Toolkit for Adoption of DLT in Public Services

From **Challenges**
to **Self-Assessment**
to **Action**

🌐 Token Website   🌐 DLT4Gov Community

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This is an interactive PDF.
You can navigate it much like a website. Clicking on the table of contents will take you to the relevant section, and the "menu" icon in the top left corner will return you here. Many pages include links to related web sources. If you wish, you can also scroll through the document as you would a regular PDF.

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Challenges

What are the challenges in public services DLT can address?

Self Assessment

Where do you stand right now?

Action

How can you improve the situation?

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Introduction

DLT may bring significant benefits to public services, however, it is not a "technological panacea", and it should not be taken for granted all the potential benefits of DLT will be transferred across to different parts of the public service. Practitioners require a toolkit in order to guide the introduction of DLT into their public service and to maximize the benefits DLT may deliver across the whole of the public service.

The Toolkit was designed for public service practitioners intent on introducing DLT to their sector.

As public services differ — and there is no one magic solution for all public services — it has been designed so that practitioners can tailor the use of this Toolkit for their needs.

This Toolkit was prepared as part of the outputs of the TOKEN project (2020–2023), which sought to understand the potential challenges and benefits of introducing DLT into public services. For ease, these are divided into four core dimensions: technological, socio-economic, organisational-cultural and institutional.

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How we prepared the Toolkit

This Toolkit brings together the findings of a three-year project on DLT in public services conducted between 2020 and 2023. Our methodology included piloting DLT into four distinct public services, selected on the basis of their not only exhibiting different but representative characteristics of other public services, but also because it was deemed that DLT scaling up was appropriate and likely.

Next, semi-structured, ex-ante interviews with public service stakeholders and a systematic review of the literature on the topic was conducted. On this basis, an Evaluation Framework for DLT adoption was built and KPIs were constructed to measure the impact of DLT across the four dimensions, to track impact and facilitate comparison. This Toolkit brings all of our findings together in a compact form, designed for practitioners in other public services to use.

HOW TO USE IT

Just as public services can differ in their key characteristics, the challenges and benefits DLT may bring to them may also be more pertinent, or even, distinct. For this reason, this Toolkit has not been designed to be used in order or in its entirety. Instead, practitioners can tailor its use for their public service by focusing on those challenges that most affect them.

For ease, challenges are divided into four dimensions, and then further divided into sub-dimensions. Practitioners can identify relevant challenges, then follow a link to a Self-Assessment question, and in turn another link to Action, providing possible solutions, in the format of "have you tried to..." or "have you ensured..."?

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Challenges of DLT innovation in public services
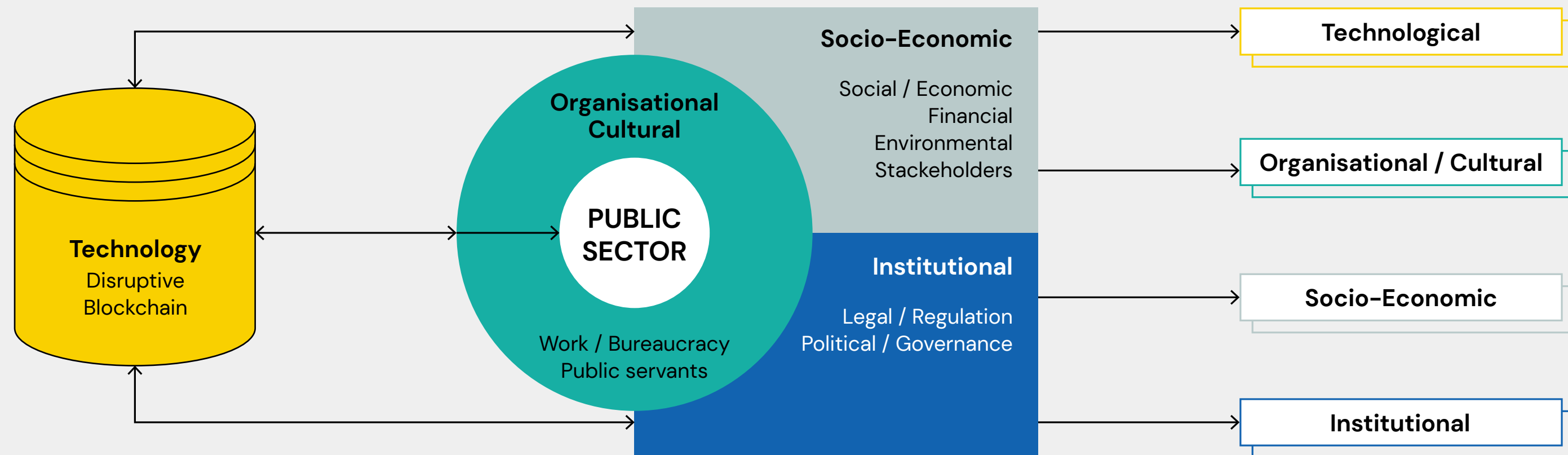
DLT is not a technological panacea, rather, a technology with the potential to bring benefits to the public sector.
This toolkit seeks to guide practitioners with a view of maximising DLT's potential across the whole of the public service.
For ease, four dimensions are considered: Technological, Socio-Economic, Organizational-Cultural and Institutional

