

Samuel Seongeun Lee, The World in 2050, South Korea

Shurong Li, Tokeny, Luxembourg

Dónal O'Regan, Fujitsu, Belgium

Hugo Volz Oliveira, Instituto New Economy, Portugal

Taras Paschenko, Simcord, Ukraine

Katarina Preikschat, MHP – A Porsche Company, Germany

Jos Röling, 2Tokens/IBM, Netherlands

Erich Schnoeckel, 2Tokens, The Netherlands

Mario Schraepen, LinkedCar, Belgium
Ricardo Simões, INATBA, France
Jens Strüker, INATBA Academic Advisory Board and Fraunhofer Blockchain Lab, Germany
Luigi Telesca, Trakti, Italy
Antonio Tresca, Trenitalia SpA, Italy
Christof Urbaczsek, MHP – A Porsche Company, Germany
Till Zwede, Fraunhofer Blockchain Lab, Germany

Reviewers and Advisors

Sebastian Becker, INATBA Board, German Blockchain Association (Bundesblock), and thebrainbehind GmbH Consulting, Germany
Peter Busch, Robert Bosch GmbH, Germany
Tonia Damvakeraki, EU Blockchain Observatory and Forum, Greece
Nena Dokuzov, INATBA Governmental Advisory Board and Government of Slovenia, Slovenia
Pierre Marro, INATBA Governmental Advisory Board and European Commission, Belgium
Izzat-Begum B. Rajan, INATBA Board and Imani Partners, France
Joachim Schwerin, INATBA Governmental Advisory Board and European Commission, Belgium
Evrim Tan, INATBA Academic Advisory Board and KU Leuven, Belgium

Table of Contents

1. Executive Summary

Undoubtedly, we have witnessed and are witnessing an ongoing acceleration of technical innovation in the industrial sector in the past 30+ years.

Apart from the chip industry's progress defined by Moore's Law, we have seen 'self-fulfilling' shifts toward connected data exchange via the internet, physical abstraction into cloud computing, hyper-connectivity with IoT technologies and ubiquitous sensors, and now the trends towards decentralised and self-operating systems with secure value-exchange capabilities (aka blockchain or distributed ledger technologies), generative technologies (AI) and end-to-end representation of full industrial processes in digital realms (Industrial Metaverse), including remote management capabilities.

While these developments basically created a situation where industrial services can be planned and (partly) executed end-to-end digitally, the next phase will pose serious challenges both for legacy systems (think of the security threats posed by quantum computing) and for the controllability of systems themselves (the opaque, potential threat dimension of future AIs).

This, in combination with the rising awareness about the limits of resources (in the future, it will most likely be more a question of raw materials and water scarcity and less about the availability of energy) means that we will have to ask ourselves a lot more strategic questions when we discuss future technological innovation.

As a result, the shorter-term challenges lie in the orchestration dilemma – we are not lacking an armada of tools, but many industries are struggling to efficiently organise themselves, let alone to master sector coupling. But to save energy and distribute it (as well as available material and financial resources) efficiently, we need to make sure that we successfully organise a major leap in sustainably organising future industrial backends and processes, based on the well-analysed and properly executed use of advanced technologies.

And if we speak about 'efficiency technologies' for these future industrial backbones, then we are not only able to benefit from the different capabilities blockchain or other exponential technologies (such as AI) are offering, but we also need to ensure that a powerful technology such as blockchain is not ruled out of the equation for the wrong reasons. This is a real danger since we have witnessed that many leaders in the political and corporate arena have not been willing to connect their fortunes to a technology that has been suffering from a bad public reputation. Certainly, there have been scams in the cryptocurrency sub-category of blockchain-based applications, but this is only one facet of the blockchain playing field, and nobody came up with the idea to condemn banking as such after clear criminal cases such as Wirecard were coming to the surface. And then there are also ill-understood perceptions about the insinuated 'energy hunger' of blockchain, a generalisation that does not apply to industrial blockchain architectures and use cases.

But we should not fall prey to these PR traps – the future of our connected economies and the health of our planet depends on our capability to assess the

best solutions in a public debate, and not leave the future technology set-up to the results of a PR battle and a fight for early adoption and market shares (at all cost). If there is a learning from the Web 2.0 and platform model era, then it should be that unregulated markets do not lead to the most sustainable results.

And we also need to worry more about the trust problem - if there is a learning from scandals such as Wirecard or Dieselgate then it boils down to a lack of proper reporting and verification or audits - a fundamental problem that blockchain tech can help to mitigate significantly. And we will face very similar issues with many AI applications, a situation that will challenge the recent hype around AI companies - since if there's no registry of or legitimacy for the contents and people that have trained an AI, these models will not lead us down the right path. So we have to get used to the fact that exponential technologies are tools that must be taught, understood, and used properly, but that the ultimate questions of representation and governance are still up to us. But only if we know our tool wizards well we might get to a point where sustainable and long-lasting decisions about the rules that guide us will be possible.

As an industry association, it is nevertheless not our goal to create a list of desirable outcomes of the next decade of tech innovation. We want to ensure that both public discussions and corporate decision-making are based on a broad basis of available and useful information.

That's why we have set up this 'Industrial Blockchain Task Force', consisting of and supported by a broad group of companies and institutional actors, both from within INATBA's member base, but also from non-members. And as our first output, we want to release this overview about the status of the large and growing number of public and private consortial projects with relevance for an industry or a number of sectors, because they are using, suggesting or standardising blockchain technology as part of their innovation roadmap.

And we do hope that this overview is sufficiently short enough to be studied for future decision-making and to lead to a broad adoption of consortial cooperation.

2. Public Infrastructure Initiatives

The debate about whether (only) the private sector or the public sector should lead in certain domains and stimulate the economy or innovation has been around for decades, if not centuries.

But without taking sides in this dispute, there are certainly some differences between common goods (aka infrastructure) and areas of market-led competition at the application or service level.

And most projects that aim at industrial or broad-scale adoption do at least touch the state's or public authorities' sphere, and as a consequence there is a role for public sector projects to determine the way forward for certain aspects of infrastructure development or regulated services.

From a blockchain sector perspective, some of the capabilities of blockchains (such as the immutability of data records or trustworthy automation based on rules that have previously been agreed upon) require public authorities to define such a set of rules that should serve as the foundation of a partially autonomous infrastructure in the future.

And of course, the nature of the rule of law and the authority of the state to issue certain credentials is demanding for an active role of the public sector in at least co-leading related initiatives. Thus, the following chapters will not only summarise where international organisations have started such consortial projects, but also highlight where results are already visible and where further progress will be needed to pave the way.

European Blockchain Services Infrastructure (EBSI): The Build-Up Phase

The Facts

EBSI is a project of the European Blockchain Partnership[1] and includes all EU Member States, the European Commission, as well as Norway and Liechtenstein. It was initiated and planned as a permissioned blockchain network in 2018 and consists of blockchain nodes that are spread across the member countries – typically one node per country, hosted by a leading, trusted, and blockchain-savvy entity in the respective area.

The initial idea was to build an infrastructure layer that could serve as a basis for both public as well as some private-sector use cases and applications.

Project Funding

In the first phase of development, EBSI was publicly funded by the Digital Europe Programme[2], as was the European Blockchain Pre-Commercial Procurement.[3]

Main Project Goal

EBSI aims to facilitate cross-border services for public services and administrations, businesses and their ecosystems as well as citizens. The goal is to verify information and make services trustworthy, based on European regulations as well as core principles.

EBSI is also oriented towards interoperability, to connect existing solutions or integrate and develop specific services. This is quite important since it is not mentioned often enough that blockchain tech can help with system interoperability, especially if it comes to trusted data sharing. If all (legacy) systems just reference specific data sets that are notarised on a blockchain, then the need for overall systems integration between legacy tech solutions is going to decrease.

Ecosystem Partner Evolution

Any organisation in one of the EBP countries can apply to host an EBSI node, as long as certain conditions are met. The candidates also need to request the endorsement of the EBP member in their country, as it is a permissioned network.

Role in the EU & Beyond

EBSI has been co-initiated by the European Commission and is supported by all the Member States. In the future, the new European Digital Infrastructure Consortium (EDIC) 'format' will most likely lead to the move of EBSI in its production phase. EDIC will be primarily led by EU Member States that are planning to become a part of the Consortium – any other EBP country is invited to join at its best convenience.

[1] https://digital-strategy.ec.europa.eu/en/policies/blockchain-partnership.
[2] https://digital-strategy.ec.europa.eu/en/activities/digital-programme.
[3] https://digital-strategy.ec.europa.eu/en/news/european-blockchain-pre-commercial-procurement.

Membership & Participation in the Consortium

EBSI is open both for new node operators as well as for companies that want to test their services against EBSI's framework or come up with new solutions. This community-driven approach is complemented by other initiatives in the EU, such as the Regulatory Sandbox. Currently, more than 150 companies are participating in the 'Early Adopters Programme', and around 200 other actors are engaged in EU-funded projects contributing to EBSI. They are mainly European but developers from all over the world are interfacing with EBSI as well for some applications.

The Consortium's Structure

EBSI is governed by the EBP[4], based on a set of rules that ensure transparency, accountability, and cooperation, while at the EC level, DG CNECT is the solution owner, and technical implementation is run by DG DIGIT.

Evolution of the Project

EBSI was technically launched in 2020 with the first prototypes and a web wallet solution, and is based on the Hyperledger Besu until now, with new EBSI versions including new capabilities proposed overtime.

In parallel, the EBSI PCP process was triggered (EBSI Pre-Commercial-Procurement), allowing only European entities to participate in this public tender, focusing on R&D and evaluation of EBSI's future technical foundation, preceded by a public consultation that started in early 2020.

The last three service providers in the PCP project were IOTA, Billon, and Chromaway. The PCP has ended recently, the possible integration of the resulting solutions in EBSI would be a decision of the new EDIC-based Europeum structure. The Commission doesn't have the mandate to run such an infrastructure in production, the initiative to do so must be taken by Europeum and its participating member states.

Current Status: Solutions & Services

EBSI developed several solution frameworks to address business problems. These 'use case families' are perceived as key areas where EBSI and blockchain tech can contribute to help with issues that are relevant to multiple sectors/domains: 'Track & Trace' for traceability, 'Verifiable Credentials' (VCs) for verification, and 'Trusted Data Exchange' for wider sharing of (personal) data between citizens, businesses and institutions, such as for the credentials in the education domain.[5] EBSI was initially focused on human-centric use cases, particularly around VCs for personal credentials. The project in the EU blockchain PCP worked on use cases that go beyond human-centric services, such as Digital Product Passports or intellectual property rights management.

[4] See https://digital-strategy.ec.europa.eu/en/news/european-countries-join-blockchain-partnership.
[5] See also Verifiable Credentials Success Stories: https://ec.europa.eu/digital-building-blocks/sites/display/EBSI/Verifiable+Credentials+Success+Stories.

Current Status: Technology & Standards[6]

EBSI is based on contemporary standards for decentralised identification (W3C Decentralised Identifiers) and digital credentials (W3C Verifiable Credentials). Education diplomas are a specific type of a VC in EBSI. EBSI currently operates on a single chain, Hyperledger Besu, an open-source Ethereum client. The system uses trusted registries, a trust framework, decentralised identifiers (DID), VCs and Digital wallets. It includes a centralised API interaction layer and operates in a permissioned environment.

The Outlook

EBSI's progress and its use has been steady but slowed down by COVID-19, the conflict in Ukraine, and the subsequent energy crisis – simply because it meant that the focus of Member States policy was not necessarily on such tech innovation and it has become increasingly difficult to mobilise resources towards these initiatives. And while EBSI still progressed (driven by the PCP programme on the strategic planning side and the early adopters and several publicly funded EBSI sub-programmes on the operational side), it was also perceived as no longer driven by the initial strong strategic political will in 2022 and 2023.

According to policy-makers at the EC and Member States level, this is about to change (see next chapter). The Belgian Presidency in the 1st half of 2024 declared blockchain technology to be a focus area early on: the mechanism that was chosen to be used for this shift of gears was that of the EDIC – a legal framework that allows Member States to set up, fund, and operate multi-country projects. The ambition is clear: secure more substantial engagement and funding, allow a smaller group of supporting states to progress with the development and turn EBSI's and the general European blockchain infrastructure plans into an undertaking that has both a renewed and clear political will behind it as well as a (number of) strategic objective(s).

Aligned with the goals of the EU's Digital Decade 2030, this should lead to a boost for the digitalisation of public and private services and become a cornerstone not only for the blockchain/DLT ecosystem in Europe but also for transparent and secure industrial processes, especially for supply chain management and anti-counterfeiting measures. Promoting Europe's digital sovereignty through international partnerships, it will integrate blockchain as a key technology into the future European 'backend', scale up EBSI and reinforce the international partnership that was already established by the EBP at the beginning of the project.

EDIC will ensure governance, further development, and operational facets of EBSI, and is bound to bolster EU policies, cross-border exchanges, and interoperability within the digital transformation agenda. These strategic objectives reflect a comprehensive approach to harnessing digital technologies for Europe's socio-economic advancement and a more sustainable way of doing business within and beyond the EU.

[6] Information about tools, libraries and APIs is available at the bottom of the page https://hub.ebsi.eu/.

So far, Belgium, Cyprus, Croatia, Greece, Italy, Luxembourg, Poland, Portugal, Romania, and Slovenia, have joined the new EBSI set-up, and others should follow. It will be important to also integrate other advanced technologies such as AI, quantum computing, and other cyber-security oriented approaches into the equation in the next phase.

It is a fact that some of the leading and larger European nations are currently still absent, and assessing this situation, it must be stated that some parties that are part of national governments are blocking the European innovation discussion in this sector because of a lack of coherent understanding of the capabilities of the technologies in question. It is on us to change this, but while waiting for a better campaign and informational push this means that we are also losing time in various areas in which efficiency gains might be a blessing. This is true for circular economy planning, grid balancing, or more efficient future mobility or supply chain solutions. It will be interesting to see the evolution of EBSI as an EDIC after the European and some national elections this year.

It should also be the duty of the European Commission as well as national governments and research institutions to ensure that the potential of exponential technologies are properly assessed and that decisions are less governed by the public's perception of selected aspects of these technologies – we need to prevent that lobby groups that represent only certain fractions of the economy are undermining important discussions by disseminating non-factual reports about some aspects of technologies that are better to be judged by expert panels.

Contact Persons

Apart from EBSI's website, each EBP country has nominated a representative[7]. The responsible EC Directorates are also touchpoints for interested parties.

Website

https://ec.europa.eu/digital-building-blocks/sites/display/EBSI

[7] See https://ec.europa.eu/digital-building-blocks/sites/display/EBSI/List+of+EBP+representatives.

EBSI in the Future: Europeum EDIC

The Facts

A European Digital Infrastructure Consortium (EDIC) is a construct that serves as a legal framework designed to assist Member States in the establishment and execution of multi-country projects. It operates under the Digital Decade Policy Programme 2030, with the aim of expediting and simplifying the implementation of projects spanning multiple countries.

In November 2023, Belgium's Secretary of State for Digitization, Mathieu Michel, emphasised[8] the importance of convergence in countering digitisation challenges. The proposal has included the European Blockchain Services Infrastructure (EBSI) initiative as part of Europeum, structured as a European Digital Infrastructure Consortium (EDIC).

In addition to expediting the development of a European blockchain infrastructure, other priorities encompass measures on use cases combining other technologies like artificial intelligence, interoperability, and skills, all aimed at fostering digital sovereignty in Europe.

Project Funding

EDICs operate based on budgets derived from contributions made by their members, supplemented by additional sources such as EU and national grants. The financial resources are utilised to support joint infrastructures, deliver services, and foster collaboration among public entities, private entities, final users, and industry. Belgium anticipates additional funding from the Commission for Europeum[9], contributing to the EU's Digital Decade 2030 objectives..

Main Goal

EDIC has been created with the objective of achieving the general goals and targets outlined in the Digital Decade Policy Programme 2030. The summarised objectives of the multi-country projects operated under the Digital Decade Policy Programme 2030 are to enhance cooperation, strengthen technological excellence, address strategic vulnerabilities, promote safe digital solutions, contribute to inclusive digital transformation, and foster digital skills for citizens with a focus on gender balance.

Role in the EU & Beyond

EDIC will be primarily led by several EU Member States that are part of the Consortium. There have been first dialogues with counterparts in Japan and South Korea about how Europeum could link into international infrastructure for documents to be recognised outside of Europe.

---

[8] https://sciencebusiness.net/news/ict/belgium-focus-public-sector-european-blockchain-during-its-eu-presidency.

[9] Ibid.

Participation by EU Countries

EDICs are established through Commission decisions upon the application of at least three Member States and subsequent approval by the Commission. Member States define the governance structure and functioning rules in the Statutes. Membership is open to all Member States on fair and reasonable terms throughout the Consortium's duration.

The Structure

The Europeum EDIC was officially launched in May 2024.

Europeum will be based on the initial participation of Belgium, Croatia, Cyprus, Greece, Italy, Luxembourg, Poland, Portugal, Romania and Slovenia, in shaping its structure. Beyond these countries, others have the option to join (also as observer countries with no voting rights) and utilise blockchain, and discussions with counterparts in the rest of the world would happen to explore integration with international infrastructure for document recognition beyond Europe.

Other large EU Member States are still not officially signing up to the plans, even though some have voiced their support and are expected to join before the end of this year, such as Spain.

The Outlook

In line with building on EBSI's groundwork, Europeum would be used for public administration and public services cases, for example allowing education or other documents to be recognised across the bloc, and facilitating procedures such as VAT declarations. With a hopefully stable EDIC growth roadmap, Europeum will also support and encourage a broad range of applications to tap into the infrastructure (well beyond the current range of EBSI sub-programmes), such as digital twins of entire cities, to better manage environmental risks and the obvious smart city hot topics such as traffic management or the delivery economy.

But as first measures, partners will need to make decisions about the process of building out the infrastructure, be it through a next phase of public commercial procurement or other ways to create a robust Europeum ecosystem that can be interfaced or intertwined with other EU policy ambitions and roll-outs, from the EU Digital Identity Wallet to a future (wholesale version of the) Digital Euro.

Contact Persons

Since the new Europeum structure has just been set up, the new / main contact points are still to be declared.

EU Blockchain Observatory & Forum (EUBOF)

Facts

EUBOF, initiated by the European Parliament and the European Commission, has aimed to expedite the innovation of blockchain and foster the growth of the blockchain ecosystem within the European Union. This effort has been intended to solidify Europe's role as a prominent global leader in this technology.

Project Funding

EUBOF is a European Parliament Pilot Project with the financial support of the European Union.

Main Project Goals

The key objectives of the Observatory have included overseeing and mapping blockchain initiatives in Europe, generating a comprehensive repository of blockchain knowledge. Furthermore, EUBOF has aimed at establishing an engaging and transparent platform for information and opinion exchange, and providing recommendations on the potential role the EU could undertake in the realm of blockchain. The knowledge acquired throughout the existence of the Observatory and Forum has been disseminated through various public-oriented initiatives.

EUBOF has also produced reports, such as 'Blockchain-Enabled Virtual Worlds' (April 2024)[10] or the 3rd updated edition of their 'EU Blockchain Ecosystem Developments', which was released in May 2024, and can be seen as a legacy of their research work.[11]

The Consortium Structure

EUBOF has operated under the auspices of the European Commission's Directorate General for Communications Networks, Content, and Technology (DG CONNECT). The Consortium overseeing the third and final edition of the Observatory (2022–2024) was led by Netcompany-Intrasoft (main contractor), with the University of Nicosia, the Institute of Information Technology/CERTH, White Research, Crystal Blockchain, and OpenForum Europe.

EUBOF in its current form ceased to operate at the end of May 2024.

Contact Persons

To reach out, email info@eublockchainforum.eu.

Website

https://blockchain-observatory.ec.europa.eu/index_en.

[10] See https://blockchain-observatory.ec.europa.eu/news/eu-blockchain-observatory-and-forum-publishes-new-report-titled-blockchain-enabled-virtual-worlds-2024-04-26_en.
[11] See https://blockchain-observatory.ec.europa.eu/news/eu-blockchain-ecosystem-developments-3-published-eu-blockchain-observatory-and-forum-2024-05-21_en.

EU Digital Identity Wallet (EUDIW)

The Facts

The EUDIW is a significant development under Regulation 910/2014, known as eIDAS, which aims to provide secure and standardised digital identification across EU Member States. The current situation in the European Parliament reflects the advancement of eIDAS – now having evolved into eIDAS 2.0 – with which the identity is generally considered, and the digital wallets represent a public good that the Member States will have to provide in the near future. The European Commission proposed amendments to this regulation, leading to the creation of the EUDIW, which will allow EU citizens, residents and businesses to access both public and private services online and offline with a single digital identity.[12]

The wallet will store and exchange information provided by governments, such as name, date of birth and nationality, as well as information from trusted private sources. It also aims to facilitate the creation of digital signatures, enhancing the functionality of digital interactions within the EU.[13] The regulation ensures that the digital identity is used on a voluntary basis, and no one will face discrimination for opting out. The open-source nature of the wallet aims to foster transparency, innovation, and enhance security.[14]

Blockchain and DLT can play a critical role in the EUDIW by providing a secure and transparent infrastructure for trust services. Under the eIDAS 2.0 regulation, qualified trust service providers (QTSPs) are responsible for managing electronic ledgers that ensure the integrity, origin, and chronological ordering of data records. These ledgers, compliant with DLT standards like ISO 22739:2020, allow for immediate detection of any changes to data, enhancing security and trust over time. The EUDIW, which includes various trust services such as signatures and timestamps, can utilise DLT as its infrastructure. QTSPs can either manage the entire DLT network or specific functions like validating nodes or consensus mechanisms, ensuring a robust and trustworthy system for digital identity and trust services across Europe.[15]

Although there is not a clear scope on how third countries have to adopt eIDAS 2.0, it is important that the legal vehicle is possible and explicitly referred to in the text, and it is also a relevant effort for such compatibility and piloting internationally with Mutual Recognition Agreement under certain conditions.[16]

The results of the efforts have concluded into 4 large-scale pilots:

---

[12] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-digital-identity_en.

[13] Ibid.

[14] https://ec.europa.eu/digital-building-blocks/sites/display/EUDIGITALIDENTITYWALLET/The+Digital+Identity+Wallet+is+now+on+its+way.

[15] https://www.ebsi-vector.eu/es/resource/public-deliverables/.

[16] https://ec.europa.eu/digital-building-blocks/sites/display/DIGITAL/Pilot+for+the+International+Compatibility+of+Trust+Services.

Figure 2: Large-scale projects. Source: CNIS[17].

The most relevant tool is the activation of the Architecture Reference Framework (ARF) for the European digital wallet development and implementation. The latest version[18] introduces the EUDI Wallet Design Guide and the enhancements to the EUDI Data model.

Additionally, the development and implementation of the EUDIW are supported by the EU Digital Identity Wallet Consortium (EWC), which includes representatives from all 27 EU Member States along with partners from other countries. This consortium is responsible for coordinating efforts, sharing best practices, and ensuring the alignment of national implementations with the overarching EU framework.[19] It operates through various working groups focusing on different aspects of the project, such as technical standards, user experience, and regulatory compliance. Co-funded by the EU's Digital Europe Programme under Grant Agreement GAP-101102744, the EWC is continually expanding, integrating new participants – experts in digital identity, national agencies, startups, and cybersecurity firms – contributing diverse expertise to cover various use cases.

Main Project Goal

The primary goal of the EUDIW project is to establish a unified, secure, and user-friendly digital identity system across all Member States to enhance digital interactions, streamline administrative processes, and protect citizens' data.

Role in the EU & Beyond

The EUDIW sets a standard for digital identity within the EU, potentially influencing global standards and serving as a model for other regions.

[17] https://www.cnis.es/sala-itcip-i-jornada-cnis24/.
[18] https://github.com/eu-digital-identity-wallet/eudi-doc-architecture-and-reference-framework/releases.
[19] https://eudiwalletconsortium.org/.

Evolution of the Project

The project has seen significant milestones, starting from the adoption of the eIDAS Regulation in 2014. Key developments include the 2021 proposal for amending the regulation, the establishment of the ARF, and the launch of large-scale pilots across Member States. These pilots are testing the EUDIW in real-world scenarios, providing valuable feedback for further refinements.

On the 29th February 2024, the voting on the eIDAS Regulation was passed, the final act was signed on the 11th of April 2024 and published in the EU Official Journal on the 30th of April 2024. It entered into force on the 20th of May 2024. Member States and the Commission have various deadlines to apply the new measures. The Commission has to adopt implementing acts for technical specifications and procedures of the European digital identity wallet by 21 November 2024 and of the qualified certificates for website authentication by 21 May 2025. Member States have to provide at least one European digital identity wallet within 24 months of the date of entry into force of the implementing acts.[20]

The table from Namirial gives the timeline at the EU level with regard to the national wallets' implementation.

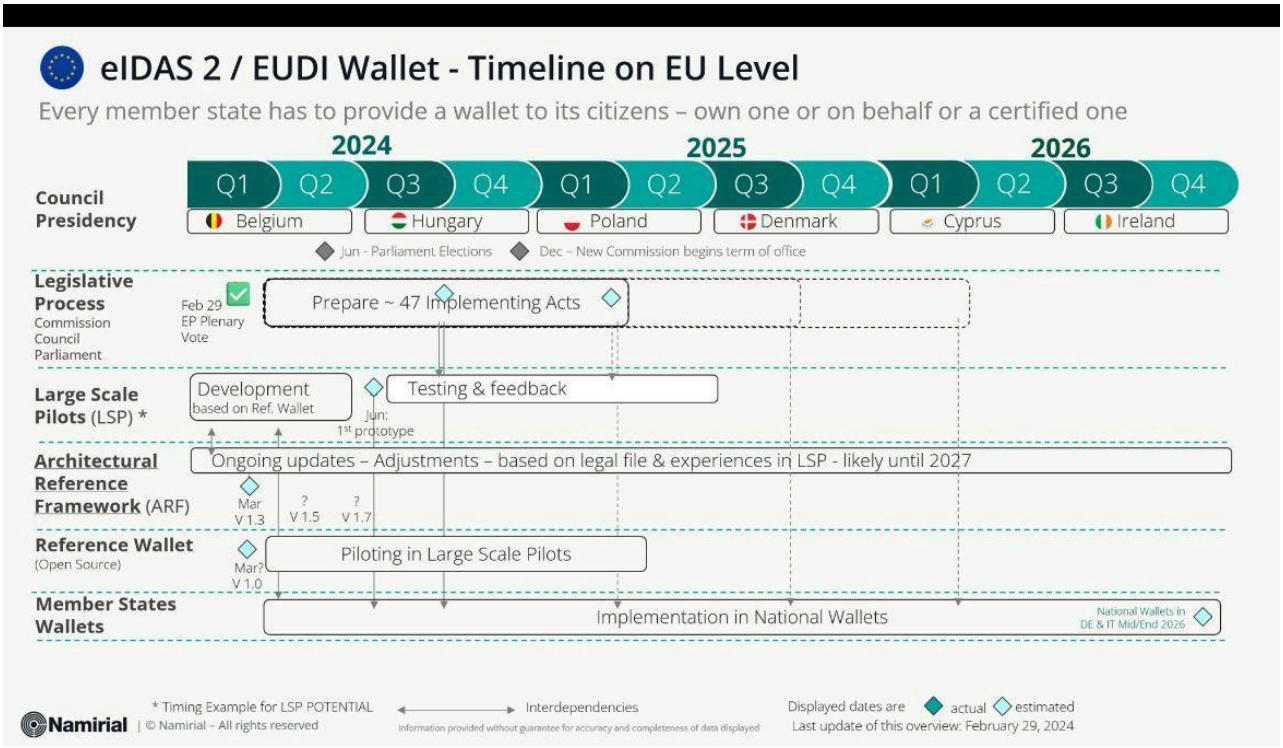

Figure 1: eIDAS 2 / EUDI Wallet - Timeline on EU Level. *Source:* Namirial.[21]

[20] https://www.europarl.europa.eu/legislative-train/spotlight-JD22/file-eid.