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Challenges Index

Technological 1 →

How can unified system standards be achieved?
How can data ledgers be aggregated?
How can processes be automated?
How can data be better protected?
How can data be more completely verified?
How can disintermediation be attained?
How can traceability be attained?

Organisational–Cultural 3 →

How can government culture be improved?
How can bureaucracy be reduced?
How can inter-agency coordination be improved?
How can transparency for citizens be improved?
How can civil servants be better trained for DLT adoption?
How can governments retain control over DLT?
How to increase the likelihood civil servants will accept DLT?

Socio–Economic 2 →

How can financial efficiency be improved?
How can public finance be used to support DLT adoption?
How can time efficiency be improved?
How can the environmental impact be reduced?
How can social and geographical inclusion be augmented?

Institutional (Legal–Political) 4 →

How can user privacy be protected?
How can legal compliance be guaranteed?
How can system security be guaranteed?
How can trust-by-design be achieved?
How can citizen participation be augmented?

Toolkit for Adoption of DLT in Public Services

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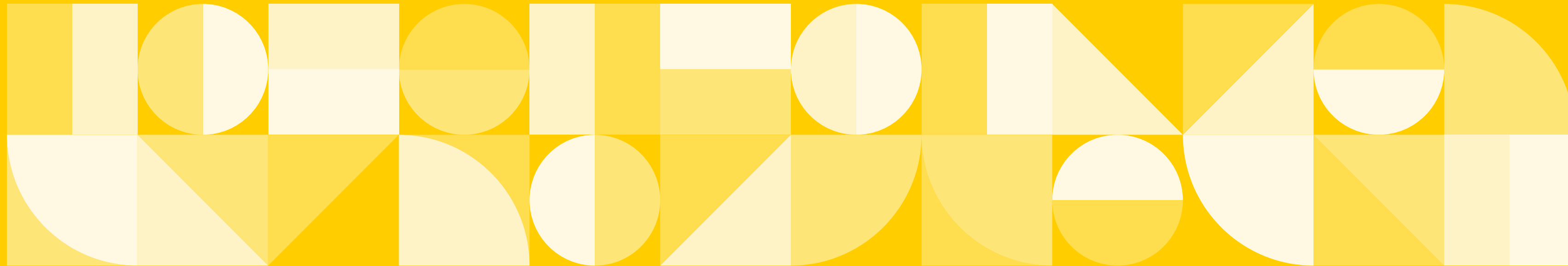
Technological challenges

Ask these questions to do a self assessment as regards **technological challenges** in your public service – then link to Action.