[21] https://media.licdn.com/dms/image/D4E22AQHXTgwlrL2X2w/feedshare-shrink_2048_1536/0/1713534126037?e=1723680000&v=beta&t=WHo9M3MWzG1U1wFi-Zndh92Fe5CuIYUZ_d4idq-TYbQ.

Current Status: Solutions & Services

The EUDIW is currently being piloted in various Member States, with implementations focusing on real-life use cases such as accessing public services, opening bank accounts, and applying for educational programs. The pilot projects involve over 250 private companies and public authorities across 25 Member States and other countries, ensuring extensive testing and validation of the system.

Current Status: Technology & Standards

The technical framework of the EUDIW includes the ARF, which outlines the common standards and specifications for the wallet. The European Commission has also developed a reference implementation to guide Member States in building their wallets. This technical foundation ensures interoperability and security across different national implementations.

The Outlook

Looking ahead, the EUDIW aims to become widely available across all Member States by 2025. Public and private services will be required to accept the EUDIW for authentication purposes by 2026. This timeline reflects the EU's commitment to creating a seamless and secure digital identity ecosystem for its citizens.

Contact Persons

To get in touch with the EU Digital Identity Wallet Consortium, you can email info@eudiwalletconsortium.org.

Website

https://ec.europa.eu/digital-building-blocks/sites/display/EUDIGITALIDENTITYWALLET/EU+Digital+Identity+Wallet+Home

https://eudiwalletconsortium.org/

European Union Intellectual Property Office (EUIPO): The EBSI-ELSA Project

At the European level, blockchain was considered as a relevant new technology early on, since it is based on decentralisation, and can enable higher transparency and security levels for both industrial and public service processes. The priorities and innovation agenda in Europe have changed quite significantly since 2017/18, and that is why it is even more important to see how the more innovative European agencies have embraced and developed the European Commission's initial plans for this technology segment.

EUIPO is based in Alicante and manages the European trade mark and community design registration processes, develops IP management tools and procedures and helps to coordinate the fight against IP infringements and product counterfeiting.

By design, the agency is forced to look not only at fundamental registration processes but also at entire value chains and the end-to-end application of those registered trademarks as they travel with the associated products across the EU-27 and beyond. This means that they need both transparent and tamper-proof registry processes, but also to establish efficient control mechanisms, e.g., at the European Union's borders, that will allow other European agencies such as Customs to check if legitimate products are underway or if actions need to be taken against counterfeit and forged items.

Given this scope, it is not astonishing that EUIPO was early on analysing blockchain technology for their future services.

The Facts

EUIPO has been seeking to update and expand their core services by applying blockchain technology in a way highly relevant to their established business. At the same time, their initiatives have been aiming at linking offices and other national service providers across Europe. This has led to two product areas: an IP register on blockchain aiming to interconnect national IP databases on registered trademarks and designs and EUIPO with a decentralised blockchain layer underneath, and the EBSI-ELSA project that focuses on product authentication and tracking to secure end-to-end solutions for supply chains involving all intermediaries in the process as well as end customers and customs offices.

Main Project Goal

The main goal is to ensure product authenticity and timestamping events in the supply chain using the European Blockchain Service Infrastructure (EBSI) and create a new information-sharing system with all involved parties, using both an open-source technology platform and peer-to-peer modules. The project output allows to receive trusted data on product definition and evolution along the supply chain, connected with serialisation and scanning techniques to verify product authenticity.

Ecosystem Partner Evolution

The EUIPO has managed to grow both a community and to use their blockathon design competition[22] to continuously improve their own use case specifications. After officially turning the project into EBSI-ELSA, the ecosystem has been attracting interested parties, shown clearly by more around 200 attendees at a blockathon forum in Q1 2024, where the roadmap of EBSI-ELSA was shared and discussed with the audience.

As an open ecosystem, both solution providers and integration partners as well as brands are invited to develop pilot projects and additional services.

Role in the EU & Beyond

EBSI-ELSA is benefiting from the dimension of their core business – the enforcement of IP rights, a global challenge – and the structure that is tackling this challenge today: offices of different stakeholders around the world. By design but also by use case, the success of this platform launch in this domain can become a global role model.

Membership & Participation in the Consortium

No membership structure is holding back interested parties from starting to work with and in this ecosystem. EUIPO has been fair in also supporting consortial pitches with their available budgets in the past, and initiatives like these will hopefully benefit from relevant public funding in the near future to achieve critical mass.

The Project and Ecosystem Structure

While the combination of the EUIPO's process-oriented thinking with EBSI's technical infrastructure was a win for both sides, it will be crucial that all companies that have registered their IP with the office will find a reason to tap into the solutions once they are rolled out. So communicating the benefits of the new approach will be crucial for the growth of this open public service ecosystem that is trying to secure the very foundation of many private sector business models – their IP base.[23]

Evolution of the Project

Before the official EBSI-ELSA project was launched, the office issued a 'blockathon' design competition, with the goal of understanding which kind of infrastructural set-up and processes would be needed to not only secure tracing and provenance solutions for goods but also to link various existing databases and product tracking solutions and make this available to all relevant stakeholders.

[22] Blockathon information: https://www.euipo.europa.eu/en/observatory/enforcement/blockathon/background.
[23] The EUIPO has started to communicate about the business model aspects ofo EBSI-ELSA, and has published a preliminary cost-benefit analysis report earlier in 2024: euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/reports/2024_EBSI_ELSA/Cost_Benefit_Analysis_en.pdf.

After the blockathon winners[24] were announced in 2022, the project quickly progressed to the next level, including EBSI's infrastructure as the underlying stack. It aims at connecting international IPO offices across Europe and potentially also beyond. As a result, EBSI-ELSA is among if not the most advanced EU blockchain infrastructure ambitions. And it has reached the launch level of their service platform.

Current Status

After the PoC phase in 2023 and several opportunities for the growing project community to give feedback during events, the EUIPO intends to select and technically support five pilots on the live EBSI-ELSA environment, carrying out logistic journeys from end to end. Pilot suggestions could be submitted until the end of June, and the final selection will be done in August 2024.

Current Status: Technology & Standards

EBSI-ELSA basically consists of two modules: an authentication and a logistics module. This means that products are registered during production through the use of different types of ID serialisation codes and the creation of a product NFT. This information can be accessed by consumers with an open-source NFT viewer, currently using OpenSea, Polygon, Metamask and QR codes. IP rights holders, on the other hand, can receive digital identities from EUIPO based on their existing trade mark rights and merge it with selected product information made available by EBSI-ELSA through the 'authentication package', a set of product details similar to what a Digital Product Passport would provide online.

[24] See https://euipo.europa.eu/ohimportal/sl/web/guest/-/news/and-the-winners-of-the-anti-counterfeiting-blockathon-event-are-?inheritRedirect=true&redirect=https%3A%2F%2Feuipo.europa.eu%2Fohimportal%2Fsl%2Fweb%2Fguest%2Fsearch%3Fp_p_id%3Dcom_liferay_portal_search_web_portlet_SearchPortlet%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26_com_liferay_portal_search_web_portlet_SearchPortlet_cur%3D24%26_com_liferay_portal_search_web_portlet_SearchPortlet_keywords%3Dforms-and-filings%26_com_liferay_portal_search_web_portlet_SearchPortlet_delta%3D20&TSPD_101_R0=089375ec4aab200048f63315acadbb3bd0986a4dd20bbdf3cba8778b5de090a50eefd8c7cf12d3f7082beacd57143000ba75fd2aa78568c08707938e2ffb8263ba51cdedc308685b47718ea839b9aaf08c79b332edd5460b894770bf78fa7bed.

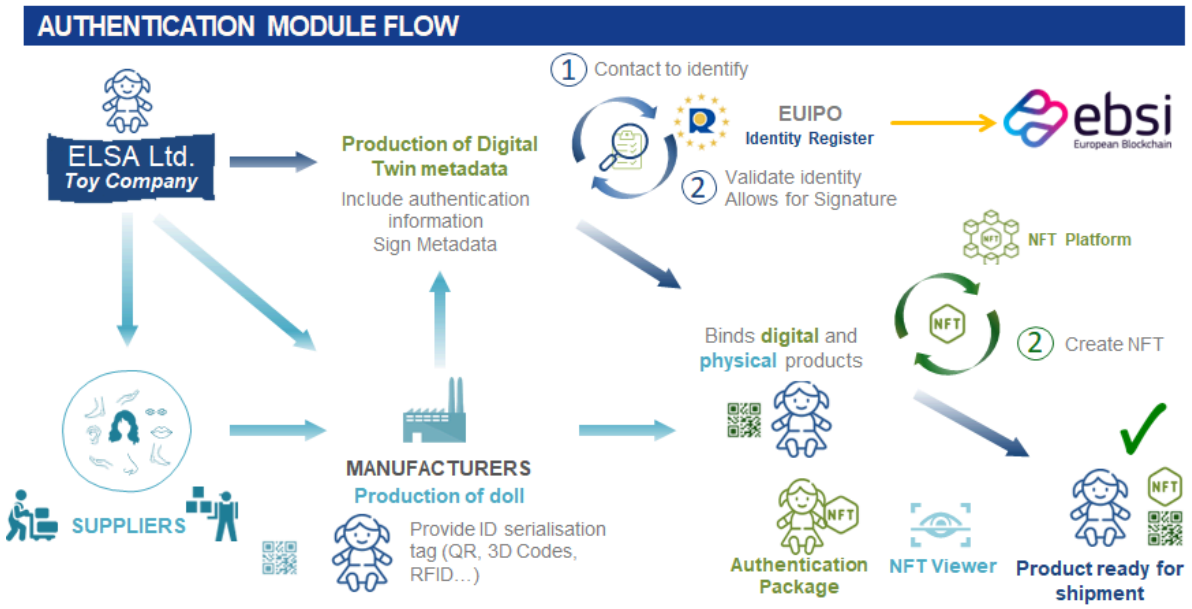

Figure 3: Authentication Module Flow. Source: EUIPO.[25]

Once the products are shipped, two logistics sub-modules are available: a peer-to-peer solution to allow the exchange of information about product logistics, including shipment offer acceptance, and a timestamping submodule to register events through a blockchain audit trail along the supply chain. While the NFTs of the products will be sent along as part of the business files, the exchange of information along the supply chains are not necessarily based on blockchain tech – the EBSI-ELSA team is not planning to overcomplicate the handling of goods along supply chains if only limited data sets need to be checked. This will also allow EBSI-ELSA to be compliant with other European supply chain initiatives, such as Catena-X, that also started with a more traditional data spaces architecture for bilateral data exchange.

25 https://euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/contentPdfs/Observatory/ebsi-elsa/2024_EBSI-ELSA_Presentation-to-external-stakeholders.pdf.

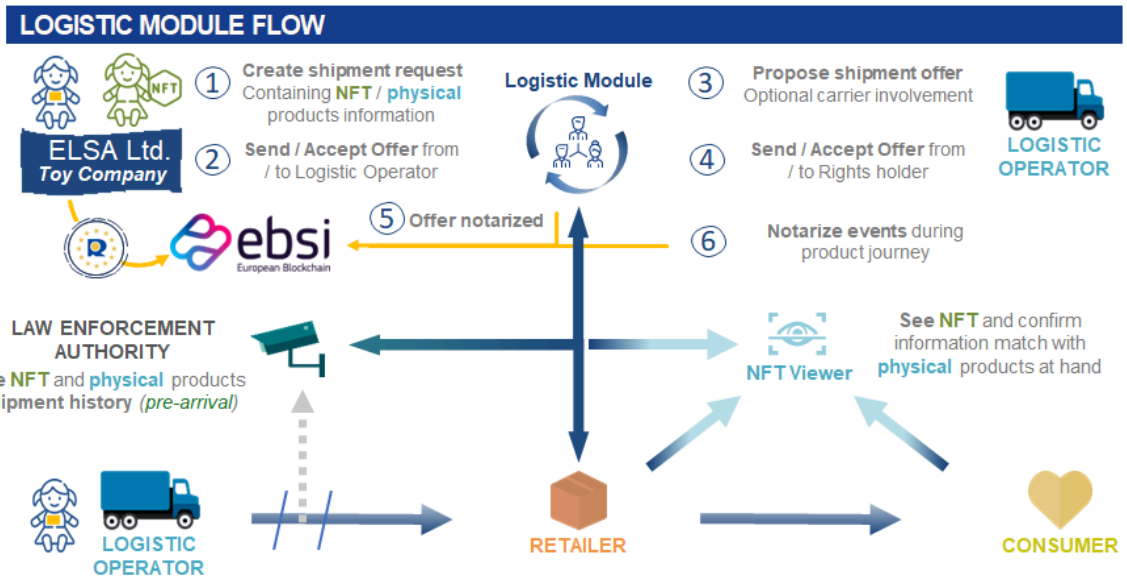

Figure 4: Logistic Module Flow. Source: EUIPO.[26]

Of course, the use cases in focus also require some additional pieces of infrastructure, such as the EUIPO or future EUDI Wallet, allowing IP rights holders to safely store their credentials. The scenarios also include shipment controls at European borders by customs offices.[27] This means that a far-reaching project such as EBSI-ELSA will be able to benefit from future standardisation by either integrating them as building blocks or upgrading the current tech set-up with it.

The Outlook

The outcomes of the upcoming live pilot phase will be presented at an event in December in Brussels thus helping to define the EBSI-ELSA roadmap beyond 2024. It is clear though that EBSI-ELSA is also depending on the progress of the underlying and neighbouring infrastructure projects, but it is of key importance that all stakeholders, as well as EU policy-makers, take a close look at this major European project – since it will be one of the first projects that is going to touch and cover several value chains and have more than one dimension – even though it is limited to administrative and control functions for now and not touching the 'new business' potential that blockchain tech offers via tokenisation – yet. But EBSI-ELSA is planned and growing as a public-led initiative, and blockchain tech service providers are already invited to build more services on top of this infrastructure, especially in the areas of authentication (including the addition of IoT sensors), logistics and aftersale modules.

Contact Persons

To reach out, you can email customercare@euipo.europa.eu, get in touch with the EBSI-ELSA Project team at ebsi-elsa@euipo.europa.eu, or contact Nicolas Hauw[28], EUIPO's project leader.

[26] Ibid.
[27] See a detailed workflow description at the bottom of the EBSI-ELSA EUIPO webpage https://ec.europa.eu/digital-building-blocks/sites/display/EBSI/EBSI-ELSA+EUIPO.
[28] https://www.linkedin.com/in/nicolas-hauw-11036448/.

Website

https://www.euipo.europa.eu/en

https://ebsi-elsa.eu

EU Blockchain Sandbox

The Facts

The EU Blockchain Sandbox, an initiative by the European Commission and funded by the Digital Europe Programme, started in 2023. It aims to foster a collaborative regulatory environment for blockchain innovations across Europe, as part of the EC's SME strategy.

Main Project Goal

Unlike a typical developer's sandbox for application testing, this platform is a **non-technical forum** where blockchain entrepreneurs and developers engage in legal discussions with regulators. Accepting 3 cohorts of 20 blockchain/DLT use cases until the end of 2025, it facilitates dialogues with national and EU regulators to enhance legal clarity for blockchain solutions, regardless of the underlying infrastructure.

Ecosystem Partner Evolution

The set-up of the sandbox has been fixed from the beginning and is intended to 'harden' a steady stream of projects per year.

Role in the EU & Beyond

The Sandbox is a highly relevant project to foster a pan-European understanding of the more and more levelled regulatory playing field and will help various use cases that highly depend on incoming regulation, such as the Digital Product Passports, to be in line with the EU's thinking. This setup can not only strengthen Europe's leading role in terms of regulation but also connect different layers in the future, such as digital assets with CO2 certificates, metadata descriptors or connected devices.

The Project's Structure

The sandbox is facilitated by a consortium under the lead of Bird & Bird with its consulting arm OXYGY and blockchain experts of Warren Brandeis (procured via an open call for tenders in 2022) and web designers Spindox. The selection and the award process will be overseen by a panel of independent academics consisting of Professor Roman Beck (IT-University, Copenhagen), Professor Soulla Louca (University of Nicosia, Cyprus) and Professor Walter Blocher (Universities of Kassel and Vienna).

Evolution of the Project

The first cohort, announced in September 2023, features diverse projects addressing various blockchain applications.[29]

One might wonder why entities would participate in this sandbox without financial incentives, a norm within the web3 domain. Feedback indicates it's

[29] A description of each project, and their relevance can be found here https://ec.europa.eu/digital-building-blocks/sites/display/EBSISANDCOLLAB/European+Blockchain+Sandbox+announces+the+selected+projects+for+the+first+cohort.

primarily for knowledge transfer, addressing a significant information gap among government agencies and navigating legal constraints for innovative companies.

Engaging in dialogue within this initiative offers a friendly platform for mutual discovery. Feedback from participants highlights Bird & Bird's committed approach, striving for solutions beneficial to all parties involved, even as these sessions sometimes raise more questions than answers due to existing legislative questions. Particularly for blockchain companies looking to launch tokens, regulatory challenges persist. It provides the perfect opportunity for coordinated discussions with, for example, central banks and security regulators, offering a wealth of information for both blockchain companies and government agencies.

For blockchain companies, this initiative provides invaluable legal advice at no cost, and for regulators, it presents an opportunity to engage with the evolving digital domain, aiming to adjust regulations accordingly. The learnings of the first year have been published as a Best Practices report.[30]

Current Status

The application and selection phase for the second batch of this important initiative concluded in June 2024. The participants have been announced and are now part of the programme 2024/2025.[31] In this second year, new regulatory areas such as the AI Act, the Data Act, eIDAS2 and the implementation of ESG reporting directives will also be included – if related projects will be selected.

Outlook

Apart from allowing startups and SMEs to expose their ideas early on to a dialogue with regulators, guided by legal experts, this sandbox programme will for sure also have an effect on the opinion of the regulators involved as well. It remains to be seen if the inclusion of the 'alumni' projects in further events of this evolving will help to create synergies over time and facilitate end-to-end process and value chain solutions. As far as the topics covered are concerned, a broad mix of technologies are used by the selected projects in the meantime. Discussions with experts about other, neighbouring European initiatives and standards such as eIDAS 2.0 are also underway and will certainly gain in importance. So far, the project has been proven to be very valuable, so it would be beneficial to turn such a format into a permanent setting.

Contact Persons

To reach out, you can email: info@blockchain-sandbox.eu**.**

Website

Sandbox Project - EBSI -

[30] The report can be downloaded at https://rb.gy/ml9394.

[31] See https://ec.europa.eu/digital-building-blocks/sites/display/EBSISANDCOLLAB/European+Blockchain+Sandbox+announces+the+selected+projects+for+the+second+cohort.

3. Supply Chain and Digital Product Passports

Blockchain technology has been tested and used for supply chain management and projects for quite a few years already – with mixed results. But even though some initiatives have failed for a variety of reasons, a lot of interest in DLTs does still exist – and decision-makers have learnt from past mistakes – even if they had to do more with consortial structures than with their technological setup.

Let us explore how DLT innovation can reshape the efficiency, transparency, and sustainability of supply chains and help to make supply chains more efficient on different levels:

- **CO2 Footprint Reduction:** Implementing blockchain in supply chains significantly reduces CO2 emissions. This is achieved through enhanced tracking and optimisation of transport routes, production methods, and energy consumption. Additionally, blockchain promotes supply chain transparency, leading to better adherence to environmental standards.
- **Cost Reduction via Regional Production:** Blockchain encourages the localisation of production by enabling precise tracking and authentication of locally manufactured products. This reduces transport costs and time, consequently lowering overall expenses. It also strengthens local economies and promotes sustainable, regional economic structures.
- **Improved Traceability in Supply Chains:** One of the foremost advantages of blockchain in supply chains is the ability to track products seamlessly from production to the end customer. This not only enhances transparency for consumers and businesses but also allows for faster and more efficient responses to quality or safety issues.
- **Triple Entry Bookkeeping as a New Standard:** Blockchain technology facilitates the adoption of triple entry bookkeeping in supply chains. This system not only records debits and credits in two separate books but also verifies each transaction in a third, immutable ledger. This increases the accuracy and trustworthiness of financial records and reduces the risk of fraud and errors.
- **ESG (Environmental, Social, Governance) Compliance:** Blockchain aids in meeting ESG criteria in supply chains. It enables more accurate monitoring and reporting of environmental standards, social responsibility, and corporate governance. The immutable recording of data helps in verifying and enhancing adherence to ESG standards.
- **Incentive Structures:** We will see digital forms of currencies, be they governed by central banks or the private sector, rising in different regions of the world – earlier in some and later in others. But at least private money has the potential to include some programmable parts, and the nexus between trade finance solutions, digital money and potential fines for failed CO2 goals along value chains might pave the way for incentive solutions to further optimise supply chain efficiencies.

In summary, blockchain in supply chains allows for more environmentally friendly, cost-efficient, and transparent business operations. This not only leads to improved sustainability and ESG compliance but also provides a strategic advantage in an increasingly eco-conscious and regulated business world.

But the private sector was of course also seeing the business efficiency potentials, and leading trade finance consortiums in this space were some of the earliest consortial blockchain-backed projects, backed by major industry players. But while some big trade finance platforms have not found early success, the komgo[32] platform is still active. The bottleneck of many supply chain platforms is - similar to insurance projects that haven't worked out (such as the B3i consortium), that it is not enough to anchor existing documents on a blockchain to facilitate access and retrieval of such electronic and paper trails, but that the automation potential of blockchain smart contracts needs to be ingrained in the business process engineering from the beginning. And additionally, complex supply chains with a lot of human intervention still provide ample opportunities for corruption and other forms of illegal intervention.

But it is clear that the multi-dimensional benefits of DLT have not been studied or understood everywhere, and that official standardisation is yet to take place in this technology sector – so the current snapshot is not only helping to show where blockchain tech is already adopted, but also how far innovation in general is progressing in this segment and where older and newer solutions are yet to grow together in the best possible way.

[32] https://www.komgo.io/.

Catena-X

Description

The Catena-X Automotive Network emerged as a pioneering force in digital transformation within the automotive industry, with a special focus on the industry's supply chains. Trust, interoperability and data sovereignty are the primary objectives and values promoted by Catena-X in order to provide secure and sustainable peer-to-peer data exchanges between organisations and companies. A collaborative ecosystem of stakeholders have come together, signifying a step toward creating a standardised and secure platform for data exchange throughout the automotive value chain. Based on an ethos of radical collaboration across the globe, manufacturers, suppliers, service providers, and other integral entities within Catena-X have formed a connected ecosystem that champions transparency, efficiency, data sovereignty and innovation through the automotive value chain.

At its core, Catena-X seeks to establish a digital infrastructure characterised by real-time, secure data sharing, leveraging state-of-the-art technologies and industry standards. By prioritising data integrity and interoperability, the initiative aims to revolutionise communication, optimise supply chain processes, and propel the industry into the forefront of Industry 4.0.

Organisation and Funding

The initiative is grounded in the Gaia-X European cloud framework, which has led to the establishment of technical requirements, standardisation, and certification. The Catena-X project was initially funded by the German Federal Ministry for Economic Affairs and Climate Action and started by a consortium of initially 28 members in 2021. It received funds from the German state in excess of triple-digit millions EUR. It is now part of the broader Manufacturing-X initiative driven by the German Federal Ministry for Economic Affairs and Climate Action.

This state-funded consortial project will come to an end in July 2024, but the work will be fully taken over and carried on by the Catena-X Automotive Network, a registered association, that has grown to more than 170 members in the meantime.

Catena-X's leadership consists of both a management board and advisory council, which have both recently expanded by a total of five seats to strengthen its focus on small and medium-sized enterprises (SMEs) and internationalisation. The leadership group brings diverse expertise spanning sustainability, supply chains, internationalisation, and IT (e.g., BMW, SAP, Circulor, etc.).

Vision

The vision of Catena-X centres around addressing the challenges of the automotive industry through radical collaboration among all stakeholders along the entire value chain. Emphasising the need for collective solutions, Catena-X positions itself as the first open and collaborative data space for the automotive sector, facilitating enhanced business processes through data-driven value chains. The initiative boasts a highly standardised and modular use-case

architecture designed to reduce time to market and implementation costs. This approach not only allows for innovation but also introduces a transformative paradigm for conducting business in the automotive industry. The overarching goal is to provide a solution that fosters unprecedented collaboration, efficiency, and innovation throughout the industry value chain.

Operations

The Catena-X operating model consists of three key components: the Catena-X Automotive Network e.V., the development environment, and the operating environment. The Catena-X Association, housed within the first component, spearheads standardisation, certifications, and governance, allowing members to actively contribute to shaping the Catena-X ecosystem. The development environment focuses on creating standardisation candidates and open-source reference implementations. The operating environment sees the operation of various services and business applications by different providers.

The Catena-X data ecosystem is founded on individual data space components, forming the architecture of the Catena-X data space. The operating environment relies on the Catena-X Regulatory Framework for data space operations, ensuring trust, interoperability, scalability, and seamless data exchanges. The association's role extends beyond governance to defining the vision, mission, and guiding principles for the Catena-X data spaces. Key partnerships play a crucial role in shaping a global data space built on trusted principles: with Gaia-X forming the basis for a trust framework, the International Data Spaces Association providing architecture principles for sovereign data exchange, and the Eclipse Foundation hosting the official open-source development project. Through collectively approved guidelines and templates, the Catena-X Association ensures that the exchanging of data on Catena-X can be executed and operated seamlessly, supporting the individual business needs of participants within the automotive industry.

Catena-X has enhanced its functionality through the Eclipse Data Space Connector (EDC), introducing a central communication component that adheres to key architectural principles. The EDC is designed to be simple, interoperable, and decentralised, ensuring that software components with necessary capabilities reside on partners' sides, enabling data exchange only between agreed points. Emphasising data protection, the EDC links transmitted data to policies via contracts, prioritising privacy over sharing, and separating metadata and data for high throughput rates. The EDC aligns with existing standards (Gaia-X and IDSA) and aims to support alternative protocols while championing decentralised data sovereignty among independent companies within the Catena-X ecosystem.

Blockchain

The use of blockchain tech was on the agenda of the international consortium from the beginning – some of the initiating companies such as Fetch.ai and BigchainDB GmbH (the firm behind Ocean Protocol) were blockchain startups, and other large founding members such as Bosch, BASF or BMW had significant teams that were researching and piloting blockchain-based use cases for several years. Nevertheless, during the Crypto Winter in 2022 and 2023 and especially

after the massive scandals in the crypto trading universe (FTX, Terra Luna etc.), it became increasingly difficult for the supporters of blockchain technology to successfully push for the official adoption of DLTs as part of Catena-X's first core implementation. As a result, the more basic Data Spaces architecture was chosen as the leading paradigm of the work of the Catena-X consortium. The fact that the approaches and reference architectures provided by IDSA and Eclipse Foundation are more standardised and established than the fast-moving blockchain tech space is certainly a good explanation for why this more careful approach has been chosen. At the same time, other consortium members such as Fraunhofer Gesellschaft are standing at the origins of IDSA and have a very good understanding of the Data Spaces approach.

This first major decision about the direction of Catena-X could be described as a rather political decision by the Catena-X leadership to not propagate the use of blockchain tech at the time when it was tainted by the above-mentioned scandals. Nevertheless, as a consequence, the idea of establishing data markets and more advanced functionalities early on was also abandoned.

In the meantime, the use of blockchain technology might start at the level of SSI-based identity services – which are also required to model end-to-end processes in the automotive supply chain.

Outlook

Catena-X seems to be on a solid path towards a future where intelligent, interconnected ecosystems redefine the entire lifecycle of automobiles, from design and manufacturing to servicing.

The transition of 'power' to the member-based Association and the drive that the newly-formed Cofinity-X GmbH[33] will bring to operations of Catena-X services and use cases will be the decisive aspects in 2024 and 2025. This evolution will show if Catena-X can progress and establish an inclusive, open and globally leading group.

As far as blockchain tech is concerned, the future will show if it can become a relevant part of future Catena-X approaches and the expansion of that universe. However, it could offer a range of benefits, including enhanced data integrity through immutable record-keeping, streamlined processes via smart contracts, heightened security features, and a thorough alignment with the decentralised nature of Catena-X. The transparent and traceable characteristics of blockchain contribute to improved audibility and accountability, while potential tokenisation presents opportunities for representing ownership or facilitating transactions and establishing data spaces along the automotive material and supply chains. Despite these advantages, careful consideration of scalability, interoperability, and participant consensus is crucial to ensure successful integration in alignment with Catena-X's goals and industry standards. By leveraging blockchain technology, Catena-X has the potential to enhance the integrity and security of its data exchange, automate and enforce agreements through smart contracts, and establish a decentralised framework that aligns with its mission of fostering trust,

[33] https://www.cofinity-x.com/.

ensuring interoperability, and maintaining data sovereignty within a reliable and collaborative automotive data ecosystem.

In any case, it will be important to not rule out any technology, but to keep the automotive and broader industrial ecosystem open and forward-looking. From our perspective, it will be hard to manage sector-coupling around charging and circular system requirements, ESG reporting duties and other relevant, data-based aspects of the future automotive industry without a feature-rich industrial process backend.

As a closing remark, this quote by some colleagues from Fraunhofer that have examined the potential of blockchain tech in the IDS context will certainly do and hopefully inspire all current and future Catena-X participants to revisit all challenges with a focus on the capabilities different technologies can add to the table – this will also be triggered by the shifts the adoption of AI will bring as well to streamline business operations: 'Blockchain has the potential to ensure data consistency and transparency in combination with the general IDS approach for data sovereignty as well as secure data exchange and sharing owners in order to turn data into business assets.'[34]

Contact Persons

The contact persons for Catena-X are Oliver Ganser[35] (Chairman of the Board) and Prof. Dr.-Ing. Boris Otto[36] (Deputy Chairman of the Management Board).

Website

https://catena-x.net/

[34] "Designing Data Spaces", Chapter 10: Blockchain Technology and International Data Spaces | SpringerLink (Wolfgang Prinz, Thomas Rose & Nils Urbach), https://link.springer.com/chapter/10.1007/978-3-030-93975-5_10.
[35] https://www.linkedin.com/in/oliver-ganser-5842067a/.
[36] https://www.linkedin.com/in/boris-otto-5701b51/.

Manufacturing-X

The Facts

Industries are undergoing digital transformation alongside the rise of digital ecosystems, post-industrialisation and automation. In response to this shift, Manufacturing-X, a collaborative effort involving industry, science, and the German government has been initiated under the Gaia-X 'umbrella' to address manufacturing challenges, such as global crises, supply chain disruptions, and regulatory demands. It focuses on spearheading digital and environmental transformation, strengthening resilience, enhancing competitiveness, and promoting sustainability by establishing an autonomous data space and asset administration shell for Industry 4.0, integrating SMEs, and adhering to and developing global standards, e.g., for digital twins.

Project Funding

The first funding project approvals are planned for early 2024, where triple-digit million euros are available for project funding and administration until mid-2026.

Main Project Goals

The initiative forms a broad alliance of companies, associations, and politicians to establish a trustworthy data ecosystem that guarantees the digital autonomy of companies. Aligned with the German government's Digital Strategy, it emphasises cross-industry initiatives for resilience, sustainability, and competitiveness.

The consortium aims to secure digital autonomy, prevent SME dependency on dominant global platforms, and enhance supply chain management efficiency and flexibility. It aims to demonstrate the harmonious coexistence of ecology and economy through intelligent networking, data integration, and multilateral data exchange, promoting data-driven solutions and new digital business models for greater production efficiency and flexibility. Ultimately, the initiative aims to bolster the EU's global competitiveness while advancing climate neutrality and sustainability.

Role in the EU and Beyond

Manufacturing-X plays a central role in growth and prosperity in Germany and Europe. The broader Industry 4.0 initiative[37] that it is based upon emphasises Germany's commitment to digital transformation and tries to support the country's role as an important driver for the European economy.

Membership & Participation in the Initiative

Several companies, initiatives, and institutions are represented on the Manufacturing-X Steering Committee, moderated by the Federal Ministry of Economic Affairs and Climate Protection. The most important participants include BMBF (Federal Ministry of Education and Research), BDI (Federation of German Industries), Bitkom, Bosch, Catena-X, Deutsche Telekom, Fraunhofer e.V.,

[37] See https://www.plattform-i40.de/IP/Navigation/EN/Industrie40/WhatIsIndustrie40/what-is-industrie40.html.

ISTOS, Phoenix Contact, SAP, IDTA (Industrial Digital Twin Association), Schunk, Siemens, Trumpf, VDMA (Mechanical Engineering Industry Association) and ZVEI (German Electro and Digital Industry Association). The participants are committed to driving the digital transformation of industries as part of the overarching initiatives made possible by the Industry 4.0 platform.

The Consortium's Structure and Evolution of the Project

Manufacturing-X as a lighthouse project of the German government is overseen by the Ministry for the Economy and Climate Protection. It was publicly launched in early 2024, and the project structure is still in an early phase.

The initiative sees itself as a decentralised platform. It emphasises the shift from an 'egosystem' to an ecosystem for better scalability in the manufacturing industry, focusing on SMEs. The first milestone involves implementing user-friendly use cases and conducting user testing. A lighthouse project will create the technological foundation, targeting interoperability for future projects.

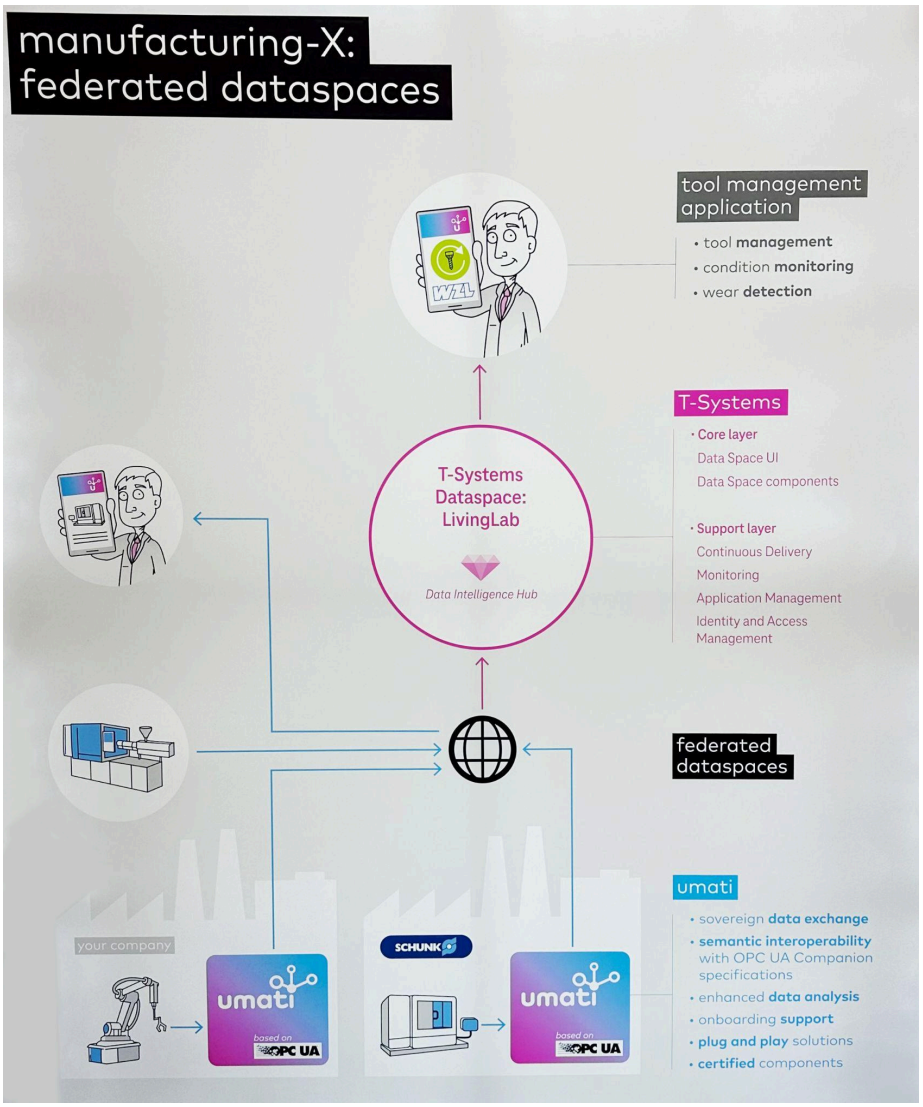

Figure 8: Structural overview from the member's perspective about Manufacturing-X's setup in the first year. Source: Manufacturing-X display at Hannover Messe 2024.

Current Status: Technology & Standards

Despite this progress, there is reluctance within the Manufacturing-X community to introduce blockchain technology and Self-Sovereign Identities (SSI) due to complex and sensitive data structures and a lack of established thinking. This is surprising, given the theoretical preference for decentralisation in establishing an open and shared data space. Although Manufacturing-X aligns with Web3 values of decentralisation, verifiability, and security, blockchain technology is not currently at the forefront of ongoing discussions, largely stemming from the fact that Manufacturing-X is based on the tech approach selected by Catena-X. The path to blockchain adoption involves ongoing cultural, technical, and practical discussions and considerations – but at least current project partners are looking into Web3 technologies for the future evolution of their members' business. This might also influence the future decisions of this consortium.

The Outlook

Blockchain technology could support Manufacturing-X to build an immutable and transparent data history that guarantees the integrity of information. Decentralisation also increases reliability and minimises the risk of data manipulation. Self-managed identity enables secure and user-centric identity data management, empowering users with data protection and control.

Implementing blockchain and SSI could create a trustworthy and efficient data infrastructure meeting both current and future requirements of Industry 4.0 projects and Manufacturing-X. Blockchain's decentralisation allows for greater scalability, security, and flexibility, moving away from central control points. Not only for transparent and traceable supply chains, but especially for the area of hyper-connectivity and an additional level of automation that will include financial settlements as well as ESG reporting of machine activities. Blockchain and SSI are recommended to be examined in detail as technical solutions for the Manufacturing-X consortial project.[38]

Contact Persons

To get in touch, please email manufacturing-X@plattform-i40.de.

Website

https://www.plattform-i40.de/IP/Navigation/EN/Manufacturing-X/Manufacturing-X.html-

[38] List of references can be found below:
BMDV. (2022). Manufacturing-X baut den Datenraum für Industrie 4.0. Bundesministerium für Digitales und Verkehr.
BMWK. (2022). Whitepaper on Manufacturing-X. Plattform Industrie 4.0.
BMWK. (2024). Plattform für Industrie 4.0. Retrieved from Steering Committee Manufacturing-X: https://www.plattform-i40.de/IP/Navigation/DE/Manufacturing-X/Steering-Committee/steering-committee-manufacturing-x.html
Böhler, T. (2023, October 23). Großprojekt: Alles zur Initiative Manufacturing-X. Retrieved from Produktion: https://www.produktion.de/veranstaltungen/deutscher-maschinenbau-gipfel/grossprojekt-alles-zur-initiative-manufacturing-x-909.html
Dr. Heister, R. (2023, 19). Blockchain and Manufacturing-X. (K. Preikschat, C. Urbaczek, & C. von Alten, Interviewers)

CIRPASS

Facts

CIRPASS stands for Collaborative Initiative for a Standards-based Digital Product Passport for Stakeholder-Specific Sharing of Product Data for a Circular Economy. As such CIRPASS was called into life in October 2022 to prepare the ground for the gradual piloting and deployment of a standards-based Digital Product Passport (DPP) aligned with the requirements of the Proposal for Ecodesign for Sustainable Regulations (ESPR) - with an initial focus on the electronics, batteries and textiles. Another goal was to provide an objective source of information for the EU Commission and all stakeholders involved.

Project Funding

The CIRPASS project has been funded by the European Commission under the Digital Europe Programme.

Main Goals

The goals of the 18-month project were to create a clear concept for the DPP, defining a cross-sectoral product data model and DPP system with demonstrated benefits for the circular economy as well as developing roadmaps for its rollout.

More specifically the goals have been as follows:

- Present an unambiguous cross-sectoral definition and description of DPPs.
- Define a cross-sectoral product data model for DPPs with demonstrated usefulness for the circular economy.
- Propose an open DPP data exchange protocol adapted to the needs of circular economy stakeholders and propose such a protocol based on up-to-date digital technologies.
- Build stakeholder consensus on key data for circularity and related open European and global vocabulary standards to be included in the DPP for the batteries, electronics, and textiles value chains.
- Develop use cases and roadmaps for piloting, deployment, and circular business value generation of cross-sectoral DPP.

Membership and the Participation of the Consortium

The CIRPASS consortium consisted of 31 consortial partners and additional partnerships with different industrial, research, digital, and international standards organisations across Europe and beyond. These are: CEA, SLR, Fraunhofer, Wuppertal Institut, Chalmers Industriteknik, DKE, GTS, +ImpaKT, F6S, ERCIM, E Circular Aps, GS1 in Europe, Politecnico Milano, Circular Fashion, Digital Europe, InnoEnergy, TUDelft, TalTech, Veltha, Energy Web, BAM, SyncForce, Innovalia, Textile Exchange, RBA, Worldline Mint, RISE, iPoint, GEC, atma.io, and Global Battery Alliance. The members can be divided in different categories, namely research institutions and universities, industry and business associations,

technology and software providers, standards and regulation bodies as well as consulting and advisory firms.

Each category of members contributed unique expertise, resources, and perspectives to advance the development and implementation of DPPs for circularity and sustainability across industries and their collaboration has been essential for the success of the project.

The Consortium Structure and Evolution of the Project

The CIRPASS project consortium partners represented thousands of industrial, research, digital, and international standards organisations across Europe and beyond. Additionally, a growing stakeholder community was established, leading to hundreds of CIRPASS newsletter recipients, workshop participants and thousands of website visits each month.

To engage in the CIRPASS project and to contribute to the development of DPP concepts, stakeholders were able to e.g. participate in a benchmarking survey, analysing more than 80 DPP-related initiatives.

Additionally, partners were providing information requirements for DPP in specific sectors in the first phase of CIRPASS.

CIRPASS held its final event[39] in March 2024, and a second CIRPASS 2 project was launched in May. This new follow-up programme aims to work with DPPs in 13 pilots, showcasing the system's functionality in real-world environments. These pilots are also meant to show interoperability and enable cross-sectoral data management which is essential for circular models like reuse, repair, and recycling.

Technology & Standards

The initial CIRPASS architecture principles in discussion have been described by Carolynn Bernier, the CIRPASS project coordinator as follows: 'The DPP is a mandatory set of data extracted from an extensible knowledge graph who's root node is the unique product identifier.'[40] One of the conclusions of CIRPASS was also to ensure that such a DPP system can be enriched later on, since voluntary data sets or data mandatory in some regions of the world, but not in others will need to be taken into account.

In this context, blockchain technologies were seen as a potential enabler for certain applications, but not as the core technology. Standardised components such as IDSA connectors are also foreseen to connect the new DPP framework to legacy, corporate IT systems, allowing for the extraction of data. Data is also meant to remain where it is created, allowing DPP providers to keep control of their data. As a conclusion, access right permissions to the data must be role-based.

[39] See https://cirpassproject.eu/cirpass-final-event-march-5th-2024/.
[40] https://www.scribd.com/document/662148862/Bernier-2023-06-12-EU-Webinar-CIRPASS.

Outlook

The launch of CIRPASS 2 and its objective to pilot 13 lighthouse projects is certainly an important step to manifest a credible and sustainable DPP ecosystem that will allow producers and industries to comply with the incoming regulation. And as part of the global economy, we will need data-driven models and processes to master various challenges, from recycling of materials to using incentives to change the behaviour of consumers and producers alike.

Looking at CIRPASS 2 from a blockchain tech adoption perspective, it is encouraging to see that out of the selected lighthouse projects some are based on blockchain tech, e.g. OBADA for IT asset disposition, working on it as a DAO.[41]

Contact Persons

To reach out, the contact form available on their website can be used: https://cirpassproject.eu/contact/.

Website

https://cirpassproject.eu/

[41] See https://www.linkedin.com/company/obada/.

TLIP

The Facts

The Trade and Logistics Information Pipeline (TLIP) was initiated as a cooperation between the IOTA Foundation and TradeMark Africa (TMA) in 2020. As an 'aid-for-trade organisation' committed to improving trade conditions for increased regional prosperity, TMA seeks to promote and harness digital solutions to challenges faced by traders in the region. The TLIP partnership was born as an idea to reshape global trade by bringing all stakeholders in cross-border processes together through a system built on IOTA's distributed ledger technology (DLT) that enables smooth and secure data sharing.

Project Funding

While TMA's role in the partnership is focused on funding of the initiative as well as stakeholder engagement, IOTA is the technology provider and implementer of the project.

Main Project Goals

The lack of an efficient digital mechanism for information exchange between parties is one of the key challenges facing international trade. Despite the rapid developments in emerging technologies, digital exchange of data between systems is not yet very advanced. While a cross-border transaction involves multiple actors and requires on average the exchange of 36 documents and 240 copies, fewer than one percent of trade documents are fully digitised. In the absence of a truly digital, interoperable infrastructure, even organisations with advanced internal digital systems and processes need to resort to converting their digital information to a paper-based document such as PDF to share it externally. Not only is the manual process of external documents sharing highly susceptible to human error, but also to fraud, loss and damage. This is costly, inefficient and lacks transparency. The consequences are many: from delays that contribute to the loss of perishable goods and hampers competitiveness to the inability to trace the source of errors in the case of a problem.

Understanding TLIP

As a response to these challenges rooted in the manual external sharing of data, TLIP aims to modernise and streamline cross-border operations through the seamless exchange of digital data and trade certificates across borders, government agencies, traders, and logistics.

TLIP is essentially a digital, collaborative infrastructure that acts as a bridge closing the connectivity gap between all different actors involved in the global trade supply chain. The principle of making all data available from the source and thereby enabling data sovereignty is central to the TLIP infrastructure. Rather than requiring the installation of new software and the abandonment of legacy systems, TLIP is integrated with other organisations' systems through APIs and pulls data directly from the source. Digital signatures and encryption ensure trust and security of the digital data, while also making each actor accountable. IOTA's DLT powering TLIP ensures features inherent to the technology such as

immutability and auditability of data and trade documents. Authentic documents can be presented in various formats such as PDF and JPG, as well as in the form of W3C Verifiable Credentials, using decentralised identities for issuers recorded on the blockchain. Using blockchain technology for these credentials is essential for ensuring data integrity and preventing denial of origin. Moreover, the decentralised structure provides each actor with full control of their data and permissions for sharing.

TLIP is not operated by central actors controlling access or use of the system, hence distinguishing itself from classic supply chain platform setups that allow certain actors to control the data.

TLIP in Action

TLIP was initially tested in flower export processes from Kenya to the Netherlands. Kenyan flower traders and freight forwarding partners used TLIP to share key trade documents, which provided a single source of truth for these documents, thereby covering gaps in the supply chain. TLIP is digitally integrated with Kenya Revenue Authorities (KRA), the Kenyan Single Window System KenTrade and Kenya Plant Health Inspectorate Service (KEPHIS), i.e. the Kenyan phytosanitary agency. Through a pin code that serves as authentication with the KRA, Kenyan traders can identify themselves and automate the access to the data held by these systems, e.g. the Export Certificate, Certificate of Origin, and the Phytosanitary Certificate.

The integration with Kenyan government agencies and successful trials of flower trade processes made TLIP a relevant candidate for other pilot programmes targeting the data sharing of cross-border processes: in 2022, it was selected to participate in the Ecosystem of Trust trials[42], a visionary model for 'frictionless' trade tested by the UK government as part of their 2025 Border Strategy. The consortium, led by the UK Institute of Export & International Trade and including global trade players such as DFDS, Nomad Foods, MCP, ECS, and DFG, used TLIP as an infrastructure to capture and share important trade data during the trials. During these trials covering a variety of commodities – coffee, tea, flowers, fish, and canned food – between the UK, Kenya, and the EU, TLIP demonstrated its great capability to improve the efficiency of global trade processes. TLIP's seamless integration with the KenTrade Single Window System proved to be one of the most powerful advantages. Thanks to this integration, TLIP expedited access to vital trade documents, including the electronic phytosanitary certificate (ePhyto) and the export declaration, allowing UK border agencies to retrieve information in a mere 3–5 minutes – weeks before export goods reached the UK border. Moreover, the trials stretched beyond sharing of trade documents and also incorporated the use of electronic seals on containers, examining TLIP's ability to record crucial events, including the time and location of seal application, seal checks, and any unauthorised attempts to open seals during transport. Exposing APIs conformant with core data standards such as the UN/CEFACT[43] and

[42] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1180988/Ecosystem_of_Trust_Evaluation_Report_August_2023.pdf.
[43] https://vocabulary.uncefact.org.

GS1 EPCIS 2.0[44] standards, TLIP enables any actors to share all relevant types of data and events. This allows any detail of a trade consignment such as port release status, digital seal on the container, location data, auditing evidence, etc. to be added for a complete overview in real-time.

Outlook

TLIP's future plans involve leveraging the numerous capabilities of DLT particularly in handling transferable records. For instance, trade documents like Bills of Lading can be represented as NFTs, and smart contracts can be utilised for the transfer process to prevent the risk of double spending. Another example is tokenising key trade documents and implementing a risk engine for trader evaluation, based on data analytics providing insights into previous performance and trade success among supply chain actors.

On a higher level, the IOTA Foundation and TMA elevated their partnership by signing a Collaboration Agreement[45] on TLIP with the World Economic Forum, the Tony Blair Institute for Global Change, the Institute of Export and International Trade and the Global Alliance for Trade Facilitation in February 2024. Through the Collaboration Agreement, these organisations committed to advancing a collective vision for TLIP as a neutral, open, non-profit, and inclusive digital platform for sharing trade data. As a first step towards collaborative governance structure, the agreement aims to bring together signatory organisations with other stakeholders, both public and private, from across the globe. Going beyond individual interests, the objective of this framework is to create an environment where collaboration thrives, and digitally powered ecosystems can be developed for the shared benefit of everyone.

Contact Persons

To reach out, please contact Åsa Dahlborn[46].

Website

https://www.tlip.io/

https://www.linkedin.com/company/trade-and-logistics-information-pipeline/

https://medium.com/@tlip.io

[44] https://ref.gs1.org/epcis/.

[45] https://medium.com/@tlip.io/tlips-vision-for-seamless-trade-gains-momentum-with-collaboration-agreement-6f202171111cf.

[46] https://www.linkedin.com/in/%C3%A5sa-dahlborn-4151a399/.

4. Energy & Grid Management

Since the energy system is undergoing the greatest upheaval in decades, and in order to achieve climate neutrality, renewable energy development projects worldwide must be expanded massively. Instead of a few large power plants as in the past, electricity will increasingly be generated by a large number of wind turbines, solar parks and also small roof and balcony solar systems that are spread across hundreds of thousands of locations. Specifically, this means that there will be more and more decentralised systems with a relatively low individual capacity of power generation. On the consumer side, charging stations for electric vehicles, heat pumps or home storage must also be integrated into the system.

In the early stages of blockchain development, the technology faced considerable scrutiny and criticism, primarily due to its perceived high energy consumption associated with Proof of Work (PoW) consensus algorithms. Recent advancements in blockchain design and the increasing popularity of Proof of Stake (PoS) blockchains have alleviated these concerns[47] though, and blockchain technology is now starting to position itself as an important puzzle piece in enabling the worldwide renewable energy transition among others through the verifiable labelling of electricity[48] or tokenisation of energy information for use along the supply chain[49].

To exemplify this paradigm shift, we shed light on consortial industrial projects and initiatives that leverage blockchain to enhance energy and grid management through the integration of decentralised flexible (data) assets, exemplifying the optimisation of energy production and consumption as well as grid management in a decentralised, secure, affordable and sustainable energy system of the future.

[47] Deutsche Energie-Agentur (Publisher) (dena, 2023) “Rethinking Blockchain’s Electricity Consumption – A Guide to Electricity- Efficient Design of Decentralized Data-Infrastructure”.
[48] Sedlmeir, J., Völter, F., & Strüker, J. (2021). The next stage of green electricity labeling: using zero-knowledge proofs for blockchain-based certificates of origin and use. ACM SIGENERGY Energy Informatics Review, 1(1), 20-31.
[49] Babel, M., Gramlich, V., Körner, MF. et al. Enabling end-to-end digital carbon emission tracing with shielded NFTs. Energy Inform 5 (Suppl 1), 27 (2022). https://doi.org/10.1186/s42162-022-00199-3.

Digital Identities as Trust Anchors in the Energy System (DIVE)

The Facts

The energy system is becoming more and more decentralised through small scale electricity production (e.g. photovoltaics) and consumption (e.g. electric vehicles or heat pumps). Owners of small power generation 'plants' either consume the electricity themselves or feed it back into the grid. Therefore, devices must be suitable for all these operational modes. In terms of an efficient energy system, the change between these applications has to be automated: If a feed-in is required for grid stability, it is automatically determined whether the decentral plant is available or not. A manual change is error-prone, expensive and does not offer the necessary flexibility and speed. Applied to the millions of production devices in our energy system, a digital and highly secure solution is required.

Project Funding

The DIVE project is led and funded by the Future Energy Lab of the German Energy Agency (dena), a subsidiary of the German Federal Ministry for Economic Affairs and Climate Action. Project Partners are Fraunhofer FIT, Forschungsstelle für Energiewirtschaft e.V., Energy Web, OLI Systems, BOTLabs, and fieldfisher. The project was launched in June 2023 and runs until December 2024.