01

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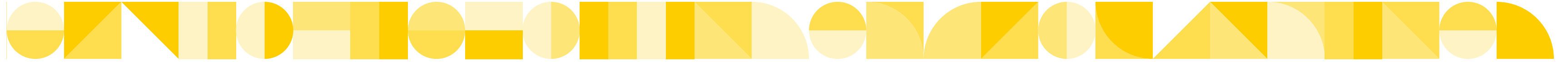
1 Technological challenges

Are you moving towards a more unified open system? →	**Has data aggregation been achieved?** →	**Are processes being automated?** →
Is data being better protected? →	**Is data verifiable?** →	**Has disintermediation occurred?** →
Has traceability been augmented? →		

Token

1 # Unified open system

Are you moving towards a more unified, open system?

As in the case of other network services, it is desirable that local, regional, and national institutions cooperate when selecting a common system to avoid inefficiencies and problems associated with interoperability.
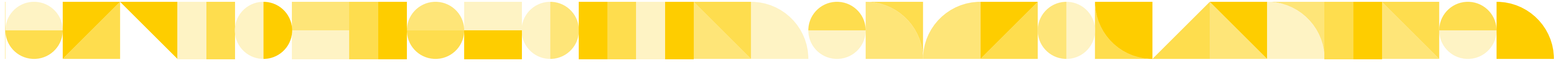
HAVE YOU TRIED...?

Identifying standards for your DLT project, at the platform or unit levels?

Good to know

The **European Blockchain Services Infrastructure (EBSI)** was established in 2018 as a pan-European network to facilitate DLT development towards a unified and open system. For further information, see the website.

Canis Major is a FIWARE technology asset which facilitates the verifiable timestamping of NGSI-LD objects (such as the ones used in "powered by FIWARE" applications) in an EBSI-compatible blockchain network, facilitating interoperability across applications in national, regional or pan-European blockchain networks compatible with EBSI and including the EBSI network itself. This was used in the City of Santander and the City of Leuven. Watch the video explainer.

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1 | # Data aggregation

Has data aggregation been achieved?

DLT is capable of aggregating data sets that are previously disaggregated (the so-called "data silo" problem).

HAVE YOU TRIED...?

Calculating the number of data sets that require integration prior to DLT adoption. Then, setting a target for data integration after DLT adoption. After adoption, analyse the extent to which your targets have been met.

Good to know

DLT was used to improve data set valorization in the Smart City of Santander. Data sets on things as diverse as air quality, crowds in urban city beaches, parking spots, weather, and public transport were aggregated. Availability of a concentrated pool of data allows exploiting synergies by providing a "360-degree" view of all data, with a potential to guide public policy and enhance its efficacy and efficiency. For more details, see the website.

BACK TO THE TECHNOLOGICAL CHALLENGES INDEX

Token

1 Process automation

Are processes being automated?

DLT can be used to automate processes through the use of smart contracts reducing the need for manual intervention and increasing efficiency.

Additionally, DLT can be used to create a tamper–proof and transparent system for record–keeping, reducing the potential for fraud and increasing public trust in government systems.

HAVE YOU TRIED...?

Mapping out the current system of management processes prior to DLT adoption, and identifying those which are targeted to be automated. After DLT adoption, check the extent to which those management processes identified for automation have been successfully automated.

Good to know

DLT was used to increase the efficiency of logistics and improve urban mobility in the city of Leuven. A number of management tasks were automated among local food producers, logistic service providers and the city council. This cut the time required to request access to the city centre for logistic service providers.

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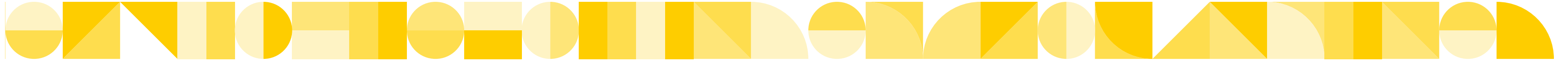
1

Data protection

Is data being better protected?

DLT can offer enhanced data protection due to the decentralised way in which data is stored.

Information is distributed across multiple nodes in the network, making it more difficult for any one entity to manipulate or corrupt the data.

HAVE YOU TRIED...?

Calculating the ratio of data that is organised decentrally prior to DLT adoption, and set a target for after DLT adoption? After DLT adoption conduct a check to ensure your targets have been reached.