Main Project Goal

The aim of the DIVE project is to build on the knowledge gained from the previous dena project 'Blockchain Machine Identity Ledger' and to test decentralised identity management using application-oriented scenarios. Specific use cases that are tested in the project are proof of origin, the participation of small systems in flexibility markets and the rapid change of suppliers at e-charging stations. In addition, all steps up to a broad implementation are presented in a transformation path, so that it is possible to build an ecosystem and roll out further applications.

Ecosystem Partner Evolution

The core consortium of the DIVE project consists of the research partners Fraunhofer FIT and Forschungsstelle für Energiewirtschaft, the legal partner fieldfisher and technical partners Energy Web, OLI Systems, and BOTLabs.

Over the course of the project, notable associated partners have joined to support the development of the DIVE ecosystem and its application to practical use cases. Among others, these include three of the four German transmission system operators, Tennet, TransnetBW, and 50hertz, the Ulm University of Applied Sciences as well as different private stakeholders from the energy domain, such as Charging Radar, Numbat, Equity, and SMA.

Current Status: Solutions & Services

To allow for the automated integration of decentralised electricity devices into different energy systems services, however, trust and the certainty that a plant actually exists and can feed in a certain amount of electricity at a certain time are needed. This is where the project DIVE comes into play: The project investigates how systems or devices in the energy system can be equipped with secure digital identities. It will also clarify which structures are required for the associated identity management.

Current Status: Technology & Standards

The Role of Digital Identities: A digital identity consists of a unique number (e.g. identity card number, ID) and further properties (e.g. name, place of residence), with the difference that it exists and is managed digitally. As with an analog identity, a digital identity has recognised authorities that can issue and revoke the identity or certain associated attributes (e.g. a driver's licence). The aim is that the verification of an identity and the associated properties (does the system actually exist? Are the specified properties such as the power and the location true? Is the system actually available?) can be automated in the energy system of the future. This ensures, for example, that the system is not scheduled for two applications at the same time and enables switching between different use cases almost in real time. For customers in particular, this can mean significant cost savings, for example, if excess electricity in the grid is absorbed by their own home storage system or the PV roof system feeds in during bottlenecks.

The Role of Blockchain: In the context of DIVE, blockchain technology plays a vital role as trust anchor for the digital identities. For once, in the pilot phase of the project, decentralised identifiers (DIDs) anchored to a blockchain will be used to provide verifiably unique identities in the energy sector. Independently of whether digital identities use DIDs or other, non-blockchain identifiers, blockchain can provide additional functionalities in the operation of a digital identity system for the energy sector. As such, blockchains can provide publicly available and verifiable signature and revocation registries which can serve to verify the signers of information as well as the validity of their claims.

The Outlook

The project aims to facilitate the integration of decentralised energy devices into several energy systems use cases, e.g. the automatic delivery of balancing services for grid stability. Preliminary results of the project's research, development, and testing will be made available through whitepapers and project publications in the coming months.

Contact Persons

If you are interested in participating in DIVE or similar projects, feel free to contact Prof. Dr. Jens Strüker at jens.strueker@fit.fraunhofer.de.

Website

https://future-energy-lab.de/projects/dive-de/

Energy Data-X

The dena-ENDA project (ENDA is an acronym for both the German term ENergieDAtenraum and the English term ENergy DAta Space) was awarded to a consortium consisting of ifok GmbH, Bonn Consulting (BC), innogence business consulting (ibc) and Fraunhofer FIT by the German Energy Agency (dena) as part of the Future Energy Lab commissioned by the German Federal Ministry of Economics and Climate Protection (BMWK). The dena-ENDA project depicts the first steps towards an energy data space for a data-based, digital energy industry.

About Data Spaces

Data spaces enable the decentralised exchange of data between the actors involved and can thus contribute to the development of new business models and services and lead to a data economy. Following the European data infrastructure project Gaia-X and the International Data Spaces Association (IDSA), sector-specific data spaces will be established at national and European level. Against the background of the energy system transformation and the need to open up further flexibility options in the energy system, the main objective of the dena-ENDA project was to develop a showcase for sovereign data exchange between different stakeholders in the distribution grid to complement existing initiatives and thus demonstrate the benefits of an Energy Data Space. The selected showcase together with other discussed use cases and the additionally generated knowledge can contribute to other (Energy) Data Spaces projects.

The Potential Role of Blockchain Technology

As with other data space projects, blockchain technology may offer significant value to the implementation of dena-ENDA. For one, the immutable record of distributed ledgers would enable enhanced data integrity, while privacy enhancing technologies such as zero-knowledge proofs would maintain the confidentiality of potentially sensitive information. In addition, blockchains would enable decentralised digital identities, as demonstrated in the project DIVE. In the context of data spaces, these can be used to identify not only decentralised assets in the energy market, but also organisations and individuals involved in data sharing. Finally, smart contracts would allow for the implementation and enforcement of rules regarding the sharing of information (e.g. to whom data should be visible, what terms of use apply, etc.). Overall, blockchain technology may contribute to a more valuable exchange of information in an energy data space, as proposed in the dena-ENDA project.

Contact Persons

Maarten Abbenhuis[50], Dr. Arina Freitag[51], and Tim Meyerjürgens[52] are the designated contact persons.

Website

https://www.energydata-x.eu/

[50] https://www.linkedin.com/in/maartenabbenhuis/.
[51] https://www.linkedin.com/in/dr-arina-freitag-b254765b/.
[52] https://www.linkedin.com/in/timmeyerjürgens/.

2Tokens Power of the Many

Energy Tokenisation – Enabling fractional ownership of energy resources through a decentralized infrastructure.

Shared ownership of solar panels: The initial issue identified was to devise a method for accessing energy generated by solar panels located off one's own roof, enabling individuals to utilise energy produced by others' panels and reap the benefits. This concept is also known as virtual rooftop solar panels.

Consumers can play a much more active role in the industry. Right now, there's the idea that they're at the very end of the value chain, paying every bill that lands on their doorstep. This can change when they become much more active and move further up the value chain by owning their own source of clean energy. By owning solar panels themselves, they can become part of the transition itself. The consumer should not be seen as a simple, passive receiver of electricity, but rather as a much larger, more active agent in the ecosystem, Energy Citizenship[53]. That's where energy communities will play a crucial role. That's where the potential for large-scale deployment lies.

About 2Tokens Foundation: Founded in 2019, 2Tokens aims to achieve a shared understanding of the token economy. The ultimate goal of 2Tokens is to provide clear rules and guidelines for tokenisation, fostering a common perspective and understanding of the benefits within the European community. Together with relevant industry partners, 2Tokens strives to inspire change. The 2Tokens foundation is a public interest initiative supported by the European Regional Development Fund and by a diverse community of technology companies, policymakers, financial advisors, banks, legal and regulatory experts, and academia.

As an impartial entity, the 2Tokens foundation ensures that societal interests take precedence over the commercial interests of the stakeholders, and it oversees the development of the token taxonomy. International cooperation can be started through partnerships.

Main Project Goal

The goal of the project is to validate the benefits of the application of tokens to support the energy transition. The validation aspects are in the domains of energy, finance, regulation, and social adoption.

The Facts

In 2023, 2Tokens released an updated version of the 'Power of the Many' whitepaper[54] on fractional ownership of energy resources through a decentralised infrastructure. This document focuses intensively on laws and regulations, and places a lot of emphasis on sensor technology and token engineering value models. This led to the nomination of the project for the prestigious 'gouden zandloper' Legal Award[55]. An agreement was made with the municipality of

[53] https://energy.nl/wp-content/uploads/schlindwein-2023-energy.pdf.
[54] https://share.hsforms.com/1wzRBAsBTSTqdras-srvdbQ4tojo.
[55] https://www.goudenzandlopers.nl/genomineerden-2023/.

Ameland[56] and the local energy cooperative 'Amelander Energie Cooperatie (AEC)'[57] to apply the 'Power of the Many' solution on the island. This marks a follow-up to the Energy Token project and a previous pilot at the Green Village[58] in Delft.

A logical next step is to support self-consumption of the owned solar panels in the farm. This is phase 2 of the project and will be closely aligned with the new energy law that needs to come into power as national implementation of the EU mandate (Article 22 of the Renewable Energy Directive, RED II).

In addition to the fractional ownership of solar panels, there is a demand from the market, partly due to European energy legislation, to also create kWh tokens so that peer-to-peer energy can be exchanged between users. This is particularly interesting for 'local for local' applications. The issuing of kWh tokens can be implemented based on the smart meter information at the household level as well as the solar farm level; by adding sensors on the solar panel, that mark the energy produced, other applications and tokens can also be developed, such as carbon offset tokens[59].

The Objective

At the end of November 2023, 'Power of the Many' was showcased at the ENLIT trade fair in Paris, garnering considerable interest there. Numerous initiatives across Europe are being launched in this domain, attracting significant investment. Following discussions with the energy and ICT sectors, it became apparent that there is a demand for a platform to assist project developers, energy cooperatives, and others in this field to enable more wide-spread energy tokenisation.

Prominent players in the energy sector joined the 2Tokens Tokenisation Working Group, contributing to workshops, hackathons and discussions. There's a recognised need for enhanced collaboration across energy, finance, legislation, and technology sectors. Concurrently, there is an initiative to test new hardware (solar panels and sensors) and software on a smaller scale in the controlled setting of The Green Village.

As a next step, learnings and achievements will be published and presented in more detail in 2024. The international expansion of the project, based on active partnerships with industry players in Germany, Italy, Portugal, Belgium is underway.

Scope

Going forward the focus lies on implementing energy tokens in cooperatives, communities, and business parks. 2Tokens envisions a future with decentralised energy systems in which people are empowered as prosumers: a new way to involve citizens in the energy transition. Citizen investments in renewable energy generation assets reduce NIMBY (not-in-my-backyard) behaviour, support

[56] https://en.wikipedia.org/wiki/Ameland.
[57] https://www.amelandenergie.nl/.
[58] https://www.thegreenvillage.org/en/.mee
[59] https://energytag.org/.

inclusion, and avoid greater inequalities caused by the energy transition. Energy Communities adopting fractional ownership concepts allow citizens who are unable to install rooftop solar – due to multi-family housing, monuments, or other restrictions – to enjoy the benefits of owning or co-owning solar power installations. The developed solutions increase the use of solar energy, lower consumer bills, alleviates energy poverty and increases energy security and independence as a side effect.

The current energy system comprises an electrical layer with various digital, transactional, and financial intermediate layers. Tokenisation offers an ideal solution to streamline these layers and develop applications addressing energy crisis challenges. By utilising 'crypto anchors' as detailed in the Power of the Many paper, energy assets like solar panels can be traced throughout their lifecycle, essential not only for ownership tokenisation but also for circular system tracking. The European Union emphasises citizen involvement in the energy transition through initiatives like Energy Communities and local ownership, aligned with the Climate Agreement. This agreement ensures equitable collaboration between environmental and market parties in developing renewable energy projects, aiming for balanced ownership distribution by citizens and businesses in the vicinity of solar parks or wind farms by 2030.

Ecosystem Partner Evolution

Supported by a diverse coalition of companies, fellows and institutions, 2Tokens engages diverse sectors. The coalition consists of many partners representing different industrial, research, digital, and international standards organisations across Europe and beyond. These partners are The Green Village, The Port of Rotterdam, Eversheds-Sutherland, Bausch Datacom, Ritter Starkstrom, Riddle&Code, Erasmus University, Catena Investment, Sunified, ABN AMRO Bank, Assetblox, Prosume.io, GBBS, ITSA and many others. A full list can be found at https://www.powerofthemany.org/.

Role in the EU & Beyond

The 2Tokens foundation has its roots in Europe and proudly supports numerous international participants and collaborators. 2Tokens aligns its concepts, models and implementations to European applications with input by participants from countries like Germany, Austria, Italy, and France. With participation at the annual Enlit energy conference, the Energy Token Working Group creates broad visibility.

Participation in the Consortium

A community of partners is supporting the 2Tokens foundation with knowledge, funds, time and materials. Partners have a number of benefits from joining such as participation in meetings, roundtables and events. Participation varies from individual ‘Fellows’ to corporate partnerships as well as enrollment fees to the 2Tokens Masterclasses and expert sessions. Since the foundation is a non-for-profit initiative with a public charter, activities are also financed from public funds and through the help of many volunteers.

The Consortium's Structure

The consortium is a legally registered foundation in the Netherlands, governed by a 5-member executive board overseeing strategy and daily operations. An Advisory Board contributes expertise from academia, law, and finance. A Supervisory Board ensures oversight, while a community of partners offers support and benefits. Tokenisation's multidisciplinary nature requires engagement from various societal sectors, reflected in the foundation's participants. Working Groups, managed by captains, focus on different streams like technology and legal aspects, with outcomes shared publicly by consortium partners.

Impact

The impact of the project on the economy translates into local and regional new activities. There will be various investment projects related to the energy transition, such as hydrogen, wind/solar and battery storage. The energy token project is an important digitalisation foundation that makes the smart multi-commodity grids possible. Tokenisation of energy makes shared assets possible, which makes new forms of financing possible for cooperatives. This decentralised form of (crowd) funding will accelerate the energy transition.

The crypto anchors utilised in the projects serve as Guarantees of Origin, offering real-time visibility into energy production volumes and taxonomy. This facilitates precise and rapid calculation of CO2 reduction. Tokenising the kWp (peak) of solar panels allows for peer-to-peer energy exchange. Tokenisation of energy yields political and economic advantages, including efficient tax collection, GDPR compliance, enhanced security, transparency, and auditability.

The solution enhances the balance of the energy grid through distributed means, thereby bolstering social resilience and energy security. In essence, we require a new energy system that not only achieves net zero emissions but also guarantees supply, stability, and affordability simultaneously. Achieving these objectives necessitates a revolutionary digital transformation of the grid as we transition towards a low-carbon economy.

From Consumer to Prosumer

We advocate for consumers to share the advantages of owning clean energy, providing them with affordable electricity, particularly during periods of high energy prices. By integrating consumers into the system, a direct connection between consumption and energy generation can be established, leveraging the benefits of smart home energy technology. In the energy sector, scale is crucial; large-scale projects are significantly more cost-effective than smaller ones. Energy tokens offer a platform where thousands of individuals can collectively own large-scale assets, benefiting from inexpensive electricity generated by wind or solar farms. Unlike centralised coal, gas, or nuclear power plants, decentralised renewable energy sources, such as solar panels, enable collective ownership.

Current Status

The fractional ownership concept has been implemented by two commercial parties and available for wider adoption. The working group specifies the token definition using the GBBC Token Taxonomy Framework and leaves it to commercial parties to implement these tokens on their technology stack of preference.

DockLab has created the ILSA platform that is fully compliant with Dutch regulation for ownership provenance and ownership transfer.

AssetBlocks is a platform fully compliant with German and UK regulation and offers ownership in solar farms in Germany and UK.

Challenges

It will be a challenge to serve the consumer market on a large scale with fractional ownership in solar farms. Gigawatts and eventually Terawatts of solar and storage projects are coming online. To facilitate scale, consumer ownership should be built into large assets that are already on the market. Ideally, a new category of digital energy assets will be included in the current laws and regulations, which will also create clarity for the tax authorities. The energy token will play a key role in this.

At the same time, energy cooperatives have a different role. They are 'uncomfortable' with their high profits and want to start supplying their members at cost price. Members also want to decide for themselves what should be done with their share of electricity generated. To this end, a mechanism will have to be built in to make energy and energy offtakes more 'programmable'. If the cooperatives succeed in matching the supply and demand of electricity at any time of the day, then the members will be the winners. Because then they always get electricity for a low price. The (or multiple) energy token(s) will play a key role in this.

The Outlook

In collaboration with industry stakeholders, 2Tokens strives to develop best practices facilitating the integration of ecosystem software and hardware for established energy infrastructure firms, grounded in decentralisation and tokenisation principles. As many of these companies, including energy cooperatives, face challenges in adopting new industry standards, the proposed Energy Token method acts as a roadmap for the industry to overcome these barriers and collaborate with blockchain software and hardware partners that meet their needs. The technology, and methodology is accessible on an open-source basis. 2Tokens shares this knowledge and insights through events, publications, and advisory projects in partnership with its collaborators. Established players are hesitant about the advantages of tokens while grappling with the transition to dynamic allocation driven by smart meter data, the growing presence of solar energy in trading portfolios, and changes in consumption patterns due to electric vehicle charging. Charting the course for 'Programmable Energy' will require a collective endeavour.

Contact Persons

Alex Bausch, Erich Schnoeckel and the 2Tokens Executive team and Board, see https://www.2tokens.org/team.

Website

https://www.2tokens.org/

5. Mobility Sector

In the evolving landscape of mobility, several groundbreaking initiatives stand out, demonstrating how technology, collaboration, and innovative thinking are reshaping how we think about movement, accessibility, and sustainability. Several initiatives, both public and private, play a crucial role in the transition towards a more interconnected and efficient future. MoveID is dedicated to developing standards and technological concepts for secure data exchange among mobility application providers and their users with the support of 19 partners. Parallelly, MOBI (Mobility Open Blockchain Initiative) represents a global effort to harness blockchain technology for creating a more connected and sustainable mobility environment. MOBI's mission is to establish standards that foster efficiency, decentralisation, and data privacy. From vehicle identity standards (VID) to insights into the global battery value chain and the development of the Connected Mobility Data Marketplace (CMDM), MOBI's initiatives are a testament to the potential of blockchain in redefining the mobility landscape.

Both MoveID and MOBI underscore a collective drive towards leveraging technology for better mobility solutions. Whether it's creating a seamless refund system in public transportation, as seen with Trenitalia and Trakti's Smart Refund System, or democratising vehicle data access through LinkedCar, these endeavours reflect a broader commitment to innovation, privacy, and sustainability. They not only address the immediate challenges faced by today's mobility sector but also lay the groundwork for a future where digital identity, data integrity, and user empowerment are paramount.

As we move forward, the synergy between such projects and the broader goals of the European Union, including compliance with directives like eIDAS and the embrace of digital wallets for public service access, highlights a concerted effort towards a digitally transformed, user-centric mobility ecosystem. This chapter aims to explore these developments, offering insights into the technologies, goals, and collaborative models shaping the future of mobility.

moveID

The Facts

MoveID is a publicly co-funded project and part of the Gaia-X 4 Future Mobility project family. It has become an accepted lighthouse project of the pan-European initiative of Gaia-X for federated data spaces. MoveID is part of the German Gaia-X hub and part of its mobility domain.

Project Funding

MoveID receives substantial backing from the German Federal Ministry for Economic Affairs and Climate Action, with a funding amount of 14 million euros. This covers half of the project's total costs, underscoring the initiative's importance and the government's commitment to advancing mobility solutions.

Main Project Goal

MoveID aims to set up a digital infrastructure for self-sovereign identities (SSI) of all participants in a mobile smart city ecosystem and – in contrast to other Gaia-X initiatives – uses blockchain technology as its decentralised tech foundation.

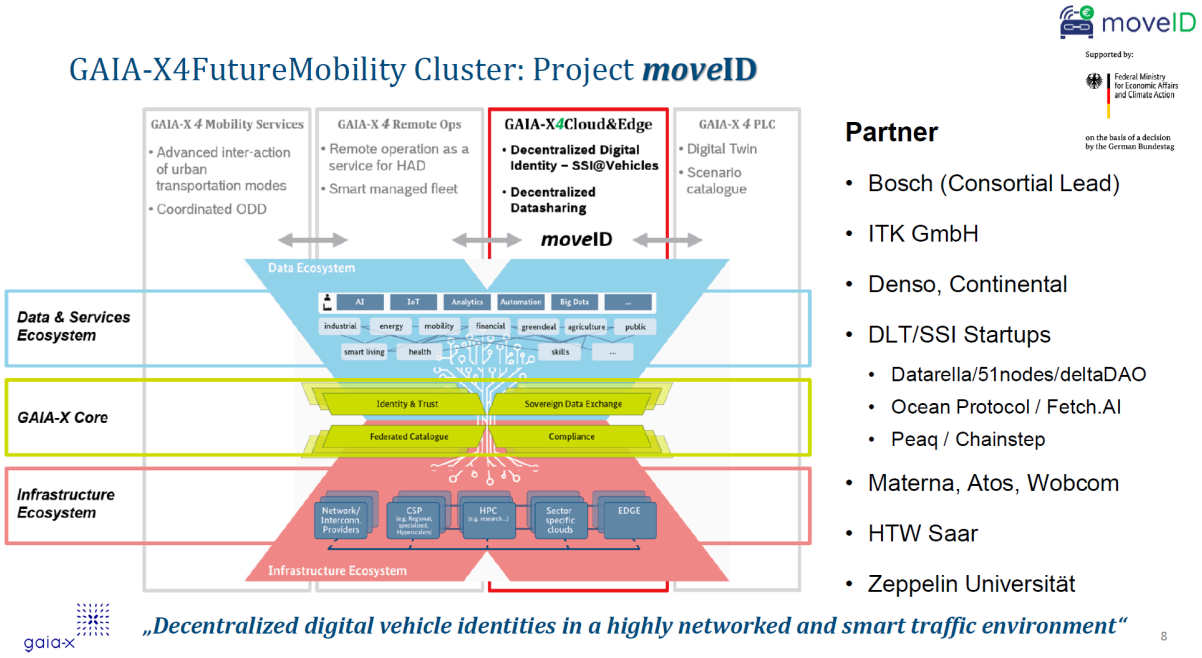

Figure 6: GAIA-X4FutureMobility Cluster: Project *moveID*. Source: BMWi & moveID presentation.

MoveID is set to develop the necessary standards and technological concepts to enable the secure exchange of information between providers of digital mobility service applications and their customers. The goal of moveID is to develop a decentralised digital identity infrastructure for mobility in Europe (focus on road traffic). 19 partners are involved from industry and science, being coordinated by the Robert Bosch GmbH. The focus of the consortium is to collaborate to implement non-discriminatory Trusted Self-Sovereign Identities and Verifiable Credentials for vehicles and infrastructure. Partners include Bosch, Continental, Eviden, Airbus, Denso, Materna, 51nodes and several more. Blockchain tech

partners apart from 51Nodes include Fetch.ai, Ocean Protocol, peaq, Delta Dao, Datarella and Chainstep.

The first demo of moveID was at IAA Mobility 2023. They showcased a demonstrator leveraging SSI and decentralised infrastructure that enabled peer-to-peer parking and charging as use cases. It supported the discovery and usage of electric charging points in a peer-to-peer manner. Companies can allow users to enable their parking lots to charge electric vehicles, with in-car digital wallets paying the parking and charging fees. More information can be found in the press release https://moveid.org/2023/08/14/gaia-x-moveid-to-showcase-peer-to-peer-smart-mobility-at-europes-largest-automotive-fair/.

MoveID, together with its partners, has also demonstrated and is working on other use cases such as Zoning, Smart Factory, Road Condition Monitoring and Traffic Awareness Services, as shown earlier this year at Hannover Messe.

The Outlook

MoveID is a consortium with a varied mixture of associated partners, each bringing their expertise to drive the future of decentralised identity and payments for mobility. While the reference stack based on regulations and compliance is being formulated, each input from the consortia is gearing towards building a modular and robust ecosystem. Future areas of activity could include the settlement of mobility- and smart city-related micropayments and other commercial activities that can benefit from an underlying infrastructure stack that is powered by blockchain in combination with vehicle /, IoT sensors and AI – and to connect it properly with new financial infrastructure and commercial bank money tokens.

Contact Persons

Contact person is Peter Busch[60] (Robert Bosch GmbH).

Website

https://moveid.org/

[60] https://www.linkedin.com/in/peter-busch-18286923/.

Smart Refund

The Challenge

In the contemporary landscape of public services and transportation, the integration of innovative technologies is pivotal for enhancing efficiency, transparency, and citizen satisfaction. This paper explores the implementation of a Smart Refund System by Trenitalia in collaboration with Trakti. The aim is to provide a comprehensive analysis of the context, scope, objectives, solution architecture, impact, standardisation, and alignment with citizen rights, including compliance with the eIDAS directive and digital wallet utilisation for public service access.

The public transportation sector faces challenges related to timely and transparent processes due to the complexity of the matter and the data transfer between different entities involved.

The Solution

In response, Trenitalia, a key player in the European railway industry, partnered with Trakti, a technology platform specialising in smart legal contracts, to address these challenges. The collaboration focuses on leveraging advanced technologies to streamline and automate the refund system.

The primary scope of this initiative is to redefine the refund experience for passengers, ensuring a seamless and transparent process. The objectives include reducing processing times, enhancing customer satisfaction, and aligning with regulatory frameworks to ensure compliance and data security.

The Smart Refund System integrates smart legal contracts and blockchain technology provided by Trakti. A unified framework orchestrates these components, enabling seamless interaction between Trenitalia's existing systems and the innovative refund solution. This architecture not only automates processes but also ensures data integrity and transparency through blockchain immutability.

The implementation of the Smart Refund System has significant positive impacts:

- *Efficiency:* Automation has reduced processing times, enabling quicker reimbursements.
- *Transparency:* Blockchain ensures an immutable record of transactions, fostering transparency.
- *Customer Satisfaction:* The simplified process contributes to enhanced customer experience.

The Smart Refund System implemented by Trenitalia and Trakti serves as a reference initiative to the transformative potential of advanced technologies in public services. This initiative not only addresses specific challenges within the transportation sector but also aligns with broader EU directives, emphasising the commitment to citizen rights, standardisation, and the digitisation of public services.

The implementation of the Smart Refund System inherently complies with the eIDAS directive, providing a legally recognised framework for electronic transactions. Moreover, by allowing citizens to use their digital wallets for accessing public services, the system aligns with the digital transformation objectives of the European Union.

In conclusion, this collaborative effort stands as a model for the integration of innovative solutions to enhance citizen experiences, uphold standards, and contribute to the ongoing digital evolution within the European Union.

Contact Persons

Luigi Telesca[61], Antonio Tresca[62].

Website

https://www.trakti.com/

[61] https://www.linkedin.com/in/luigitelesca/.
[62] https://www.linkedin.com/in/antoniotresca/.

LinkedCar

The Facts

In today's world, 96 %[63] of all new cars are connected. This connectivity has become a lucrative opportunity for vehicle manufacturers, who are currently the exclusive 'owners' of this data. This dominance in data ownership is projected to generate a revenue of $750 billion by 2030[64]. Yet, the driver, the primary source of this data, sees no benefit.

The EU Data Act[65] dated 27 November 2023 changes this. The Act re-empowers the driver, placing them at the center of vehicle data control. For LinkedCar, consumers, and mobility partners – insurers, lease companies, roadside assistance providers, etc – this is a pivotal moment.

On the ***business*** side, the vehicle data challenge has been twofold. Firstly, mobility partners have faced limited or no access to crucial vehicle data, hampering their ability to offer tailored services. Secondly, even when data is accessible, user consent issues often arise, hindering data utilisation.

LinkedCar's solution uniquely breaks down these data silos, ensuring fair comprehensive vehicle data access while seamlessly managing user consent.

Then there's the issue of vehicle data from the perspective of ***individuals***. It's a significant concern, as 92 % of consumers[66] think that vehicle owners should have control over who sees their vehicle's data, yet this isn't what's happening in practice.[67] Federation Internationale de l'Automobile (FIA) did a consumer study in September 2023 amongst 11.000 respondents. 61 %[68] of respondents do not remember authorising car data use by their vehicle manufacturer.

By giving individuals control over their vehicle data and the choice of sharing it, LinkedCar can empower individuals and emphasise the importance of data privacy. It will also promote the ideals of a shared economy, where data are shared for mutual benefit and monetisation.

LinkedCar democratises access to vehicle data – your data is yours, and your vehicle is part of a larger, interconnected, and ethical ecosystem.

---

[63] https://www.statista.com/statistics/1276018/share-of-connected-cars-in-total-new-car-sales-worldwide/.

[64] https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/accelerating-the-car-data-monetization-journey.

[65] https://www.whitecase.com/insight-alert/data-act-eus-bid-ensure-fairness-digital-environment-and-competitive-data-market-has#:~:text=It%20applies%2C%20inter%20alia%2C%20and,such%20services%20to%20customers%20in.

[66] https://www.ipsos.com/en-us/news-polls/Most-Car-Owners-Agree-That-Today%27s-Vehicles-Could-Be-Considered-Technological-Devices.

[67] https://foundation.mozilla.org/en/privacynotincluded/articles/what-data-does-my-car-collect-about-me-and-where-does-it-go/.

[68] https://www.fiaregion1.com/consumer-survey-understanding-drivers-preferences-and-attitudes-in-europe/.

LinkedCar is planning to work together with the EU Digital Identity Wallets (EUDI)[69]. These wallets will also include a digital driving licence, which will be the key to authentication.

Vehicle data platforms represent a specialised niche. Within ecosystems like Ethereum, projects such as VINchain or DIMO are present; however, there's currently a lack of focus on critical areas like interoperability, scalability, and compliance with legislative frameworks like the EU Data Act or automotive industry standards (such as Gaia-X). LinkedCar could be playing an important role in changing the way we look at vehicle data in Europe.

For context, DIMO in the States raised $9 million[70] in a seed round a few years ago. Today, their token is worth 693 % more than it was a year ago.

Today LinkedCar's focus is to be compliant with different EU-regulations:

- MOBI (Mobility Open Blockchain Initiative) has written a business paper on the standardisation of vehicle identification, known as VID.[71] (The ISO VIN-standard combined with W3C's decentralised identifiers /DIDs/.) This unique identification will be implemented in the LinkedCar platform.
- Integrations must align with evolving European standards. We need to explore options like EDC[72] and Simpl[73], as Europe itself is in the midst of developing these standards.

Also, the Flemish Smart Data Space (VSDS)[74] has taken on a crucial role. Through agreements with open standards and reusable building blocks, it aims to make Flanders the European leader in the field of smart regions. With Linked Data Event Streams (LDES) the goal is to use data sustainably and scalably. LDES[75] provides a uniform way to exchange open data, based on Linked Data principles. It's also supported by SEMIC (Semantic Interoperability Community Europe)[76].

Contact Persons

To get in touch, email info@linkedcar.eu.

Website

https://www.linkedcar.be/

[69] https://digital-strategy.ec.europa.eu/en/policies/eudi-wallet-implementation.
[70] https://www.coindesk.com/business/2022/02/15/coinfund-joins-9m-round-for-digital-infrastructure-incs-bid-to-decentralize-vehicle-data/.
[71] https://dlt.mobi/wp-content/uploads/2023/05/MOBI-VID0001WP2021_Version-2.1.pdf.
[72] https://azure.microsoft.com/en-us/blog/gaiax-gets-new-support-with-european-eclipse-data-connector/.
[73] https://digital-strategy.ec.europa.eu/en/policies/simpl.
[74] https://www.vlaanderen.be/digitaal-vlaanderen/onze-oplossingen/vlaamse-smart-data-space.
[75] https://joinup.ec.europa.eu/collection/semic-support-centre/linked-data-event-streams-ldes.
[76] https://en.wikipedia.org/wiki/Semantic_Interoperability_Centre_Europe.

The Mobility Open Blockchain Initiative (MOBI)

The Facts

MOBI is a global non-profit mobility consortium (members include Accenture, Achmea, AWS, BMW, Bosch, Cognizant, Continental, EU, Ford, General Motors, Renault, Honda, Hyperledger, Hyundai, IBM, Mazda, Nissan, Stellantis, World Economic Forum and many more).

Their focus is to create standards for connected ecosystems (mostly vehicles). The goal of MOBI is to make transportation more efficient, decentralised and sustainable while preserving data privacy for users and providers. It aims to foster cross-industry interoperability through the development of blockchain technology, thereby making the digital economy more efficient, equitable, and secure. By collaborating with the world's largest vehicle manufacturers, startups, NGOs, and other stakeholders, MOBI is committed to accelerating the adoption of innovative technologies and building a Web3 infrastructure that supports connected ecosystems and IoT commerce.

One of the most important standards is VID (Vehicle Identity). Whitepapers can be found on the website https://dlt.mobi/standards/.

An initiative where the EU was involved was an insight in the global battery value chain (sustainability!). CMDM – the Connected Mobility Data Marketplace is another interesting one (because Europe has a plan for its own European Mobility Data Space 'EMDS').

MOBI, a key participant among over 140 members in the Global Battery Alliance (GBA), is recognised through its MOBI batteryTRAK as a GBA affiliate. The GBA has conducted pilot projects with major automakers Tesla and Audi. Additionally, blockchain firms Circular and Everledger have been part of GBA's initiatives. Despite Everledger filing for bankruptcy, Circular successfully secured $25 million in funding in 2023. Furthermore, Circular plays a crucial role as one of the primary technology providers for the Battery Pass Consortium, which enjoys partial funding from the German government and is associated with the GBA. Its technology is utilised by several automotive giants, including Mercedes, Volvo, and Jaguar Land Rover, highlighting its impact across the industry.

Citopia was created out of MOBI. It's a member-owned and operated federated network of nodes to create an interoperable Web3 marketplace. It's designed to facilitate tamper-evident and privacy-preserving transactions (e.g. EDC – Eclipse Data Connector – used in different EU projects like Catena-X).

Chris Ballinger, chairman and chief executive of MOBI, was the former chief financial officer and director of mobility services at the Toyota Research Institute Inc.

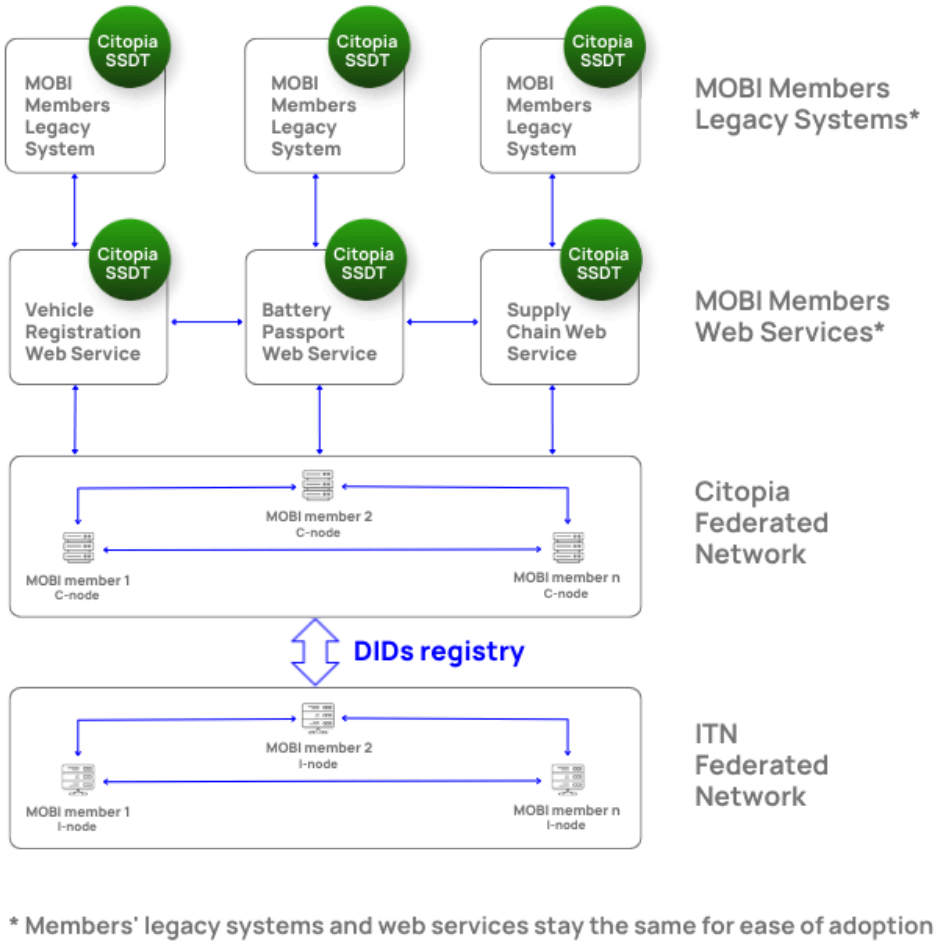

Figure 7: Citopia Passport Source: Citopia.[77]

Contact Persons

To get in touch, email connect@dlt.mobi.

Website

https://dlt.mobi/

[77] https://citopia.global/technology/.

6. Construction Sector

The construction industry will play a key role for some of Europe's most relevant policy goals of the decades to come - especially for becoming a carbon-neutral, pan-regional economy.

The sector and its suppliers are not only producing a significant percentage of Europe's or the global CO2 emissions but are by design also struggling with material supply chains, employing freight forwarders and moving a vast number of people around between construction sites.

But while efficiency can certainly be improved in this area, the more important contribution of blockchain tech and innovation in the sector in general will be to help preparing for data-driven planning not only of construction processes themselves, but by laying the foundation for drawing a multi-sectoral map and allowing future generations to manage fully functional smart buildings and homes, that register incoming energy types in the same way as allowing utility companies to remotely manage kitchen supplies or vehicles associated with homes and commercial buildings.

This industry will in any case play an important role - if our societies want to assess where we stand in terms of reducing CO2 emissions sustainably – every brick that is not a smart block of stone and every piece of wire that is not available in digital registers, every heating system that is not a good choice given the local circumstances and every roof or façade without photovoltaic assets will result in a net-negative total balance, for this sectors and others. And it's not easy to convey this message without sounding overly dramatic – not everything will be possible immediately, but every year that will pass in the construction economy will count as seven years for the rest of the industrial puzzle.

GAIA-X iECO

Description

The 'From Design to Demolition: IOTA in Gaia-X iECO Ecosystem' project aims to revolutionise the construction industry's data management processes by leveraging the principles and infrastructure of the Gaia-X initiative. The project will focus on optimising building processes through enhanced data sharing, the project seeks to break down data silos and facilitate the creation of digital twins, covering the entire construction life cycle from planning to controlled demolition. From a regulatory perspective, this relates directly to the recently announced Construction Products Regulation (CPR), which provides requirements regarding the performance of construction products manufactured by different manufacturers and regions. By fostering collaboration and integration among stakeholders, the project aims to significantly reduce inefficiencies and develop advanced services to further optimise building processes.

Organisation

Gaia-X iECO, which stands for Intelligent Empowerment of Construction Industry, is a consortium of 11 partners, funded by Germany's Federal Ministry for Economic Affairs and Climate Action (BMWK). It was selected as one of the projects under the Gaia-X initiative, which provides a federated infrastructure for interoperable data exchange and services. The project involves collaboration with the IOTA Foundation, which contributes expertise in distributed ledger technology (DLT) specific to the construction industry. Additionally, partnerships with Software AG and A1 Digital are pivotal for achieving a holistic digital twin solution, combining DLT know-how, edge technologies, and cloud expertise.

Vision

Gaia-X iECO aims to establish a shared data space in the construction industry, laying the groundwork for digital twins that represent buildings throughout their entire life cycle. By breaking down data silos and enabling smart services, Gaia-X iECO aims to enhance collaboration among stakeholders, improve productivity, reduce costs, enhance safety measures, and streamline legal processes within the industry. Furthermore, the project emphasises sustainability by providing transparency regarding building materials and CO2 emissions throughout the building life cycle. Through its innovative approach, Gaia-X iECO seeks to bridge the existing productivity gap in the construction sector and contribute to the broader goals of the Gaia-X initiative.

Blockchain's Impact

Blockchain technology is integral to the Gaia-X iECO project, profoundly influencing its trajectory. It serves as a backbone for data integrity and transparency, whereby blockchain ensures the immutability and traceability of critical information throughout the construction lifecycle. The project uses decentralised identity management which empowers stakeholders with secure access control; and the use of smart contracts to automate processes, enhancing operational efficiency and accountability. Furthermore, asset tokenisation introduces new incentive structures, aligning stakeholders with project goals, and

blockchain-enabled sustainability initiatives drive environmental responsibility. Together, these blockchain-driven advancements accelerate digital transformation, foster collaboration, and promote sustainable innovation across the construction industry.

Contact Persons

The contact persons are René Wolf[78] and Tobias Hamacher[79].

Website

https://ieco-gaiax.de/

[78] https://www.linkedin.com/in/renewolf68/.
[79] https://www.linkedin.com/in/tobias-hamacher-4274201b/.

7. Carbon Credits & Circular Economies

In the area of carbon credits and circular economies, blockchain solutions present a promising opportunity to address the challenges associated with existing systems. Traditional methods often face criticisms due to lack of transparency, insufficient reductions, and inequitable distribution. This chapter delves into transformative optimisation approaches, focusing on two notable initiatives: the 2Tokens Carbon ESG token project and the Environmental Carbon Offset Alliance (ECOTA). These projects work on leveraging blockchain technology to support the tokenisation of carbon credits, promising enhanced transparency, traceability, and efficiency in the carbon credit market. As we explore their objectives, scopes, responsibilities, and impact, it becomes evident that these initiatives are not merely technical endeavours but pivotal steps towards a more sustainable and equitable future.

2Tokens Carbon ESG Token

The 2Tokens Association was already introduced earlier in this report - and they have been discussing internally how tokenised carbon credits contribute to sustainability goals.

The Facts

The goal of carbon credits is to create economic incentives for reducing greenhouse gas emissions and combating climate change. However, there are several concerns and criticisms associated with the concept of carbon credits:

- Lack of additionality.
- Lack of transparency.
- Insufficient reductions.
- Inequitable distribution.

It's important to note that these criticisms do not apply to all carbon credit projects and mechanisms. Tokenisation of carbon credits is an emerging concept that leverages blockchain technology to enhance transparency, traceability, and efficiency in the carbon credit market.

The Objective

Designing, developing and implementing a carbon credit token standard that facilitates the efficient and transparent trading and transferring of carbon credits will contribute to acceptance and use of carbon credits in both an industrial (corporate) and a household setting.

The project will convincingly demonstrate the relevance of asset backed tokenisation for the provision, distribution and use in accounting and reporting of carbon credits, by developing and promoting a working and sustainable solution in conceptual, organisational, technical and commercial terms that benefit those who contribute most to mitigating global warming potential.

Scope

The project has focussed on the following key areas:

1. Designing the architecture and technical specifications of the carbon credit token system, where, if possible and relevant.
2. Developing smart contract protocols for issuing, tracking, and verifying carbon credits.
3. Establishing mechanisms for efficient trading and transfer of carbon credit tokens.
4. Ensuring interoperability and/or alignment with existing carbon credit standards and frameworks.

5. Incorporating mechanisms for robust monitoring, reporting, and auditing of carbon credit transactions.
6. Addressing security, privacy, and data integrity concerns associated with the carbon credit token system.
7. Considering scalability and energy efficiency aspects of the chosen blockchain platform or infrastructure.
8. Collaborating with relevant stakeholders, including environmental organisations, regulatory bodies, technology experts, auditors and accountants and industry participants in any of the following:
    - Explore business value modelling.
    - Explore objective benchmarking with industry players, field trials.
    - Create token values and guidelines for ESG metrics/VCM/carbon accounting.
    - Design the token taxonomy using the TTF framework.
    - Create specialised training program.
    - Work on joint-funding applications.
    - Do a legal and regulatory review.
    - Leadership and social impact.
    - Ensure alignment with carbon accounting frameworks, guidelines and regulations such as CSRD, GHG Protocol, SBTi and CDP.
    - Build a ReFi community in the Netherlands.

Responsibilities

The project has undertaken and will continue to undertake the following responsibilities:

1. Conducting research and analysis to identify the most suitable blockchain technology and carbon credit token system standards.
2. Drafting the technical specifications and guidelines for developing and deploying the carbon credit token system.
3. Collaborating with blockchain developers and experts to design and implement the necessary smart contracts and supporting infrastructure.
4. Coordinating with environmental and regulatory bodies to align the carbon credit token system with existing standards, protocols, and regulations.
5. Performing rigorous testing, security audits, and simulations to ensure the robustness and reliability of the carbon credit token system.

6. Developing user-friendly interfaces and tools for market participants to access and interact with the carbon credit token system.
7. Facilitating education and awareness programs to promote adopting the carbon credit token system and its benefits.
8. Regularly monitoring and evaluating the performance and effectiveness of the carbon credit token system and recommending improvements as necessary.

Reporting, Governance, Participation and Membership

The project operates under the following reporting and governance structure:

1. A designated captain oversees the project's activities and provides leadership and direction.
2. A project/process manager facilitates the project.
3. The project, its members or participants provide regular progress reports, updates, and recommendations to relevant stakeholders and governing bodies.
4. Decisions within the project's working group shall be made through consensus, and in case of disagreements, a democratic voting process shall be followed.
5. The project's working group may establish subcommittees or task forces to focus on specific aspects of the carbon credit token system development, as deemed necessary.
6. Participation in the project is open for all that want to contribute to the improvement, implementation or acceptance of the carbon credit tokens or the derived products or reporting.
7. Participants are requested to contribute in time, knowledge, research capacity, money or all other resources that allow this project to be successful.

The Summary

The Carbon Credit Token Project and the Working Group shall endeavour to create a robust, transparent, and scalable carbon credit token system that incentivises and accelerates global efforts to combat climate change. Where possible and applicable the working group will reuse results of other tokenised carbon credit projects in the market. The working group shall foster collaboration, innovation, and integrity to ensure the market's successful implementation and adoption of the carbon credit token system.

Carbon Credits Background

- Carbon markets overview (covering the dynamic of web2 developments):
    - Working on standardisation:

        - ICVCM, VCMI & CDP & SBTi, ICROA.[80]
    - Different baseline and crediting carbon schemes:
        - Intergovernmental: Paris Agreement Article 6.2 & 6.4, EU removal certificate.
        - Intragovernmental: US, South Korea.
        - Independent: Verra, GS, GCC, World Bank.
        - Subnational: France, Netherlands, Spain, UK.
        - Blockchain native: regen network.
- Stakeholder overview:
    - Legal framework for tokenised carbon credits: IOSCO, Bafin.
    - Association for capacity building: ECOTA.
    - Projects: 2Token, projects from this database.
    - Consortiums: Project Genesis 2.0, Climate Action Data Trust.

Contact Persons

To get in touch, email info@2tokens.org.

Website

https://www.2tokens.org/carbon-token

[80] Additional information about their respective areas of work:
ICVCM: Supply side standardisation.
VCMI: Demand side claim standardisation.
CDP: Largest climate-related reporting platform, not trying to do anything in VCM.
SBTi: Sticks to standardisation related to target setting.
ICROA: Registry-level assessment framework.

Environmental Carbon Offset Alliance (ECOTA)

Main Project Goal

The Environmental Carbon Offset Alliance (ECOTA) was launched to advance the development of decarbonisation using blockchain technology. They work on token-based solutions for achieving a net-zero Europe and emphasise transparency in supply chains and the creation of global carbon markets. ECOTA offers education and knowledge transfer about CO2 tokenisation, regulatory changes, and decarbonisation technology.

Project Funding & Institutional Partners

ECOTA has been sustained by membership fees. Institutional partners include PARTICULA, ImpactScope, earthchain, Carbify, ASES, Ecological and Sustainable Services, UCO Network, Liechtenstein Bankers Association, Neutral, Greenertoken, Jacaranda Capital, and Arbon.

ECOTA Structure

Organisation is led by three executive directors, and the community comprises 108 experts and 125 fellows. Qualifications for experts include demonstration of at least 2 relevant publications in the field. Fellows are on-chain carbon asset enthusiasts who are part of the ECOTA-community to learn, build knowledge, and participate in discussions about tokenised carbon credits and other ways to use blockchain technology to achieve a net-zero Europe.

Evolution of the Project

ECOTA was initiated by the late Prof. Philipp Sandner, and designed as a think tank to ensure that state-of-the-art technologies such as blockchain and tokenisation are properly employed to advance the carbon offsetting markets.

Since its inception, ECOTA has launched a number of projects and initiatives, together with different partners. After the sudden death of Philipp Sandner, the ECOTA initiative is now taken private as a project of a newly formed GmbH. In the future, it will also earn money from consulting formats and continue to have a focus on education programs. So it is certainly worthwhile to follow ECOTA's evolution and take a look at other initiatives that want to pave the way for more standardized ways to do business in this sector - and

- *Refi Talents:* In collaboration with Climate Collective, Frankfurt School Blockchain Center, Multichain Asset Managers Association (MAMA), Digital Euro Association (DEA), DEC Institute, Vanagon Ventures, and Particula, the ReFi Talents program is an 18-week, three-phased mentoring initiative designed to onboard and educate young individuals about regenerative finance (ReFi). It aims to nurture future entrepreneurs, technologists, regulators, investors, and influencers who can contribute to a regenerative economy through technology. Since September 2023, 200 participants have been accepted for the first cohort – and the second cohort is starting in Summer 2024.

- *Web 3 Carbon Database:* The Web3 Carbon Database, developed by ECOTA in partnership with PositiveBlockchain.io, is a comprehensive resource focusing on tokenised carbon claims in the realm of ReFi. This includes various forms of carbon accounting such as offsets, insets, and emission reports. It serves to equip industry stakeholders, policymakers, and the public with valuable, fact-based insights into the carbon tokenisation value chain. The database represents the efforts of the 'Ecosystem Analysis' Working Group, active from January to October 2023, and aims to add neutral, factual value to the industry. This initiative is going to be updated soon and its use will be altered slightly, depending on ECOTA's future models.

Contact Persons

The contact persons are Abdullah Melik Yildiz[81], Jovan Milic[82] and Maximilian Rösgen[83].

Website

https://www.ecota.io/

[81] https://www.linkedin.com/in/abdullah-melik-yildiz-002b50175/.
[82] https://www.linkedin.com/in/jovan-milic-847534254/.
[83] https://www.linkedin.com/in/maximilian-roesgen/.

Climate Action Data Trust (CAD Trust)

Project Background

The Climate Action Data Trust (CAD Trust) is a global initiative designed to enhance transparency and trust in carbon markets. It aggregates and harmonises carbon credit data using an open-source distributed ledger technology. This approach aims to prevent double-counting and boost confidence in carbon credit data, aligning with the Paris Agreement's goals.

Since 2019, the World Bank has been developing the CAD Trust, conducting three simulations with various governments and organisations to refine the system and understand the technology. The final simulation concluded in August 2022, with the official launch occurring at the Asia Climate Summit in December 2022. Founded by IETA, the World Bank and the Singapore Government, CAD Trust's platform involves diverse stakeholders, including national governments and multilateral organisations, to ensure comprehensive and transparent tracking of carbon market transactions.

Institutional Partners

As of the time of the publication of this report, 30 organisations and 11 national governments have joined the initiative throughout 58 testing sessions.[84] The participating organisations during Phase III are listed below:

Governments	***Independent Standards***	***Multilateral Organisations***	***Other Market Participants***
Switzerland Sweden Spain Japan Singapore Chile Peru Senegal Uganda Rwanda UK	Verra Gold Standard ACR CAR GCC Other registries: HIS Market, Eco-registry Colombia	EBRD UNDP UNFCCC WB CATS WB CMI IFC	Climate Change Coalition Climate Check GenZero SK Group IETA Open Earth Foundation

Summary of the Initiative

CADT leverages blockchain technology, specifically the Chia Network's Data Layer[85], to link, aggregate, and harmonise data from major carbon registries. This decentralised infrastructure supports data sharing and provides a transparent, publicly accessible record of carbon credit transactions. By doing so, CADT helps identify risks of double counting and enhances the integrity of the carbon market.

[84] https://climateactiondata.org.
[85] https://ik.imagekit.io/mtozw1gojis/world-bank/Chia_as_the_Blockchain_Technology_for_the_Climate_Warehouse_3f553aff80_pROYXIe0g.pdf.

Since its launch, CADT has rapidly expanded, now covering 85 % of all issued carbon credits[86]. Key registries on board include Verra, the Global Carbon Council, and the Kingdom of Bhutan, with plans to integrate more registries this year. The platform's development has been supported by significant funding and technical collaboration, including a grant from Google.org.

The operational phase of CADT began with a media launch in October 2022 and an official launch at Asia's Climate Summit in December 2022. A critical milestone was the launch of an interactive data dashboard during the COP28 United Nations Climate Change Conference in December 2023. This dashboard allows users to track carbon offsets from over 17,300 projects, providing detailed information on the lifecycle of carbon credits.

The ultimate goal of CADT is to support the development of a more transparent, reliable, and efficient global carbon market. By enhancing the visibility of carbon credit transactions and ensuring the integrity of the data, CADT aims to build trust and facilitate the broader adoption of carbon credits as a tool for climate action.

CADT Governance

CADT's governance structure includes an independent legal entity based in Singapore, managed by a Board and Council consisting of government representatives and major carbon registries. The platform also engages with national registries, international standards bodies, and various market participants to ensure robust and inclusive data management.

The council receives and provides recommendations to a Board of Directors, which is the main decision-making body. The Board has mandates to implement the work plan and is supported by a legal entity and a Secretariat, which provide operational, strategic, and communication assistance. There are two advisory groups: the Technical Committee, consisting of data providers and market practitioners who advise on technical development, and the User Forum, comprised of market practitioners and data users who advise on functionality and usage. This structure is designed for the interim period of January 2023 to January 2025.

86 https://www.edb.gov.sg/en/business-insights/insights/singapore-backed-platform-cad-trust-boosts-transparency-covers-85-of-carbon-credit-market.html.