Good to know

Estonia experienced large-scale cyberattacks in 2007 which highlighted the need to secure government data, such as healthcare and property registries against potential threats. In response, Estonia implemented hash-linked time stamping to ensure data integrity and real-time verification, with the Succession Registry being one of the first successful implementations of blockchain technology. For more information, see this report.

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1 Data verification and integrity

Has data integrity improved?

DLT verifies every transaction through a consensus mechanism so no one single party can alter this.

Once data is introduced into the blockchain, it is almost impossible to manipulate it.

HAVE YOU TRIED...?

Calculating the ratio of data that is immutable versus legacy data prior to DLT adoption? Then, setting a percentage target for the immutable data you seek after DLT adoption. Perform an analysis after DLT to check targets have been reached.

Good to know

EBSI taps into blockchain's tamper–evident, immutable and decentralised properties to support public services. Using EBSI's Verifiable Credentials system, citizens can share their educational, professional, and other information with businesses and governments. Take a look at the first success stories here.

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[1] # Disintermediation

Has disintermediation occurred?

DLT uses a secure and transparent ledger, and it has been claimed this reduces the need for an intermediary to oversee transactions.

HAVE YOU TRIED…?

Identifying the number of third parties involved in processes before DLT adoption, chose which are targets to eliminate, and return after DLT to check targets have been met?

Good to know

Academic certificate fraud is a significant problem worldwide. The Maltese Ministry for Education and Employment used DLT to address this problem. In 2017, they initiated a project based on earlier work with open certification standards at MIT and Learning Machine, with the goal of supporting self–sovereign identity and giving citizens more control over their data. Check out its progress and challenges in this report.

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1 # Traceability

Has traceability been augmented?

DLT has the advantage of providing traceability.

This is of relevance across many public services, especially those which involve movement of goods, services or data itself.

HAVE YOU TRIED...?

Calculating the percentage of which goods, services or data you are responsible for moving or transferring are traced prior to DLT adoption and set out a target for the percentage you required to be traced. After DLT adoption, conduct a check on this percentage that has been traced.

Good to know

In the City of Leuven, DLT was adopted to facilitate traceability of vehicles entering the city with a view to prioritising local food producers accessing the city. A prerequisite was established that vehicles would be transporting local food during this pilot. Watch the explainer video.
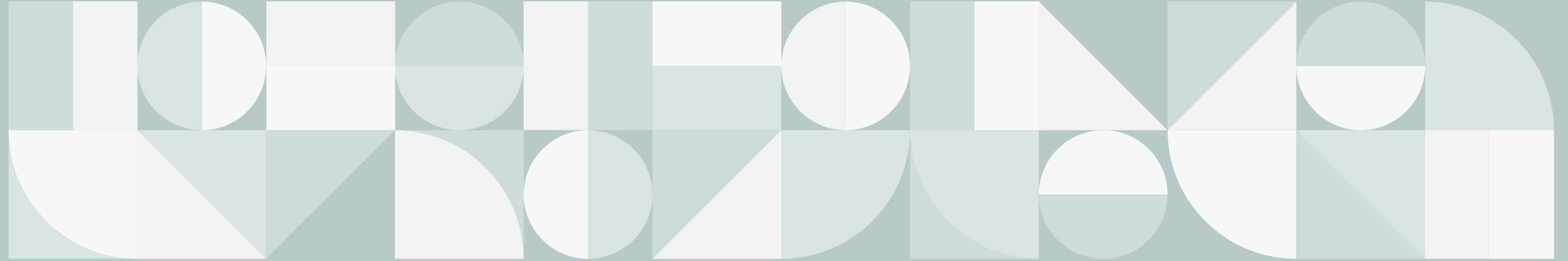
Socio-Economic challenges

Ask these questions to do a self assessment as regards **socio-economic challenges** in your public service – then link to Action.

02

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2 Socio-Economic challenges

Have you experienced lower costs?

→

Has societal value been created?

→

Has time efficiency improved for government and stakeholders?

→

Have environmental benefits outweighed the costs?

→

Have previously excluded stakeholders been included?