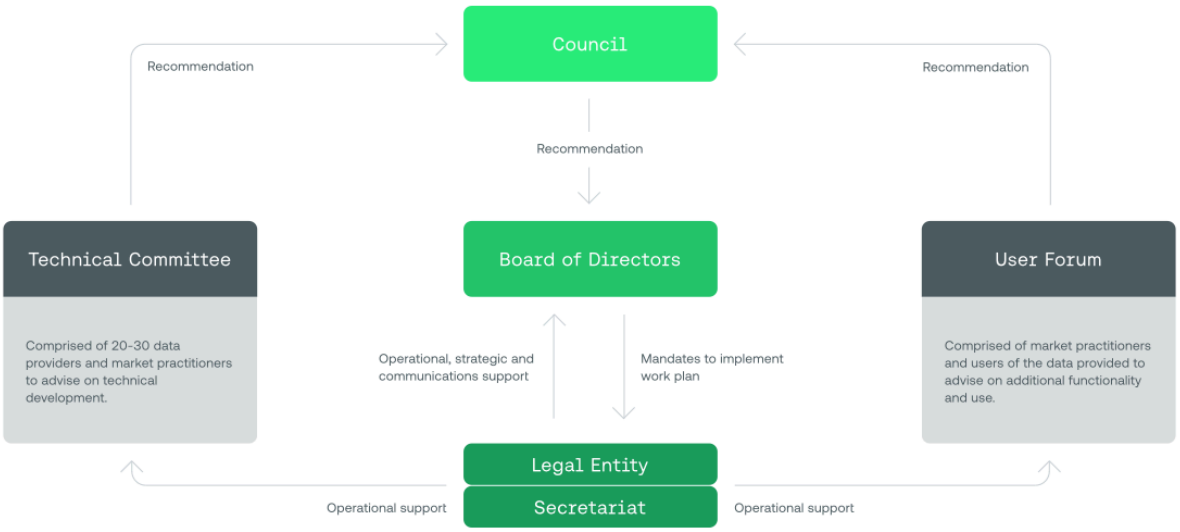

Figure 9: CADT Structure. Source: CADT.[87]

Contact Persons

To reach out, the contact form available on their website can be used: https://climateactiondata.org/contact/.

Website

https://climateactiondata.org/

[87] https://climateactiondata.org/about/.

Project Genesis 2.0

The Facts

Project Genesis 2.0 is about exploring how blockchain technology can be used to improve the green bond market. It looks at using smart contracts to attach carbon credits to green bonds.

Main Project Goal

Project Genesis 2.0 is a collaborative effort aiming to improve the efficiency of green bonds, which finance eco-friendly projects, by utilising smart contracts on a blockchain to securely link them with carbon credits representing verified emission reductions. This approach targets increased transparency through verifiable transactions and enhanced efficiency via automated processes, potentially making green bonds more attractive to investors seeking impactful environmental solutions.

Role in the EU & Beyond

While Project Genesis 2.0 emerged from a collaboration led by the BIS Innovation Hub, its emphasis on tackling greenwashing and leveraging MOIs for environmental accountability aligns with global trends in sustainable finance. This suggests the project's success could serve as a model for other regions, including the EU, seeking to strengthen the transparency and environmental impact of their green bond markets.

The Consortium's Structure

The consortium's structure of Project Genesis 2.0 is two-sided. Public partners, including the BIS Innovation Hub, UN Climate Change Global Innovation Hub, and the Hong Kong Monetary Authority, collaborated with private consortia. These private groups, one led by Goldman Sachs with Allinfra and Digital Asset, and another led by InterOpera with Krungthai Bank, Samwoo, and Sungshin Cement, brought industry knowledge and technical skills to the project.

Current Status: Technology & Standards

The project's core innovation centred on leveraging blockchain technology to create a secure and transparent record-keeping system for green bonds with attached MOIs. This involved utilising smart contracts to automate processes like bond issuance and trading, while integrating the Internet of Things for real-time monitoring of the environmental impact associated with the projects financed by the green bonds.

Contact Persons

The contact persons are Bénédicte N. Nolens[88] and Massamba Thioye[89].

[88] https://www.linkedin.com/in/benedicte-n-nolens-77529747/.
[89] https://www.linkedin.com/in/massamba-thioye-b36ba7ba/.

Website

https://www.bis.org/about/bisih/topics/green_finance/genesis_2.htm

Circular Economy Solutions

In addition to Carbon Credits and Carbon Offsetting, there are also plenty of optimisation opportunities for circular economy models. Let us understand how blockchain technology can contribute to a smoother transition to more sustainable production and consumption habits with the help of specific examples which incentivise participants to reduce waste, reuse raw materials and recycle products at the end of their lifecycle. Some of those projects are not consortial projects, so mentioning a selection of corporate initiatives here is also meant to give an outlook in the next potential field of activity of this task force - as explained in the 'Miscellaneous' chapter at the end of this report.

TRICK

TRICK is an EU-based consortium which received €8 million in funding to develop permissioned blockchain-based pilots for circular economy solutions – first in the textile industry and then in the food sector, between 2021 and 2024. Its particular focus is an SME-affordable information management system that helps organisations reduce waste in their supply chains, while also providing a marketplace for the anonymised data that is gathered. The project uses Hyperledger Fabric as well as the Quadrans Foundation blockchain.

Contact persons

To reach out, the contact form available on their website can be used: https://www.trick-project.eu/contacts.

Website

https://www.trick-project.eu

***

Circularise

The mission of this Dutch software provider is to 'bring a circular economy to industrial supply-chains'[90] and is working with the likes of Mitsubishi Chemicals, Philips and Porsche. Using Ethereum, zero-knowledge proofs and selective data sharing, it helps its clients trace raw materials and be more transparent to their end users, while preserving their own confidential trade secrets. Circularise has also partnered with the EU-financed Circular Foam research project to address the difficulty in recycling or reusing rigid PU foam, typically used to insulate fridges.

Contact Persons

To reach out, the contact form available on their website can be used: https://www.circularise.com/contact.

Website

https://www.circularise.com/

[90] https://www.circularise.com/press-releases/circularise-secures-investment.

***

CircularChain

The French-based Suez Group is a world leader in waste recycling and recovery with nearly €9 billion in revenue and 40,000 employees. Through its 3C division, it has developed CircularChain, a blockchain-based traceability platform, to improve transparency and trust in the recovery cycle. It kicked off with an agricultural use case for reusing organic waste in a transparent and shared manner to reassure farmers which wanted a quality alternative to synthetic fertilisers.

Contact Persons

To reach out, the contact form available on their website can be used: https://www.suez.com/en/contact.

Website

https://www.suez.com/en/

***

LoopID

The Munich-based LoopID is a SaaS solutions provider focuses on how companies and consortia can benefit from the circular economy through innovative new business models and use cases. At the same time, the platform is aiming at enabling compliance with upcoming regulations such as the Ecodesign Sustainable Products Regulation (ESPR) and the Digital Product Passport (DDP), while improving the customer loyalty, profitability and carbon footprint for companies and their products. The start-up has just received a grant by the German Federal Ministry for Economic Affairs and Climate Action in the category 'innovative business models'.

Contact Persons

To reach out, the contact form available on their website can be used, the main contact is Christian Adler.[91]

Website

https://www.loopid.com/

[91] (13) Christian Adler | LinkedIn

8. Sustainability Reporting & Legal Compliance Issues

Blockchain technology is the best technology choice for multi-dimensional challenges and can thus offer significant potential to enhance the transparency, accuracy, and efficiency of sustainability reporting. Currently, organisations are struggling with their preparations in order to meet the incoming CSRD regulation, and we could label this period 'the data aggregation phase'.

This will result in a best-effort race to get all the data from vendors and trials on how to get the best hold of data flowing upstream and downstream in different systems. This exercise is unavoidable, but the quality of the reports will be most likely only mediocre. But reporting that serves an important purpose should not be done to see legislation executed properly but to progress and create synergies for the reporting entities. This will mean that the next phase – let's label it 'the operational excellence phase' – should begin soon after. Its end goal must be to use verified and trustworthy data sets coming from out in the field and to use it as trigger points for further automation, to drive sector-coupling management decisions and serve as the basis to calculate and execute (micro)payments.

This will be the best way to improve sustainability performance, build greater trust with stakeholders and create stronger bonds with suppliers and customers alike. However, careful consideration must be given to the implementation challenges to ensure that the best technology modules are selected and used effectively and sustainably.

So far, the focus on the data aggregation challenge might be one of the reasons why this field has so far been relatively unexplored by consortial activities. But we are sure that techniques that enable companies to collaborate on the infrastructure part without having to expose any unencrypted data sets to their colleagues and partners will lead to a surge in joint actions in this segment - the tasks are vast and many consortiums are underway in neighbouring areas. So the first ESG data aggregation service provider making use of blockchain tech in combination with AI features in a relevant way might be very well-positioned for the operational excellence decade that we have ahead of us.

Digital Measurement, Reporting, and Verification (dMRV) based on DLTs will become one of the pillars to bring back trust to a market segment such as the voluntary carbon market that has been hit hard by a combination of scientific 'revelations' and subsequent media coverage. First signs of this up and coming trend can be seen, especially in related agro-forest and agritech projects[92] and also the media and experts have started to dig deeper in this area over the past two years.[93] Other early stage leaders for such initiatives are Hedera Hashgraph with their Guardian transparency ledger.[94]

[92] Some interesting examples at a sub-consortial level include projects such as TraceX partnerships such as https://tracextech.com/a-green-initiative-foundation-greens-the-landscape-with-tracexs-dmrv-platform.

[93] Compare e.g. https://abmagazine.accaglobal.com/global/articles/2022/specials/cpd-special-edition-december-2022/blockchain-can-support-esg.html.

[94] See: Guardian | Hedera

So we are positive that this chapter will be filled soon with additional, interesting consortial approaches as well. The blueprint in this case comes from the Asian region, where Singapore-based STACS's ESGpedia[95] blockchain platform is underpinning the ESCAP Sustainable Business Network (ESBN) Asia-Pacific Green Deal digital platform, the ASEAN Single Accesspoint for ESG Data (SAFE) pilot initiative, and the Monetary Authority of Singapore's Greenprint ESG Registry. The company behind it is a private company, Hashstacs Pte Ltd, that has all the support from Singapore's and other regional authorities and has grown from a financial services provider that uses blockchain technology into a hub for ESG data in the ASEAN region.

Another relevant blockchain initiative that was born by a consortium of major players in the oil and trade financing industries is VAKT, involving some of the biggest global players such as Saudi Aramco's trading arm, Reliance, Chevron, Koch Industries, Shell, BP, TotalEnergies and others and received investments from among others S&P Global Commodity Insights or Saudi Aramco Ventures. [96] And even though VAKT's focus is on business efficiency and profitability, the companies involved do agree that by using this Ethereum-based private Quorum blockchain as a single source of truth has been established by using web3 tech stacks. This offers all of the details and stages of a trade, and they can be recorded and seen as well as be agreed upon by all VAKT stakeholders and partners involved in a trade. This means VAKT enables a trade in real time and helps to mitigate potential risks. But it also means that data coming from VAKT's platform can play a crucial role in establishing end-to-end records for energy carriers being produced, sold and used in the end.[97]

Going forward it will be interesting to see if different data tiers will emerge from the ESG reporting requirements - since ESG data that will come directly from machines operating on embedded crypto chips and directly registering the emanating data sets on a blockchain platform will have a higher level of trustability than self-reported corporate data that is brought on-chain. Since in the end, there is no possibility of ruling out manual input errors or the import of data that are not correct from corporate cloud sources - but if the responsible personnel is registered and cleared by a role-based model, such a 'proof of authority' process can not only reduce the number of corporate input points, but will also help to establish a clear path of responsibility for any data input (or repair and calibration records if we talk about monitoring machines).

[95] See https://stacs.io/.
[96] See https://www.vakt.com/company.
[97] See https://www.vakt.com/press/using-blockchain-to-support-the-energy-transition.

Carbon Emission Reporting: CA2SIG

Brief History

The Hyperledger Climate Action and Accounting Special Interest Group (CA2SIG) was established to leverage blockchain technology to enhance global climate accounting and action. It aims to develop frameworks, standards, and use cases to improve transparency and accountability in carbon emissions tracking and environmental, social, and governance (ESG) reporting.

Structure

The CA2SIG comprises various working groups focused on standards development, consumer disclosure, and building tools for emissions recording and offset tokenization. The group operates under the broader Hyperledger umbrella and collaborates with community members, including blockchain developers, policy experts, and industry professionals.

Summary

CA2SIG is dedicated to creating a global interoperable layer for climate accounting using open-source blockchain technologies. It engages participants through working groups, project leadership opportunities, and collaborative efforts to develop and implement solutions for accurate and transparent climate action reporting. Key initiatives include developing a sustainability score for consumers and building a Distributed Autonomous Organization (DAO) for climate action voting.

Whistleblowing

The Whistleblowers Protection Directive[98] entered into force in 2019, some Member States are still in the inception moment to adopt the competencies in accordance with it, some European members are also under awareness of sanctions for delaying, however, it is a common understanding of the importance to protect the identity of whistleblowers.

Naturally, there is an interesting match whereby blockchain and DLTs can be an enabler for the achievement of the Sustainable Development Goal 16[99] mainly, however, there is a wide spectrum for acting to fight criminal acts and/or infractions. This impacting regulation is very transversal. Some Member States are more evolved with the scope of the acts and requirements, others are more in the initial phases with a limited type of activities under the law of the land. In any case, consumer and business protection are just one scenario whereby public entities, universities, listed and non-listed companies, including SMEs with more than 50 employees are obliged to provide internal mechanisms to whistleblow otherwise sanctions will be applied. Some countries even have established a specific independent authority to protect the whistleblowers for these particularities, like Spain.

Blockchain and DLT have demonstrated the ability to provide rewarding mechanisms which can harmonise the compensation to whistleblowers and trace at the same time the process of the digital evidence and/or proofs that have been provided. Basic cryptography within blockchain and DLT provides the attributes to protect the whistleblowers, like the project WISP.GLOBAL, launched recently by Kron World®, whose community is contributing to the standardisation efforts like ITU-T in the Focus Group on Metaverse. The project provides critical protection to whistleblowers and also provides internal standardised channels as well as external channels which are inspired by the ISO 37002:2021 and the ISO 37008:2023.

There are also programs to detect bugs which are mechanisms perfectly valid to promote the whistleblowing of malicious smart contracts and other potential vulnerabilities and detections, like in EBSI[100].

The co-living of multi-technology within Metaverse and CitiVerse gives blockchain and DLT systems participation in the building of new advanced tech. In particular INTERPOL has raised a policy in this aspect for Metaverse[101].

For more information, you can access https://commission.europa.eu/aid-development-cooperation-fundamental-rights/your-rights-eu/protection-whistleblowers_en or https://www.euronews.com/green/2024/02/27/revolutionary-eu-criminalises-the-most-serious-cases-of-ecosystem-destruction.

---

98 https://commission.europa.eu/aid-development-cooperation-fundamental-rights/your-rights-eu/protection-whistleblowers_en.

99 SDG 16: Promote peaceful inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels. https://sdgs.un.org/goals/goal16.

100 https://ec.europa.eu/digital-building-blocks/sites/display/EBSI/Big+Bug+Bounty+programme.

101 https://www.interpol.int/en/News-and-Events/News/2022/INTERPOL-launches-first-global-police-Metaverse.

9. Learning and Education

From the previous chapters it has become obvious that in the realm of industrial applications, blockchain and DLT can present transformative opportunities. Education plays a critical role in harnessing its potential not only in the industrial sector.

This chapter focuses on one of the consortia initiatives that are at the forefront of promoting blockchain education, enhance understanding of blockchain technology by promoting research and educational programs, and equip individuals with the skills needed to thrive in a blockchain-driven landscape: CHAISE: Blockchain Skills for Europe. The project works to address the blockchain skills shortages in the industry, with the aim to prepare a new generation of experts to be able to innovate and implement blockchain solutions in various sectors.

CHAISE

The Facts

CHAISE, a Sector Skills Alliance, which is at its core committed to shape a strategic approach to the development of blockchain skills across Europe. The primary goal is to deliver training solutions that are future-proof, effectively addressing the current shortage of blockchain skills and meeting the evolving needs of the European blockchain workforce.

Project Funding

Backed by substantial funding from the Europeum Commission through the ERASMUS+ program, the CHAISE project ensures financial sustainability and the ability to execute its mission effectively. This funding is strategically allocated to various facets, including curriculum development, outreach programs, and the creation of innovative learning tools.

Main Project Goal

CHAISE focuses on strategically developing blockchain skills in Europe to address the skill gap. Its objectives include creating an open governance system, delivering future-proof training, and establishing a European Blockchain Skills Strategy. The project addresses skill shortages and aims to enhance the sector's attractiveness. CHAISE monitors workplace requirements, defines EU-wide occupational standards, and develops a 5-semester Blockchain VET Programme in 11 EU languages. The initiative also promotes mobility for blockchain students and professionals and fosters a European blockchain ecosystem through strategic collaboration at European and national levels.

Ecosystem Partner Evolution

CHAISE establishes a robust European blockchain community by uniting prominent multinational corporations, essential institutional entities, EU umbrella organisations, social partners, education and training providers with thematic focus, as well as public authorities and regulators. The collaboration of the project with its 23 partners spans across 13 European Union countries, fostering a diverse and inclusive initiative. Part of the community is also the CHAISE Expert Advisory Board, comprising 17 experts from various sectors and 15 European countries, playing a pivotal role in guiding and assessing the progress of the European Blockchain Skills Strategy, providing technical expertise, validating intelligence, and contributing to strategy evolution based on sectoral needs. Furthermore, organisations can request to become Associated Partners. As a CHAISE Associated Partner, an organisation has the opportunity to contribute to CHAISE work streams and helps build long-term cooperation in support of the project goals.H

Role in the EU & Beyond

Within the European Union and on a global scale, the CHAISE project plays a pivotal role in advancing blockchain education. By actively participating in

discussions, policy advocacy, and cross-border collaborations, the project positions itself as a key player in the international blockchain community.

Membership & Participation in the Consortium

The CHAISE project thrives on collaboration within its consortium, a diverse assembly of stakeholders including educators, industry leaders, and policymakers. Membership in the consortium not only reflects a commitment to shared goals but also ensures a broad perspective in shaping the project's trajectory.

The Summary

The CHAISE project stands as a beacon for blockchain education in Europe. With a focus on collaboration, substantial funding, and a clear mission, the project is poised to make a lasting impact on the region's digital skills landscape.

The Consortium's Structure

The consortium supporting the CHAISE project is structured to facilitate effective collaboration. Comprising experts from academia, industry, associations and governmental bodies, the consortium embodies a holistic approach to blockchain education, ensuring a well-rounded and adaptable curriculum.

Evolution of the Project

Since its inception, the CHAISE project has undergone a notable evolution, adapting to emerging trends in blockchain technology and educational methodologies. This evolutionary mindset positions the project as a responsive and forward-thinking entity within the dynamic realm of digital skills development.

Current Status: Solutions & Services

The CHAISE project currently offers a range of solutions and services catering to diverse learning needs. In 2023 they published the first version of the online courses and workshops to mentorship programs. The project provides a multifaceted approach to building blockchain skills, addressing the practical aspects of implementation.

The Outlook

Looking ahead, the CHAISE project envisions a future where blockchain skills are integral to Europe's digital landscape. With plans for expansion, deeper collaborations, and ongoing innovation, the project aspires to be a driving force in shaping the next generation of blockchain professionals and innovators.

Contact Persons

To get in touch, you can avail of the contact form at the project website: https://chaise-blockchainskills.eu/contact/.

Website

https://chaise-blockchainskills.eu/

10. Blockchain & Tokenisation in the Financial Sector and the Role of Treasuries

The European measures known as the 'Digital Finance Package' are the first comprehensive regional regulatory framework governing blockchain technology and its applications worldwide. Elsewhere in the world, it is clear that the differences with the European *legis corpus* are great, for better or for worse.

The most impactful text of the 'Digital Finance Package' is the regulation on crypto-asset markets known as 'MiCA' adopted on April 20, 2023.

This set of measures includes the following four proposals (presented in chronological order of their proposal numbering):

1. The regulation COM/2020/593 on Markets In Crypto-Assets known as 'MiCA', the text was finally adopted by the European Parliament at first reading on April 20, 2023 after multiple public consultations and significant modifications to the text made by the European Securities and Markets Authority (ESMA or ESMA in English); the text is finally validated by the European Council on May 30, 2023 and published in the OJEU on June 9, 2023.

2. The Regulation COM/2020/594 on a pilot regime for market infrastructures based on distributed ledger technology, known as the 'DLT Pilot Regime Regulation'; this text is adopted and is Regulation (EU) 2022/858 of the EP and the ConsUE of 30 May 2022 on a pilot scheme for market infrastructures based on distributed ledger technology, and amending Regulations (EU) 600/2014 and (EU) 909/2014 and Directive 2014/65/EU; it came into force on March 23, 2023.

3. The Regulation (EU) 2022/2554 on digital operational resilience of the financial sector; it entered into force on January 16, 2023 but will only be applied from January 17, 2025.

4. The Directive COM/2020/596 amending Directives 2006/43/EC, 2009/65/EC, 2009/138/EU, 2011/61/EU, 2013/36/EU, 2014/65/EU (MIF 2), (EU) 2015/2366 and (EU) 2016/2341 allowing these texts to be adapted to blockchain technology and distributed registers. The text was proposed by the European Commission in September 2020. Since then, it has been discussed and examined by Member States and the European Parliament, who have proposed amendments. In March 2021, the European Parliament adopted an amended version of the proposed Directive, which still needs to be approved by the Council of the European Union. The Directive has therefore not yet been adopted in its final form.

Additional texts to this package of measures were also voted on and must be read in conjunction (or sometimes with references) to the above texts already adopted:

- The regulation on information accompanying transfers of funds and certain crypto-assets known as 'Transfer of Funds Rule (TFR)': This text was adopted by the Parliament on April 20, 2023, at the same time as the 'MiCA' Regulation.

- The proposal for a regulation establishing harmonised rules for fair access to and use of data (called 'Data Act'): Adopted on March 14, 2023.

The MiCA Regulation aims to regulate the issuance and use of digital assets, including stablecoins but excluding security tokens, and will come into force during the course of 2024 and for the last provisions at the end of December 2024. The main stablecoin provisions of the MiCA Regulation include:

- *Prudential reserve requirements:* Stablecoin issuers will be required to hold reserves of high-quality assets to ensure the stability of the value of their tokens. The nature and amount of these reserves will depend on the type of stablecoin and its use.
- *Transparency obligations:* Stablecoin issuers will have to publish clear and regular information on their reserves, activities and risks.
- *Authorisation and supervision:* Issuers of large stablecoins will need to obtain authorisation from European financial regulatory authorities and comply with enhanced prudential requirements.
- *Prohibitions on certain practices:* The MiCA Regulation prohibits certain practices, such as the use of misleading names or false advertising to promote stablecoins.

Many companies are currently looking at different ways to sell their goods and services in dematerialised worlds (metaverses, digital twins for instance). One way is to tokenise those goods and services. In this case, depending on what rights and obligations are tokenised, if they are utility tokens, they will then also be subject to the MiCA Regulation. If security tokens, they will then be subject to MiFiD regulations. Companies will then end up with a fiat treasury and a digital asset treasury, both needing to be managed effectively to ensure liquidity, minimise risks, and comply with regulatory requirements, all while optimising financial operations.

Central Bank Digital Currencies (CBDCs)

CBDCs are (just) a logical continuation of the advancing digitisation, which does not stop at the product 'money'. The key difference to disruptive transformations in other industries – think of the music industry and the difficult transition it phased after the accidental and messy introduction of mp3 as a new file codec, or the triumph of Netflix, YouTube & co. as a result of the digitisation of video distribution – is that the money monopoly by nation states leads to (at least) one division of the market: While the central banks will introduce the digital currencies they are designing to both fulfil their sovereign duties and issue another form of the same money/currency (from their point of view), their private sector counterparts will potentially be equipped with more degrees of freedom.

Because the discussion about the design of CBDCs and CBMTs (Commercial Bank Money Tokens) is not primarily about the question of whether these (as wholesale or retail variants) will be based on blockchain tech, but rather whether they will allow shades of programmability. So far, this only seems to be part of the planning for private bank money tokens – in particular, highly developed industrial countries and industry players dependent on complex global supply chains will need such comprehensive solutions in order to be able to use IoT logic and end-to-end solutions for delivery conditions and subsequent settlements.

This is also the most important point for future industrial strategies: regardless of the degree of concrete implementation on blockchains, the entire flow of money can be processed digitally, protected by cryptographic procedures and in highly automated ways. This means that our thinking must change, with digital assets and hyper-automation in mind – the concrete classification of the 'digital rails' for this is less decisive and will change anyway over time.

But Europe in particular cannot take too long to decide about its future path – otherwise the industry segments based here will suffer a further competitive disadvantage compared to other regions of the world that are approaching this transformation of money in a much more global-strategic way of thinking.

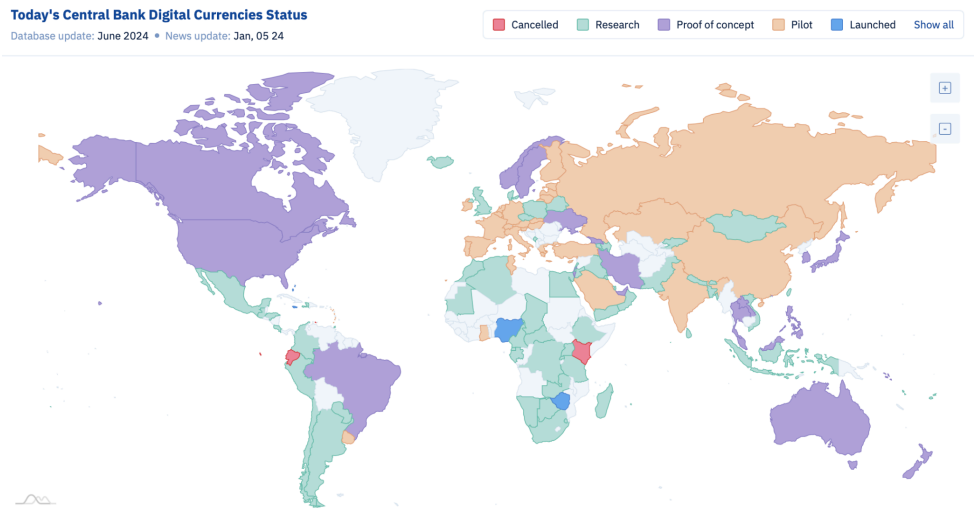

Figure 10: The status of Central Bank Digital Currencies Projects around the world.#

Digital Euro

The Facts

The Digital Euro is a current initiative led by the European Central Bank (ECB) to explore and establish a digital/additional form of cash. The current form of the Digital Euro is focused on retail. In parallel, different technological implementations, e.g. using distributed ledger technology, or central ledgers are being explored without any final recommendation.

Wholesales Central Bank Digital Currencies are more or less available to banks and used in interbank transfers. In the euro area, the Eurosystem offers banks the possibility of settling wholesale digital transactions through its TARGET Services using a centralised ledger already. Retail Central Bank Digital Currencies give end-users access to digital money and it can be used like regular cash.

Project Funding

The project is driven and funded by the ECB.

Main Project Goal

A Digital Euro would exist alongside Euro cash and other electronic means of payment, offering additional freedom of choice to end users. It is the very nature of a central bank to provide its people with free access to safe money. The Digital Euro would not be a crypto asset since it would be backed by a central bank.

The ability to exchange money issued by banks (or other private money issuers) any time into a form of money that is issued by the central bank (and thus backed by the sovereign) and is legal tender provides reassurance and an anchor of stability for the payments system as a whole. Currently, cash is doing this job alone.

In the future a Digital Euro would ensure public money continues to perform this role even as consumers increasingly prefer to pay digitally. With a Digital Euro, people would have more choice in how to pay and a secure solution that fully respects their privacy.

The central bank has no interest in monitoring peoples' payment patterns and no commercial aspirations. It would not have access to or store any personal data that would directly identify end users.

The Digital Euro is also intended to achieve a cash-like level of privacy for offline payments, as it would require no third-party validation and would rely simply on the direct transfer from the payer to the payee.

Moreover, a Digital Euro would be easy to use, so those who have more difficulties with digital devices would not be left behind.

A basic offer should continue to be provided for everyone when it comes to paying, whether it's in-store, online, between individuals, or government transfers.

Ecosystem Partner Evolution

As stated in the legislative proposal presented by the European Commission, a Digital Euro would be made available to people, businesses and public entities that reside or are established in a euro area Member State on a temporary or permanent basis.

Role in the EU & Beyond

A Digital Euro would offer a pan-European payment solution, available throughout the euro area, under European governance. It could therefore help reduce Europe's dependence on private, non-European payment providers, while acting as a counterweight to their market dominance. In turn, a Digital Euro would make the European payments landscape more competitive and innovative by offering a platform that makes it easier for payment service providers to offer pan-European solutions of their own.

Membership & Participation in the Initiative

Broad engagement with market stakeholders will ensure that a Digital Euro meets users' needs. A set of initiatives have been put in place, including (i) market contact groups, (ii) surveys and (iii) calls for expression of interest on the technical design features of a Digital Euro. ECB experts also exchange views on a Digital Euro with representatives from European civil society organisations and academia.

The Consortium's Structure

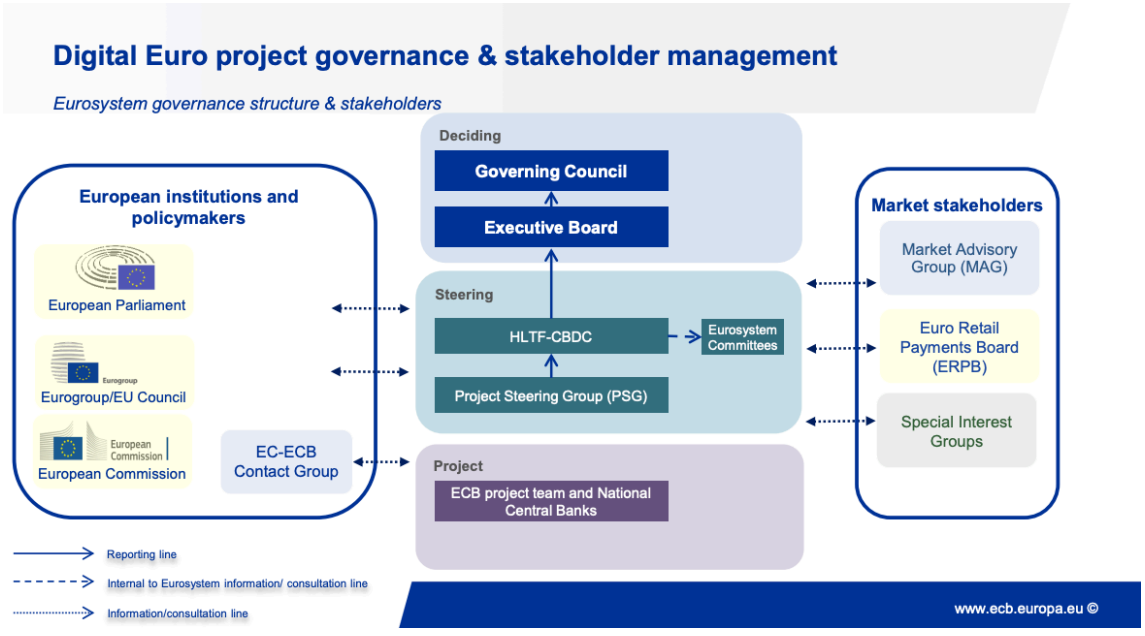

Figure 11: Digital Euro Governance and Stakeholders. Source: European Central Bank.#

Evolution of the Project

The Digital Euro project was launched in July 2021. At that time, the Governing Council decided to enter into a two-year **investigation phase** on the Digital Euro

from October 2021. The phase concluded in October 2023. During this phase, the Eurosystem focused on a possible functional design that was, in turn, based on users' needs. To this end, focus groups were set up, prototypes were created and conceptual work was advanced. Protecting citizens' privacy was given high priority throughout the process. The Eurosystem also investigated various use cases for a Digital Euro, and analysed the potential impact of a Digital Euro on the market. The project also focused on whether changes to the EU legal framework might be necessary to eventually introduce a Digital Euro.

Current Status: Solutions & Services

The **preparation phase**, which started in November 2023, focuses on further preparing for the development of a Digital Euro. It will lay the foundations for a potential Digital Euro, with work to include finalising the rulebook and selecting providers to develop the platform and corresponding infrastructure. The preparation phase will pave way for potential future decisions on issuing a Digital Euro and builds on the findings from the investigation phase.

Current Status: Technology & Standards

Users could access Digital Euro services via their payment service provider's proprietary app and online interface, or via a Digital Euro app provided by the Eurosystem. Companies involved in first prototypes include CaixaBank, and Worldline for peer-to-peer payments; EPI and Nexi for points of sale payments; and Amazon for e-commerce payments.

The Outlook

The Digital Euro will have a dedicated legislative framework. It will be for European co-legislators to ensure that it replicates key characteristics of cash in the digital sphere. A possible decision by the Governing Council of the ECB to issue a Digital Euro would be taken only after this legislation has been adopted. And the ECB will consider any changes to the design of a Digital Euro that may result from the legislative deliberations.

The European Commission initiated the legislative process for a Digital Euro with the publication of a legislative proposal in June 2023 for adoption by the European Parliament and the Council. The ECB stands ready to provide any technical input needed to support the work of the co-legislators.

It's expected that the preparation phase will take two to three years. It's likely to not expect a publicly issued Digital Euro before 2027.

Contact Persons

To reach out, the contact form available on their website can be used https://www.ecb.europa.eu/ecb/contacts/html/index.en.html.

Website

https://www.ecb.europa.eu/euro/digital_euro/html/index.en.html

Asset Tokenisation

Asset tokenisation or real-world asset (RWA) tokenisation is becoming a prominent issue in the industry for companies to be able to sell their goods and services differently, borderless-ly, and most importantly being able to be paid in digital assets when tokenised assets (goods or services) are purchased. The ERC-3643 smart contract standard is one example of asset tokenisation. Again, as stated above, depending on the rights and obligations tokenised, those digital assets will be treated as security tokens or utility tokens. The difference matters as it will affect how the companies will have to comply with either MiCA Regulation (utility tokens) or the Financial Regulation (security tokens) applicable in Europe.

ERC-3643 Association – Standardising the Asset Tokenisation Smart Contract

The Facts

Tokenisation has become the top priority for large financial institutions. As institutional research arms and consulting companies predicted, the tokenisation market will grow to a range from $4 trillion[102] to $16 trillion[103] by 2030, and a €400 billion[104] revenue opportunity for alternative investment by distributing to individuals. The strong statement that tokenisation will be 'the next generation for markets'[105] by the CEO of Blackrock, Larry Fink, indicates the tokenisation transition is inevitable.

However, the market is progressing, but not yet fully taking off to large volumes – due to the lack of standardisation, among other reasons. Market participants are looking for a way to not only enforce compliance but also ensure interoperability of tokenised securities. That's why the market could benefit from an industry-wide, recognised token standard that meets these needs while offering validated, high quality code. Other aspects are that a larger number of developers are required to pay attention to these aspects, e.g., activated by lighthouse cases in this area.

The open source ERC-3643 standard meets such requirements, for tokenising securities. It is validated by the Ethereum community by receiving the 'final' status for its Ethereum Improvement Proposal (EIP) and audited by Hacken. The token standard is widely recognised by authorities (e.g. ESMA[106]), institutions (e.g.

[102] https://www.citigroup.com/global/insights/citigps/money-tokens-and-games.
[103] https://web-assets.bcg.com/1e/a2/5b5f2b7e42dfad2cb3113a291222/on-chain-asset-tokenization.pdf.
[104] https://www.bain.com/insights/how-tokenization-can-fuel-a-400-billion-opportunity-in-distributing-alternative-investments-to-individuals/?utm_medium=social_advocacy&utm_source=LinkedIn-dysi&utm_content=659945e8-bafb-4474-abae-0cdb8cd50411&utm_term=147236.
[105] https://www.forbes.com/sites/davidbirch/2023/03/01/larry-fink-says-tokens-are-the-next-generation-for-markets/.
[106] https://www.esma.europa.eu/sites/default/files/2023-10/ESMA12-2121844265-3182_Report_on_the_DLT_Pilot_Regime_-_Study_on_the_extraction_of_transaction_data.pdf.

Citi[107]) and industry leaders (e.g. Polygon[108]) in the reports mentioned in the footnotes.

Main Project Goal

Standardising the tokenisation industry with the ERC-3643 smart contract standard. To ensure institutions do not reinvent the wheel and create new silos, it is essential to invite market players from both the traditional financial world and blockchain world to promote, guide, and build with the most suitable token smart contract to achieve standardisation. The non-profit ERC3643 Association has been created to achieve that.

The ERC3643 Association is bringing together industry leaders with a shared mission to advance the adoption of the ERC-3643 standard and promote the development of a standardised, secure, and compliant technical framework for tokenisation by providing educational content for market from business and legal perspectives, as well as developing free tools for developers to use ERC-3643 easily.

Ecosystem Partner Evolution

- *Financial Services:* MoraBanc, Peregrine Limited, A55, Creatrust, SS&C, Worldline, Invesco, Aztec Group, Avant Garde, Apex Group.
- *Global Law Firms:* CMS, Karm, Mayer Brown, Norton Rose Fullbright, DLA Piper.
- *Integrators & Consultancy & Association:* QualitaX, Fujitsu, Dev Pro, INATBA, Reply, Rethink Ledgers, Inveniam, Capgemini.
- *Tokenisation Solutions:* Bitbond, Real Tokn, Defactor, Boulder Tech, Consilience Group, Token City, Tokn1, Montis Group, Nyala, T-Rize Group, Tokeny, TokenForge, Rooba.
- *Blockchain & Web 3:* Chainlink, Zodia Custody, Ownera, CryptoLink.Tech, Dapps Factory, Taurus, Ledger, Republic Crypto, Avicenne Studio, Hacken, Frictionless Markets, eNor, CLST, Klaytn, Polygon Labs, Oasis Pro Markets, DFNS, Bitstamp, Archax.

Role in the EU & Beyond

In the EU and global tokenisation markets, the association plays three key roles:

- *Educator:* Members are dedicated to producing educational content, aimed at helping decision-makers in the capital markets understand how technical risks can be mitigated to enforce compliance while ensuring interoperability through ERC-3643. More intriguingly, the association shares the most successful tokenisation use cases and practices to inspire market participants.

[107] https://www.citigroup.com/rcs/citigpa/storage/public/Fund-Tokenization-Summary-Report.pdf.

[108] https://it.telangana.gov.in/wp-content/uploads/2023/12/Technical-Guidance-Note-on-Asset-Tokenization.pdf?utm_content=277407022&utm_medium=social&utm_source=linkedin&hss_channel=lcp-4874605.

- *Lobbyist:* Members, especially global law firms and tokenisation solution providers, collaborate to demonstrate to regulators how ERC-3643 can enforce compliance and track ownership. The objective is to reassure regulators that issuers can control tokenised securities, even on public blockchains. Thus, there is no need for additional regulations. Instead, the focus should be on providing a clear definition that tokenised securities are, indeed, securities, adhering to the same securities laws. To date, the association has presented this framework to several regulators, including the CSSF (Luxembourg), BaFin (Germany), DFSA (Dubai), FSRA (Abu Dhabi), and MAS (Singapore). These regulators have appreciated the framework's ability to enforce existing security laws, and additional meetings with regulators globally are already scheduled.

- *Enabler:* Members, especially blockchain companies and tokenisation providers, organise public workshops and develop free tools. The purpose is to enable any developer to understand how to use ERC-3643. Currently, the community has already published a free tool for any DeFi Protocols. This tool provides a seamless experience for interacting with ERC-3643, reflecting on compliance check status, and offering guidance for qualification by redirecting users to the onboarding platform for dedicated tokens.

Membership & Participation in the Consortium

The association's mission is to provide value and accelerate standardisation. Therefore the association only accepts members who can make valuable contributions, ensuring it doesn't merely focus on marketing efforts but evolves into actions that provide tangible results to make an impact on the development of the tokenisation industry. Companies intending to utilise ERC-3643 can freely access all open-source code on GitHub and content on the ERC3643.org website, without needing to join the association.

The Summary

The tokenisation market is gaining momentum, and ERC-3643 offers a versatile template for companies to develop or collaborate on tokenisation solutions and innovative use cases. This framework allows the tokenisation of various asset types across jurisdictions by implementing compliance rules and controls on EVM-compatible blockchains. The ERC3643 Association is committed to fostering adoption by providing publicly accessible concrete resources. This approach ensures that companies and institutions avoid reinventing silos, contributing to the establishment of a foundational and interoperable finance system.

The Outlook

- *Regulation Clarity:* Expect increased regulatory clarity in the major financial hubs by 2025 by educating regulators on how technology risks can be addressed with the right smart contract standard ERC-3643.

- *Institutional Adoption:* Anticipate a surge in institutional adoption as ERC-3643 gains credibility in 2024 and years to come. This shift will signify

wider acceptance within traditional financial structures, validating the protocol and fostering greater integration into mainstream finance.

- *Market Growth:* Foresee an improved tokenisation landscape with high quality assets, attracting more investors, which leads to increased liquidity, and the emergence of new financial services and interoperable applications.

Contact Persons

To get in touch, email contact@erc3643.org.

Website

https://www.erc3643.org/

Tokenize Europe 2025

The Facts

The Tokenize Europe 2025 initiative is a joint effort by the European Commission and the German Banking Association to position Europe at the forefront of tokenisation technology.

Project Funding

Specific details about funding haven't been publicly disclosed. Despite this the initiative involves collaboration between the European Commission and the German Banking Association. This suggests potential joint funding efforts.

Main Project Goal

The main project goal of Tokenize Europe 2025 is to solidify Europe's position as a global leader in tokenisation technology. This initiative, launched by the European Commission and the German Banking Association, aims to achieve this by fostering widespread adoption of tokenisation across various sectors. By establishing a supportive regulatory environment and upskilling the European workforce in digital technologies, Tokenize Europe 2025 seeks to unlock the potential of tokenisation for European businesses. This, in turn, aims to enhance competitiveness and create new digital business models across the continent.

Role in the EU & Beyond

Tokenize Europe 2025 plays a multifaceted role in the European Union. Within the EU, it aims to solidify Europe's position as a technological leader by driving innovation in tokenisation. This could create a more efficient and competitive European economy, particularly in areas like supply chain management and finance. By fostering collaboration between public and private entities, the initiative hopes to establish clear regulations and best practices for tokenisation use. This could not only benefit the EU but also serve as a model for other regions looking to adopt this technology. Ultimately, the success of Tokenize Europe 2025 could influence global standards and best practices for tokenisation, shaping the future of this technology on a broader scale. Meetings are being held this Summer with representatives from overseas and the EU Commission to explain the Tokenize Europe approach and the consortium’s goals.

Membership & Participation in the Consortium

The Tokenize Europe 2025 initiative is founded by the European Commission and the German Banking Association, moderated by consulting firm Roland Berger. Major financial institutions from across Europe are involved, including BBVA, Commerzbank, Deutsche Bank, and Banco Santander. Additionally, leading industrial players like Daimler Trucks, Renault, and Repsol contribute their expertise. Besides the German Banking Association, its counterparts from Italy and Liechtenstein are involved as well as payment firms Iberpay and Worldline.

Current Status: Solutions & Services

The Tokenize Europe 2025 initiative launched various working sessions and boot camps during the summer of 2022. As a result, they published a report explaining evaluations of the current state of tokenisation in Europe, along with the conclusions and recommendations drawn from them. The report proposes a five-step plan to overcome challenges, including clearer terminology, better communication between policymakers and innovators, and showcasing real-world benefits through pilot projects.

Contact Persons

The contact persons for the European Commission are Dr. Joachim Schwerin and Dr. Lukas Repa[109]. For the German Banking Association, they are Tobias Tenner[110] and Simon Zieglgruber[111], and for Roland Berger, they are Sebastian Maus[112] and Sebastian Steger[113].

[109] https://www.linkedin.com/in/lukas-repa/.
[110] https://www.linkedin.com/in/tobias-tenner-07689a24/.
[111] https://www.linkedin.com/in/zieglgruber/.
[112] https://www.linkedin.com/in/sebastianmaus/.
[113] https://www.rolandberger.com/en/Persons/Sebastian.Steger.html.

Other Blockchain and Tokenisation Initiatives in the Financial Sector

With the positive regulatory backdrop created by the DLT Pilot Regime and MiCA Regulation, and with the additional support of the Tokenize Europe 2025 initiative, co-founded by the European Commission, the EU has suddenly become quite attractive for the development of various blockchain and tokenisation projects in the financial sector, akin to industrial use cases in other sectors. Let's see how the old continent is trying to develop itself into a fully-fledged token economy with one novel example.

European Investment Bank's Bond Tokenisation Experiments

In 2021, the EIB has started to experiment with Ethereum to tokenise bonds by issuing a €100 million 2-year bond on the most popular dApp-focused blockchain, in collaboration with Goldman Sachs, Santander and Societe Generale. The goal was to analyse its potential to reduce intermediaries and costs, while increasing settlement and transparency. Now, in 2023, the EIB issued another bond, but this time sterling-denominated and issued in the new private blockchain of HSBC, Orion. However, it still registered the transaction on Ethereum for record-keeping purposes. This way, it ensured the privacy of the participants, which would otherwise be lost if it had opted to do it entirely in a public blockchain.

Contact Persons

The contact person is Susanna Seymour[114].

Website

https://www.eib.org/en/press/all/2021-141-european-investment-bank-eib-issues-its-first-ever-digital-bond-on-a-public-blockchain

[114] https://www.linkedin.com/in/susanna-seymour-b6096241/.

11. Standardisation

In 2023, BlockStand and SeeBlocks emerged as pivotal consortia in the EU's blockchain standardisation efforts, both funded by the EU, each with unique strategies yet shared goals.

BlockStand, with a €400,000 funding allocation for standardisation experts, focuses on amplifying the EU's global leadership in blockchain standardisation, rallying around a community-driven approach to embody European values in international standards. Its consortium includes the European DIGITAL SME Alliance, INATBA, SBS, and UNINFO.

Conversely, SeeBlocks, supported by the Digital Europe Programme and a €300,000 budget for SEPs, seeks to strengthen the European presence in blockchain/DLT standardisation through an industry-led, democratic initiative. Trust-IT Srl leads this consortium, with partners like COMMpla Srl, Dublin City University, and the Fraunhofer Institute, developing tools and reports that resonate with European principles.

Both initiatives are crucial for the EU's ambition to be at the forefront of blockchain innovation and standardisation. Yet, they cater to different aspects of the ecosystem's evolution, highlighting the diverse strategies employed to achieve European dominance in blockchain technology. Combined, they represent a 700.000€ allocation to leverage Blockchain and DLT standardisation experts' activities.

BlockStand

The Facts

BlockStand is a pivotal initiative to reinforce the European Union's leadership in global blockchain standardisation. It is designed to ensure that internationally used blockchain standards reflect European values and needs. The project is instrumental in promoting Europe's strategic autonomy in the blockchain sector.

Project Funding

The project receives funding from the European Union and is highlighted by its commitment to support the participation of European experts in blockchain and distributed ledger technology (DLT) standardisation activities. An indicative figure of €400,000 has been allocated to fund around 40 experts in these standardisation activities.

Main Project Goal

The primary aim of BlockStand is to elevate the EU's leadership in blockchain standardisation globally. This is to be achieved by enhancing the participation of European experts in the standardisation process, ensuring that the standards adopted internationally embody European principles and address the continent's specific requirements.

Ecosystem Partner Evolution

The four partners in the BlockStand consortium include the European DIGITAL SME Alliance, the International Association for Trusted Blockchain Applications (INATBA), Small Business Standards (SBS), and UNINFO. These organisations bring together a vast network of SMEs, advocate for blockchain adoption, represent SME interests in standardisation, and focus on information technologies related to blockchain, respectively.

Role in the EU & Beyond

BlockStand's role extends beyond standardisation; it supports the European Commission’s ICT Standardisation Rolling Plan, strengthens ties with the European Blockchain Partnership (EBP) and the European Blockchain Services Infrastructure (EBSI), and encourages European participation in international and European Standards Developing Organisations.

Membership & Participation in the Consortium

With significant blockchain standardisation expertise, the four partners mentioned above lead the consortium. The governance includes an Executive Management Board and a Technical Coordination Board, ensuring strategic guidance and technical oversight of the project's execution. Standardisation experts are welcome to apply for funded contributions through the website https://blockstand.eu/ on a rolling basis until the last cut-off: 15 February 2025.

The Summary

BlockStand stands as a cornerstone for fostering European leadership in the blockchain standardisation arena. It aims to create an inclusive online blockchain community, encouraging collaboration and idea exchange to secure the EU's position as a leader in blockchain technology.

The Consortium's Structure

The consortium is structured around a core group of partners, including industry leaders, public institutions, and academia, managed by an Executive Management Board for strategic direction and a Technical Coordination Board for expert coordination.

Evolution of the Project

Through its lifecycle of 2 years from May 2023 to May 2025, BlockStand focuses on supporting the implementation of key EU blockchain initiatives, reinforcing strategic partnerships, and facilitating expert participation in standardisation activities, namely in Standards Developing Organisations. This involves a series of deliverables, such as a repository of blockchain standardisation activities and a roadmap for European blockchain standardisation.

Current Status: Solutions & Services

BlockStand is working towards achieving its objectives by fostering a vibrant community of stakeholders engaged in continuous collaboration. The project emphasises creating and sharing resources, such as the Standardisation Gaps & Recommendations Atlas and success stories from experts, to inspire further participation and leadership in blockchain standardisation.

Current Status: Technology & Standards

The initiative is geared towards filling standardisation gaps, offering a roadmap for European blockchain standardisation, and documenting the integration of blockchain technologies into the EU's Rolling Plan for ICT Standardisation.

Contact Persons

For more information or inquiries, interested parties are encouraged to contact BlockStand through their official communication channel at blockstand@digitalsme.eu.

Website

https://blockstand.eu/.

SeeBlocks

The Facts

SeeBlocks is a pivotal initiative under the Digital Europe Programme, structured to bolster European interests in the standardisation of blockchain and distributed ledger technology (DLT). This 24-month project is distinguished by its democratic, industry-led approach, aiming to enhance European presence in international blockchain/DLT standardisation efforts.

Project Funding

The project facilitates the engagement of European blockchain experts through four Selection and Engagement Procedures (SEPs), with a funding pool of €300,000. These procedures are designed to support over 40 European blockchain specialists in their research activities, contributing significantly to the field.

Main Project Goal

The primary objective of SeeBlocks is to foster a unified, industry-driven initiative that propels European interests in blockchain/DLT standardisation. It aspires to achieve a tangible impact by strengthening European participation in international standardisation, producing vital research outputs such as the landscape and gap analysis report, and ensuring Europe's strategic position in the global blockchain/DLT standardisation landscape.

Ecosystem Partner Evolution

The project leverages a multi-disciplinary panel of experts, funded through SEPs, to streamline effective standardisation processes. This collaborative effort is essential for maintaining an ongoing dialogue from various perspectives including regulatory, governmental, policy, business, and technology.

Role in the EU & Beyond

SeeBlocks plays a crucial role in representing European interests on the EU and international stages. By developing tools like the Standards Visualisation Tool and engaging in activities like the delivery of the Landscape and Gap analysis Report, it seeks to educate, build capacity, and influence blockchain standardisation in alignment with European values.

Membership & Participation in the Consortium

The consortium is spearheaded by Trust-IT Srl, alongside key partners like COMMpla Srl, Dublin City University, and the Fraunhofer Institute for Systems and Innovation Research ISI. These entities bring a wealth of experience and expertise to the project, contributing to its objectives and outcomes.

The Summary

In summary, SeeBlocks represents a strategic effort to unify European expertise in the standardisation of blockchain and DLT, aiming to assert European interests

and values in the global arena while fostering innovation and collaboration within the ecosystem.

The Consortium's Structure

Led by Trust-IT Srl, the consortium comprises entities like COMMpla Srl, Dublin City University, and the Fraunhofer Institute, each playing a significant role in the project's execution and achievement of its goals.

Evolution of the Project

The project's evolution is marked by the establishment of the Permanent Task Force, the development of the Standards Visualisation Tool, and the execution of SEPs to engage European blockchain experts actively.

Current Status: Solutions & Services

The project has launched an online consultation to shape future blockchain standards in Europe, reflecting its commitment to incorporating stakeholder inputs into the development of standards that align with European interests and values.

Current Status: Technology & Standards

SeeBlocks is dedicated to ensuring that future standardisation efforts reflect European interests, contributing to the blockchain chapter of the Rolling Plan for ICT Standardisation and facilitating the engagement of European experts in international standardisation activities.

Contact Persons

For more detailed inquiries and direct engagement with SeeBlocks: https://seeblocks.eu/contact-us

Website

https://seeblocks.eu/

The European Digital Identity Wallet (EUDIW)[115] Consortia

The POTENTIAL consortium launched to pilot the new European Digital Identity Wallet (EUDIW) and its first general assembly took place in July 2023 at the Ministry of Economy, Finance, Industrial and Digital Sovereignty of France.

This meeting of paramount importance brought together stakeholders from a wide range of backgrounds, including government officials, industry leaders and academics from the 19 European Union Member States and Ukraine to lay the foundations for a concrete project placing the citizen at the heart of digital identity. Co-led by France and Germany, POTENTIAL is one of the four[116] large-scale pilots selected by the Commission to experiment with digital identity throughout Europe. It has received 16m EUR infunding through the Digital Europe programme. POTENTIAL aims at fostering innovation, collaboration and growth in six digital identity sectors (governmental services, banking, telecommunications, driving licence, electronic signature and health). It represents a huge promise and marks a crucial step in collective efforts to strengthen the European Union's digital decade. As more and more of our daily tasks shift onto the internet and more and more people have access to and use online services, all European countries are keen for every citizen to have a secure, authentic and verifiable identity and to enjoy the full protection of their personal data.

The EUDIW project transcends the simple notion of digital identity to establish itself as a true trust infrastructure on a continental scale. This ambition is based on a technical architecture of unprecedented sophistication, combining the latest advances in cryptography, blockchain and artificial intelligence. At the heart of this innovation is a subtle balance between decentralisation and interoperability. EUDIW leverages distributed consensus protocols, ensuring exceptional resilience against threats of compromise or manipulation. At the same time, its modular design allows for seamless integration with existing systems, whether traditional banking infrastructures or emerging fintech platforms.

At its launch, the POTENTIAL consortium is adopting a pragmatic, user-centric approach guaranteeing interoperability between the systems of different businesses and institutions. The unique group of public and private-sector experts is well-placed to address the issues (technical, business, regulatory, etc.) involved in providing every citizen with a single digital identity.