→

Token

2 Financial Efficiency and Societal Value

Have you experienced lower costs? Has societal value been created?

DLT can be used in the public sector to reduce costs while providing social value by streamlining and automating processes, reducing the need for intermediaries and increasing transparency and accountability.

For example, DLT can be used to create digital identity systems, reducing the costs of identity verification and increasing access to financial and other services for marginalized communities.

HAVE YOU TRIED...?

Identifying services where physical presence can be eliminated or reduced after DLT adoption, for example, by using digital notification or traceability? Then, setting cost reductions for the public service (for example, public servants deal with fewer emails and phone calls). Also, setting time and energy reduction targets for public service users. Finally, calculating the extent to which the new service actually achieves these targets.

Good to know

Voatz (US): Blockchain-based complementary distance voting. Check out its progress and challenges in this report.

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2 Time efficiency

Has time efficiency improved for government and stakeholders?

DLT enables real–time and automated recording of transactions, reducing the need for intermediaries, and streamlining processes.

The use of smart contracts, which are self–executing agreements with the terms of the agreement directly written into code, can automate many time–consuming processes, such as identity verification, payment processing, and contract enforcement.

HAVE YOU TRIED...?

Mapping out the number of hours required in given processes to be affected by DLT adoption. Then, setting out time gains expected (percentage) and finally conducting a check on whether expected time gains have materialized.

Good to know

When administrative steps are cut out, time efficiency improves. In the City of Leuven, DLT adoption reduced the time required by vehicles seeking to enter the city by between 10–15 minutes. Watch the explainer video.

Token

2 # Environmental impact

Have environmental benefits outweighed environmental costs?

DLT has environmental costs, but also the potential to bring about environmental gains, via facilitating remote processes thus eliminating or reducing consumption.

HAVE YOU TRIED...?

Identifying processes in your public service where remote provision could reduce consumption, such as fuel usage and paper at your public service or for users? Then, establishing consumption reduction targets (e.g. percentages), and finally checking after DLT adoption on target achievement.

Good to know

IMEC implemented DLT in the field of urban mobility with a view to reduce congestion and pollution in the City of Leuven. DLTs' traceability feature served to reduce over 40% of traffic measured by kilometers driven in the inner City. By also promoting the use of electric vehicles, effects of reducing pollution was improved even further.

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2

Social and Geographical inclusion

Have previously excluded stakeholders been included in the public service?

DLT can be used to include previously excluded stakeholders by providing a transparent and tamper–resistant platform for record–keeping and transactions.

This makes it possible for individuals or groups that were previously marginalized or lacked access to traditional financial systems to participate in transactions and secure their assets on a decentralized platform.

HAVE YOU TRIED...?

Identifying stakeholder groups who may have been previously excluded from using your public service (by category and/or number) and establishing a target improvement to capture after DLT adoption. Finally, conducting a check (category/number) after DLT adoption on targets achieved.

Good to know

FUNDING BOX piloted DLT in an attempt to improve access to the uptake of SMEs to cascade funding. By reducing bureaucracy, the number of SME applications saw a notable increase. In the first two months, over 200 new applications by SMEs were performed. In a survey conducted as part of this project, 93% of respondents stated more SMEs were applying to open calls under the new system.

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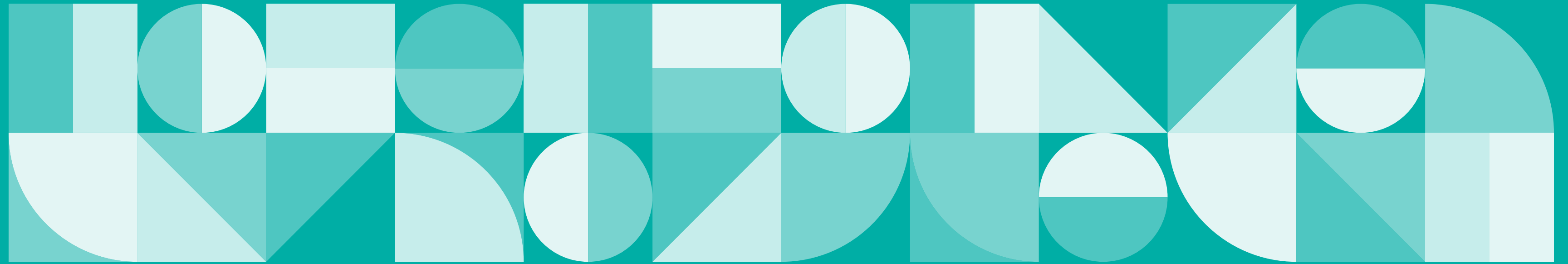
Organisational–Cultural challenges