Its goals are to:

- Collaboratively develop interoperable national digital wallets accessible across Europe in a fully secure manner.
- Streamline online procedures such as opening a bank account, renting a car or signing documents electronically.
- Forge stronger ties across Europe and help people, businesses and governments to work together more efficiently.

[115] https://www.digital-identity-wallet.eu/.
[116] See: Beyond eIDAS 2.0 (neosfer.de)

The POTENTIAL consortium, which aims to complete its work within the next two years, will focus its attention on six use cases aligned with the priority needs expressed by citizens in Europe:

- *eGov Services:* A secure digital ID that will allow citizens to quickly and securely prove their identity as part of their online citizenship procedures.
- *Bank Account Opening:* A secure digital ID that can be used to open current and savings bank accounts everywhere in Europe, including across borders.
- *SIM Card Registration:* A secure digital ID suitable for activating pre-paid and post-paid mobile telephone contracts online, including cross-border subscriptions.
- *Mobile Driving Licence:* A secure digital driving licence that will be accepted by car rental agents and police officers everywhere in Europe.
- *Qualified eSignature::* A secure qualified digital signature that will enable all citizens across Europe to sign documents and declarations remotely.
- *ePrescription:* A secure digital way to fill or refill prescriptions anywhere in Europe.

Website

https://www.digital-identity-wallet.eu

LinkedIn

https://www.linkedin.com/company/potentialeu/about/

12. Overarching & Special Topics

This chapter explores initiatives that work on a variety of topics beyond the EU area, as well as projects that focus on very specific areas of industrial blockchain use, such as the area of agriculture, with a global outlook.

Hyperledger and LACChain exemplify collaborative efforts to advance blockchain technology globally. Hyperledger provides modular frameworks and tools for enterprises to build secure and scalable blockchain networks. At the same time, LACChain aims to accelerate blockchain adoption in Latin America and the Caribbean, enhancing digital security and trust through partnerships with government agencies, financial institutions, and technology companies. Together, these initiatives drive innovation, standardisation, and inclusive development, showcasing the global impact of blockchain technology.

TRUSTyFOOD supports policymakers in the agri-food sector by clarifying the benefits and opportunities blockchain technology can offer, creating a comprehensive roadmap for blockchain applications with a cohesive strategy for the future of more efficiently managed food systems and the objective to better preserve soil and nature at the same time.

These projects are another set of examples highlighting the versatility and impact of blockchain technology in addressing industry-specific challenges and driving digital transformation.

Hyperledger

The Facts

Hyperledger is an open-source project under The Linux Foundation that fosters collaboration between various companies and organisations to advance blockchain technologies. It provides open-source frameworks and tools for businesses to build their own blockchain networks. Hyperledger is not a single blockchain platform, but an umbrella project that hosts several blockchain projects.

Project Funding

Hyperledger is funded by its members. There are three tiers of membership with different fees: premier, general, and associate.

Main Project Goal

The main project goal of Hyperledger is to enable developers, enterprises, and organisations to openly develop and govern blockchain frameworks and tools.

Ecosystem Partner Evolution

Hyperledger's ecosystem is continuously evolving through its partners. New players, such as startups, are joining and bringing fresh ideas. Existing partners, like IBM, are enhancing their offerings. For example, IBM has expanded its Hyperledger Fabric expertise to offer consulting and implementation services, aiding businesses in leveraging the technology more effectively. Collaboration is also intensifying as partners collaborate on specific use cases. This dynamic exchange of expertise among different partners ensures that Hyperledger remains innovative and adaptable in the evolving landscape of blockchain technology.

Global Role

While Hyperledger itself isn't an EU-based project, it also contributes to the European blockchain ecosystem in a few ways. First, its open-source frameworks like Fabric are used by European companies to build blockchain applications, while other projects such as Hyperledger Besu (even though being a public blockchain- / Ethereum-based solution that joined Hyperledger Foundation in 2019) are underpinning public infrastructure initiatives such as EBSI.

Second, Hyperledger fosters collaboration between various entities, which can benefit European initiatives like Tokenize Europe 2025. Finally, by providing open-source tools, Hyperledger helps accelerate innovation in blockchain technology across Europe. Beyond the EU, Hyperledger serves as a cornerstone for global blockchain development. It offers open-source frameworks like Fabric for businesses to build secure blockchain networks, fosters collaboration to accelerate industry adoption, and contributes to standardisation efforts, making blockchain technology more interoperable and reliable for worldwide use.

Membership & Participation in the Consortium

Hyperledger embraces an open and collaborative approach. Participation is facilitated through a tiered membership model (premier, general, associate) catering to different levels of involvement. This allows a diverse range of organisations to join, each contributing their expertise and shaping the project's direction.

The Consortium's Structure

Hyperledger functions as an open community. Organisations join at varying tiers and collaborate through working groups focused on specific blockchain goals. A steering committee, with representatives from member organisations, provides technical oversight and project direction.

Evolution of the Project

The Hyperledger project, launched in 2015 by The Linux Foundation, marked a significant step forward for enterprise blockchain solutions. Key industry players like IBM, Intel, and SAP joined forces to drive this initiative. Initially, the focus was on creating a diverse range of open-source frameworks. Projects like Fabric, Sawtooth, and Iroha emerged, each catering to the specific needs of different industries. To foster a collaborative environment, a tiered membership model was established, attracting a wide range of organisations and their expertise. As the project matured, the focus shifted towards ensuring interoperability and standardisation of blockchain technologies. Today, Hyperledger remains a frontrunner, offering a robust framework for businesses to build secure blockchain networks. By fostering collaboration through its working groups, Hyperledger continues to accelerate industry adoption internationally.

Current Status: Technology & Standards

Hyperledger has cultivated an ecosystem of open-source blockchain frameworks, each catering to distinct industry requirements. The marquee framework, Hyperledger Fabric, remains a popular choice for building permissioned blockchain networks. Fabric 2.5, the latest stable release, boasts enhanced performance and scalability features, making it suitable for high-volume enterprise use cases. Beyond Fabric, frameworks like Hyperledger Iroha cater to permissioned environments with a focus on user identities, while Hyperledger Sawtooth prioritises modularity and allows developers to choose specific components for their blockchain applications. Moreover, the project prioritises interoperability and standardisation across its frameworks. This focus ensures that blockchain applications built on Hyperledger technologies can interact seamlessly with each other, fostering a more cohesive and integrated ecosystem.

The Outlook

Looking ahead, Hyperledger is constantly evolving, with new features and functionalities being added to its frameworks. Businesses around the world are seeing value in the initiative, for instance, Microsoft joined the Hyperledger community in 2019. However, its long-term success hinges on its ability to achieve interoperability with other blockchain platforms, navigate the evolving regulatory

landscape, pursue standardisation efforts, and integrate with emerging technologies like AI and IoT. By addressing these challenges, Hyperledger can solidify its position as a leader in enterprise blockchain solutions, but must also master the effects of the corporate roadmaps of their major industry stakeholders.

Contact Person

Hyperledger itself doesn't have a single point of contact as it functions as a collaborative community. The website provides different options depending on your inquiry: 'Event Inquiries' can be directed to events@hyperledger.org, while 'Membership Inquiries' require visiting the join page. General information can be obtained through info@hyperledger.org, and for membership-specific support, there's membersupport.hyperledger.org.

Website

https://www.hyperledger.org/

LACChain

The Facts

LACChain is a global alliance that promotes blockchain technology in Latin America and the Caribbean. It is led by the Innovation Lab of the Inter-American Development Bank Group (IDB Lab). LACChain focuses on two main pillars: community and infrastructure.

Project Funding

The project is sponsored by the IDB Lab and works with a global alliance of partners.

Main Project Goal

The main project goal of LACChain is to accelerate the adoption of blockchain technology in Latin America and the Caribbean. The alliance aims to empower people, improve digital security, and generate trust in the digital economy and society.

Ecosystem Partner Evolution

The Ecosystem Partner Evolution of LACChain showcases a growing network of partnerships across various sectors. Government agencies, including Colombia's Ministry of Finance and Mexico's CONDUSEF, collaborate with LACChain on blockchain applications. Financial institutions like Banco Santander and technology companies such as IBM contribute expertise, while academic institutions like Universidad de los Andes and Tecnológico de Monterrey drive research and educational initiatives. These partnerships drive innovation and social impact in Latin America and the Caribbean.

Role in LatAm & beyond

LACChain's focus on permissioned public blockchains for social good projects in Latin America and the Caribbean has the potential to be a global role model. This approach balances security with accessibility, ideal for regions with evolving regulations. Furthermore, LACChain's prioritisation of social good could inspire worldwide initiatives that extend beyond just financial applications. Finally, their successful collaboration between the public (IDB Lab) and private entities positions LACChain's model for replication in other parts of the world, potentially accelerating positive social and economic change through blockchain technology.

Membership & Participation in the Consortium

LACChain's membership and participation are organised through its Alliance program, which brings together a diverse range of stakeholders including government agencies, financial institutions, technology companies, and academic institutions. Additionally, LACChain fosters international partnerships to promote interoperability and scalability in blockchain applications, furthering its mission of driving inclusive development and transparency in the region.

The Consortium's Structure

The IDB Lab spearheads the initiative, but it involves a global alliance of partners. This suggests a semi-centralised structure with IDB Lab providing leadership and potentially technical or resource support, while other members contribute expertise or participate in working groups on specific projects.

Evolution of the Project

LACChain has evolved significantly since its inception in 2018. Initially conceived as a blockchain platform to foster financial inclusion and improve transparency in Latin America and the Caribbean, it has expanded its scope to encompass a broader array of applications beyond finance. In 2020, LACChain launched its Alliance program, partnering with over 30 organisations including government entities, startups, and academic institutions, to develop blockchain solutions addressing various social and economic challenges in the region. Furthermore, LACChain has been actively involved in promoting interoperability among different blockchain networks, notably through its collaboration with Algorand in creating a cross-border payment corridor. This evolution underscores LACChain's commitment to leveraging blockchain technology for the benefit of the region, fostering innovation and collaboration across sectors.

Current Status: Solutions & Services

LACChain provides a public-permissioned blockchain infrastructure based on existing standards from organisations like ISO and ITU and collaborating with the Hyperledger Foundation. This infrastructure allows participants to build their own solutions and services on a secure, transparent, and interoperable platform. LACChain aims to be inclusive and cater to a wide range of uses, from social good projects to business applications.

The Outlook

Looking ahead, LACChain envisions a future where blockchain technology seamlessly integrates into Latin America and the Caribbean, empowering development through socially impactful applications. This vision hinges on fostering collaboration between stakeholders and establishing interoperable standards to overcome current limitations and create a scalable ecosystem.

Contact Persons

Interested entities in Latin America and the Caribbean can contact LACChain via email at lacchain@iadb.org.

Website

https://www.lacchain.net/

TRUSTyFOOD

The Facts

The initiative entitled 'Stakeholders-driven pathways for blockchain implementation in the agri-food sector' was launched in 2021 in response to a Horizon Europe funding programme topic asking for providing support to government agencies in making strategic decisions in relation to blockchain technology application in the agri-food sector. Indeed, the conflicting opinions about the tech on the one side and the rapid and unpredictable direction of blockchain innovation make it particularly hard for these stakeholders to understand how to respond to this and plan for the future.

Approved as the winning initiative under the competition, TRUSTyFOOD obtained a grant and started in July 2022 – with a project duration of 36 months.

The project involves 13 partners, in representation of 7 European countries and 1 third country, through a multi-actor approach (involving academia and research centres with experience in ICT/blockchain technology, sustainability, economics; but also associations representing the food system, i.e. farmers, food industries).

Project Funding

The granting authority is the European Research Executive Agency, the total funds are in the range of three million Euros.

The Main Goal

The TRUSTyFOOD project has a strategic and supportive mission. Focused on the agrifood sector, it intends to support policymakers in shedding light on the current partial and fragmented picture of blockchain tech applications in the agri-food domain, by clarifying the benefits and opportunities which blockchain tech can concretely offer to stakeholders throughout the food chain. It intends to arrive at drawing up an R&I Roadmap for blockchain technologies in this sector and to prepare the way for R&I activities for the decade to come.

The pathway towards such a roadmap foresees:

- Exploring and assessing existing use cases that demonstrate blockchain's capabilities (both through desk research and by establishing a dialogue with stakeholders).
- Identifying barriers, drivers and actions for intervention.
- Summing up all the evidence in common public papers useful to provide orientation and guide future policies in R&I.

Consortium Evolution

The consortium started from the belief that in order to maximise the achievement of demanding project's goals and the EC expectations, as well as to guarantee a major impact, results need to be generated through the involvement of a broad range of stakeholders, among them representatives of different

interests (science, businesses, other). Even if the project's partners have been chosen to guarantee complementary skills for implementing the project and for complying with all the obligations stated with EC, no consortium alone – however large and well-balanced – can guarantee such a broad perspective. Accordingly, the project consortium does not work in isolation, but continuously involves external stakeholders through a participatory and voluntary process.

The project partners will act as 'facilitators' and as main actors in creating the basis for the conceptual framework and discussion, but external stakeholders – in different phases – contribute as well through Working Groups or Task Forces. The project regards as stakeholders: scientists, technology providers and their associations, and end users (actors along the food supply chain).

Role in the EU & Beyond

TRUSTyFOOD aims to play a pivotal role in the EU and beyond by fostering collaboration among diverse stakeholders in the agrifood sector. Through partnerships, the project does not stop at EU level but investigates also the North-African and Middle-Eastern situation. The presence of the World Farmers Organisation (WFO) also contributes to a global outreach.

Progress of the Project

The initiative just ended the second year of action. During this period, the project carried out an in-depth context analysis, through desk research and by directly involving people who worked on blockchain technology's application, identifying working practices, implementation techniques, and remaining gaps. A dashboard with 320 use cases was realised, which can be accessed here https://www.trustyfood.eu/framework-of-services/dashboard/.

Eight workshops with stakeholders were carried out, identifying the barriers and drivers to blockchain technology application in the sector. Phase 3 is now starting, the 'strategy co-creation' (aimed at identifying most appropriate solutions), while Phase 4 ('Consolidation and reflections') is expected to be completed by the beginning of 2025. In line with the EU Blockchain Strategy[117], task forces are organised to discuss technical issues such as 'Interoperability and Standardisation issues related to BCT application in agrifood', 'Skills development for BCT application in agrifood', 'New digital trends in agrifood sector and the contribution offered by BCT'. Such collaboration should produce – in a joint effort – three white papers, intended as strategic documents.

Contact Persons

For inquiries and joining the Stakeholder Community (contributing to Working Groups, Task Forces), please reach out to the TRUSTyFOOD team through the link https://www.trustyfood.eu/sign-up-to-our-stakeholder-board/ or contact info@trustyfood.eu.

Website

https://www.trustyfood.eu/

[117] https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy.

13. Miscellaneous Projects

This section's purpose is to open the door to the second phase of the Industrial Blockchain Task Force: inviting private sector projects and grassroot initiatives to volunteer information about their value addition through leveraging blockchain in the industrial context.

SEKAI

SEKAI is an example for a start-up initiative.

The Facts

Today, the global economy and its various sectors face productivity ceilings that require overall efficiency improvements impossible without the right technologies.

The advent of the internet has brought about a paradigm shift, and while big data has helped companies like Google, Facebook and OpenAI gain ground and shape the way we consume content, real-world productivity gains, especially in economic and industrial contexts, require a more sophisticated approach than merely collecting and analysing tons of data.

SEKAI is the first protocol of its kind to attempt such a solution using patented data interoperability along with machine learning and artificial intelligence (on a graph database), to allow entities to unlock real-world, impactful insights in a visual space throughout time.

Project Funding

The venture has been bootstrapped by the founders up to this point in time. All in all the accrued costs approximate 500k USD. SEKAI is in Seed Round in 2024.

Main Project Goal

This technology and its individual components, including the EKG (Elastic Knowledge Graph), and Logic Patterns, have already had successful implementations – in the form of digital twins – with some of the world's largest industrial clients.

The goal now is to expand on these building blocks to open up the full potential of our unique offering that is already significantly faster, open and more flexible than any other existing solutions. To do so the project is opening up to the public in an app marketplace model for anyone to use.

With the upcoming implementation of an advanced AI layer, SEKAI's aim is to disrupt industrial and operational processes across the board, resulting in meaningful improvements to aggregate efficiency, resource utilisation, and the development of global sustainability goals. This use case, combined with the innovation crowdsourced from our community of builders, places SEKAI at the leading edge of productivity enhancement.

Ecosystem Partner Evolution

Any business or individual can use SEKAI in private or public mode to make data interoperable and build digital twins. With a similar concept to the Apple Store, users can create for themselves or for mass consumption through the marketplace all operating via smart contract through your wallet sign in. SEKAI is already testing the platform with private clients with success and aims to launch in 2024 with 10 clients.

Role in the EU & Beyond

SEKAI is Swiss-based and helps actualise the 3rd Industrial Revolution (Jeremy Rifkin) that is taking place in Europe, particularly in bringing ESG tracking and regulation data into alignment and use.

Membership & Participation in the Consortium

SEKAI is an established b2b web2 company that is expanding into web3. SEKAI's current clients, including Hitachi have expressed interest in integrating web3 products into their collaboration and SEKAI is actively seeking to collaborate with data scientists and developers from across the blockchain space as well as universities and current web2 companies that seek to expand into web3. SEKAI hopes the use and potential integration of theplatform to all members of the consortium will boost the collaboration and common technology advancement as SEKAIbuilds the network of web3 integration and interoperability between the web2 and web3 world.

The Consortium's Structure

SEKAI is an AG in Switzerland.

Evolution of the Project

SEKAI was launched in November 2022. Built on the breakthrough core technology of SEKAI, the aim is now to address the market not covered by the B2B approach. To truly scale the technology, it must be put into the hands of builders to use. SEKAI aims to do that through developing a builder SDK and platform for the marketing of data, data models, and skills directly to industry.

The Sandbox Platform is now complete and in use by clients. The public SEKAI Platform aims to launch 12 months after the seed round raise completes.

Current Status: Solutions & Services

With the advent of IoT devices and sensors, a person's ability to gather data has seen unprecedented improvements. Today one can find data for almost anything, ranging from global weather patterns to supply chain data, population growth, and even wildlife migration.

However, most of this data is siloed and is lacking interoperability. This means different data sets can't communicate with each other in any meaningful way, resulting in limited value generation capabilities.

Imagine being able to take localised weather and climate data; connect it with regional wildlife tracking data, satellite images and study potential behavioural changes in animals as the climate changes. Now imagine being able to explore, simulate, and discover impacts down to specific weather patterns and animal species. The possibilities of connected data are endless when the tools are put in the hands of the data owners via the SEKAI platform.

The Outlook

Data is far more extensive than is commonly perceived. SEKAI typically refers to data in the context of databases, documents, or files on digital storage mediums; data, when contextualised, unlocks game-changing insights.

The amount of data being generated and collected around the world by mobile service providers, transport operators, computer software providers, schools, governments, independent researchers, and large corporations presents a treasure trove of untapped commercial interactions awaiting monetisation.

With its patented solution to data interoperability combined with tools enabling a creator economy, SEKAI is unlocking a blue ocean, facilitating the emergence of entirely new economic models and processes driven by data insights.

This untapped potential is as large as your imagination. Looking at only two of the addressable markets from a large pool, the market size can be estimated at around $230bn with incredible growth forecasts.

Market for Digital Twins: Digital Twins are poised to be critical aspects of real-world data interoperability. According to Meticulous, the digital twin market is valued at $30.1b, and a CAGR of 38.1 % is predicted for 2025. Other analysts, such as Global Market Insights, rate the market for 2027 >$50b at a CAGR of >35 %.[118]

Market for Data Processing and Data Analytics: This is one of the largest and fastest-growing markets in the world. As the biggest chunk of this market, big data analytics is projected to grow from $200bn in 2020 to $700bn in annual turnover in 2030, with annual growth of more than 10 %. Monetising data using data analytics and data shows even stronger growth, projected to hit $133bn in annual turnover by 2026, growing 26 % year over year.[119]

The coming EU regulatory clarity and openness to Metaverse policy initiatives places SEKAI well to help enable this sector to thrive.

Contact Persons

To reach out, the contact form available on their website can be used: https://www.sekai.io/contact.

Website

www.sekai.io

[118] https://www.meticulousresearch.com/product/digital-twin-market-5060.
[119] https://outlook.gihub.org.

Bitbon System as an Ecosystem of Digital Services

The Bitbon System is a grassroots initiative, a platform solution that allows users to tokenise assets and manage their rights to these assets in new ways by utilising a comprehensive infrastructure of services. One of these services is the Meta Studio Digital Economy, which allows users to create meta-assets and use them as a personal tool for accounting and managing tokenised asset rights.

The Bitbon System is a part of the platform economy, continuously developing with developing tendency with an exponentially growing influence on all spheres of modern society.

To carry out professional and commercial activities, the Bitbon System has a range of statuses and roles that allow you to use your competencies and expertise in dynamically developing industries. Users of the Bitbon System use meta-assets as a new tool for managing tokenised rights to assets such as real estate, vehicles, artwork, gaming artefacts, jewellery, natural resources, services, access to services, and virtually any type of asset, to conduct social and economic relations. Meta-assets allow for efficient and secure accounting and disposal of tokenised rights in full compliance with the framework of the current regional legislation.

In general, the use of meta-assets meets the current requirements of the global community and ensures the achievement of many effects, including addressing global inequality, providing access to new economic and social models, and modernising e-commerce, among others.

The Bitbon System as an ecosystem of digital services has been developing dynamically since 2017 and expands the range of user capabilities following the stages of implementation of the 'Bitbon System'; startup developed by the Ukrainian company Simcord.

The Bitbon System, as a comprehensive decentralised solution for integration with government public service delivery mechanisms, is a new global platform for tokenising socio-economic relations between the state, business and citizens. The main components of the ecosystem include decentralisation, infrastructure (services and components), tokenisation, and a community that, as of January 2024, has over 50,000 members from more than 30 countries worldwide.

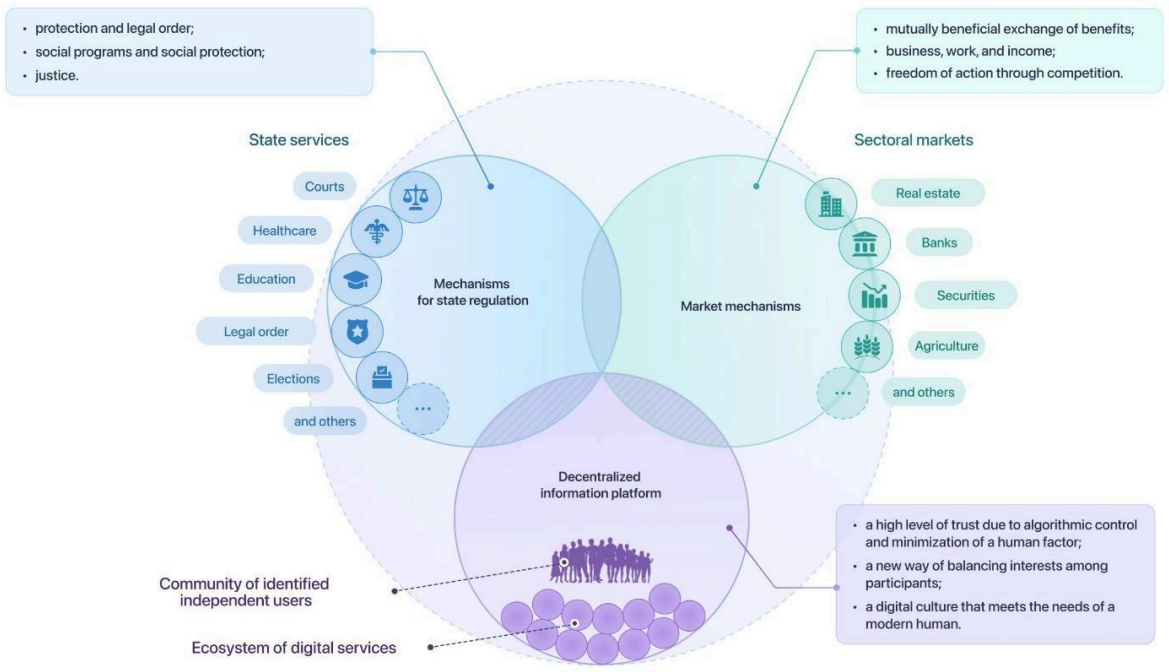

Figure 12: Bitbon System. Source: Simcord.

Contact Persons

To reach out, the contact form available on their website can be used: https://www.bitbon.space/en/cooperation/forums-mass-media.

Website

https://www.bitbon.space/en

14. Conclusion

It is clear that blockchain technology is not at the top of the innovation hype cycle anymore, nor has it been for the last 2–3 years. But beyond the slightly cyclical nature of this new industry (the Bitcoin halving cycle every 4 years is the root cause for this new economical heartbeat), we also have to take into account that the past five years have not been normal.

They have not been normal at the global scale with COVID-19 and an increasing number of more and more impacting armed conflicts, and also not for many corporates. The energy price hikes after Russia waged war against Ukraine and breaking global supply chains have led to a complete overhaul of industrial priorities and policy agendas in the broader tech and IT sectors.

But – and this has become clear with the rise of consumer mass applications of AI in the last two years – we are not going to face a normal innovation cycle: the next decade will pave the way for entire industries and regions to go to the moon or drown in stormier waters. At the same time, the resilience of processes and industrial assets will be threatened by an increase in cyber-criminal attacks and warfare, and the shortage of skilled employees will put pressure on the efficiency of hyper-automation and hyper-acceleration.

This means that exponential technologies will have to deliver a lot more than parroting chatbots or meme-coins. In order to prove the utility of any tech solutions, public institutions and corporates alike will have to invest in and develop infrastructure – and nobody will afford to rule out certain technologies or components based on a lack of detailed understanding or an overflow of political opportunism.

We are all called to thoroughly assess the potential and capabilities of technologies that can help us progress and are able to serve as mesh components for a future industrial fabric.

Blockchain technology can bring some key capabilities: it is the better technology for registry use cases. It offers flexible transparency options, high degrees of secure automation, a rich governance toolbox, strong cryptographic building blocks – and yes, settlement capabilities as well. It can gamify the key performance tableau of entire sectors and bring new financing options and processes to drive efficiency across and in between industry sectors. And increase resilience of infrastructures and do all of this with on-chain logic and using one tech stack instead of several horizontal or vertical siloed systems.

That being said: it is not the intention of this Task Force's first report to propagate the use of blockchain technology in every corner of every industry, but to look at and use this multi-dimensional technology where it helps us (best) to achieve our goals as industries and societies.

Blockchain technology and process have made it into the machine room of one of the most heavily regulated industries in the world, the finance sector. And whoever believes that the coming decade of exponential technologies will lead to less financial leverage options is most certainly on the wrong path. It is not an echo of Silicon Valley's techno-optimism – but if we extrapolate the trend of

technological breakthroughs at various fronts, the demographic erosion of our educated workforces in the first world and our tumbling democratic foundation, then innovation is a must, not an option. And many readers of this report have a duty to pursue excellence in this task – for the rest of their professional careers.

Contact details

Website inatba.org

Contact contact@inatba.org

Join INATBA membership@inatba.org