Ask these questions to do a self assessment as regards **organisational–cultural challenges** in your public service – then link to Action.

03

Token

3 ## Organisational–Cultural challenges

Has government culture improved? →

Has red tape been reduced? →

Has inter–agency coordination improved? →

Has transparency for citizens improved? →

Has suitable training been provided? →

Is the PA in control of the DLT? →

Have public servants embraced the introduction of DLT? →

Token

3 # Government culture

Has government culture improved?

DLT can improve government culture, for example, by ensuring "tamper–proof government" increases perceptions of transparency.

HAVE YOU TRIED...?

Conducting an anonymised internal survey among public service workers on their perceptions of how government culture may have changed after DLT adoption?

Good to know

Vignette studies are suitable to uncovering participants' perceptions of change. The local government in the Municipality of Katerini, Greece, conducted a vignette survey of public servants in parallel to deploying DLT in its processes of public procurement. On average (5.58 out of 7), public servants agreed government culture had improved as a result of DLT application.

BACK TO THE ORGANISATIONAL–CULTURAL CHALLENGES INDEX

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3 Red tape

Has red tape been reduced?

DLT can reduce red tape by creating a more efficient system through the use of a decentralized and transparent ledger.

Automation of procedures and collaboration between organizations is facilitated, leading to a reduction in manual processes and coordination.

HAVE YOU TRIED...?

Listing the number of tasks involved in a given process, by bureaucratic steps, and establish a target regarding how many of these tasks could be eliminated due to DLT adoption? After adoption, calculate the extent to which targets have been achieved.

Good to know

In the City of Leuven, red tape, measured as tasks involved in the process of checking requests by vehicles to enter the city, including time-consuming manual paperwork, and collecting information from various parties, were counted and significantly reduced through DLT adoption. As an outcome, red tape around the process to enter the city was cut down, with most steps automated.

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Token

3 Agency coordination

Has agency coordination improved?

DLT can be used to improve inter-agency by providing a secure, transparent, and tamper-proof platform for sharing information and executing transactions.

With DLT, agencies can collaborate more effectively and efficiently, reducing the risk of errors and duplicated efforts, and at the same time, improving transparency and accountability by providing a permanent, auditable record of all transactions and interactions between departments.

HAVE YOU TRIED...?

Identifying the agencies involved in specific public service tasks prior to DLT adoption and set a target for agency coordination. After adoption, analyse the number of coordinated agencies as a result.

Good to know

Adopting DLT in the context of prioritising transport of local food producers in Leuven involved greater agency coordination across departments including those responsibility for mobility and legal compliance. Increased agency coordination resolved complex and sensitive issues around what data to store, how and when. Watch the explainer video.

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3 # Transparency

Has transparency improved?

Although a single–node, centralised system could be transparent, DLT transparency is based on trust, as transactions cannot be manipulated after they have been recorded.

The rebalancing of power in every transaction where information asymmetry is evident is an immediate consequence of this benefit for citizens.

HAVE YOU TRIED…?

Carefully selecting the appropriate DLT platform as well as the network structure (ex. public or private; permissioned or permissionless) according to the type of data to be shared, taking into account current legislation.

Good to know

In the City of Santander, a Data Valorisation App was designed which allows data providers to log into a dashboard to see how data is produced and consumed. This facilitates transparency, leading to a better understanding of data usage, and information required to improve allocation of resources for future investment in data capture around the city, also improving local government accountability and developing the local economy.

BACK TO THE ORGANISATIONAL-CULTURAL CHALLENGES INDEX

Token

3 Organisational readiness

Has suitable training been provided?

As in the case of most innovation and change, when the workforce and other stakeholders receive good quality training, their ownership and understanding of the benefits of change are enhanced, as is the likelihood of their acceptance of this change.

HAVE YOU TRIED…?

Planning a number of training sessions and developing a training guide for stakeholders. Collecting feedback from participants on the usefulness and attractiveness of these seminars.

Good to know

When DLT was applied to urban logistics in the City of Leuven, multiple user-training sessions organised with stakeholders (the city, the order platform and logistic service providers) addressed how stakeholders could interact among themselves.

Token

3 # Control over DLT

Does the public administration maintain control over the DLT?

When public organizations follow procurement rules, they often separate design from implementation, leaving vendors to handle most of the design work.

This can be a problem for blockchain implementations as it keeps the organization away from the technical details.

HAVE YOU TRIED...?

Responsive and iterative approaches in the design process as well as the use of open source can enable knowledge development and guarantee the autonomy of the technological solution.

Good to know

A number of infrastructure initiatives, like the "public–permissioned" European Blockchain Service Infrastructure (EBSI), aim to provide reusable components that allow for the design of blockchain–based solutions that rely on this infrastructure, offering supporting services at the same time. These components are designed in a way that ensure that the digital service will be fully compatible with others on the market.

Token

3 Technology acceptance

Have public servants embraced the introduction of DLT?

Public servants are key players in the successful implementation and adoption of DLT in public services.

Their acceptance is necessary to ensure that the technology is aligned with the needs of the public and the government, and that it is integrated into existing systems and processes effectively.

HAVE YOU TRIED…?

Organising information sessions including interactive panels with staff to explain the positive benefits of DLT? In particular, civil servants may be more ready to accept DLT when they believe it will provide benefits for citizens.

Good to know

University of Cantabria deployed an experimental vignette on public servants who were presented with imaginary scenarios of having to use DLT in Santander and Leuven. In Santander, it was found that public servants had a positive view of the introduction of DLT: on average, 5.55 out of 7. Public servants were more like to embrace DLT when its configuration allows further involvement of citizens. This result was also found in Leuven.

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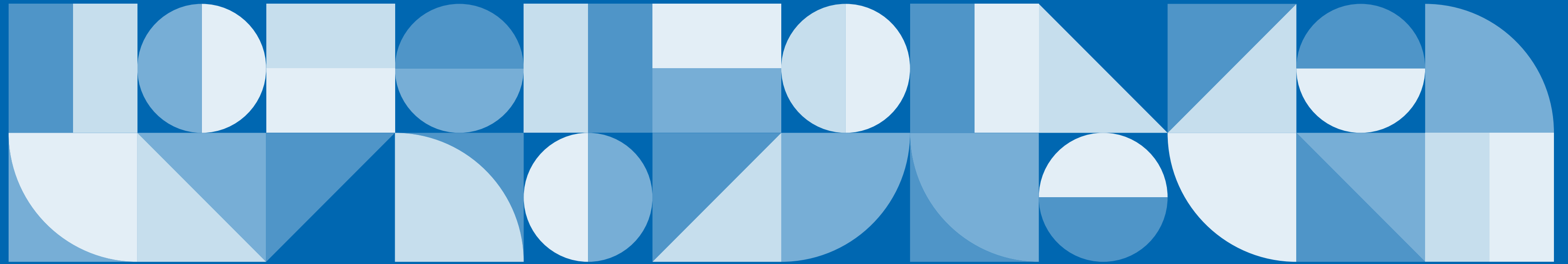
Institutional challenges
(Legal–Political)

Ask these questions to do a self assessment as regards **institutional challenges** in your public service – then link to Action.

04

Token

4 Institutional (Legal–Political) challenges

Are privacy and
security requirements
met?

→

Is the processing built
on compliance with
standards?

→

Has DLT led to greater
trust in government?

→

Are citizen
participating more
in governance?

→

Token

4 # Privacy and security

Are privacy and security requirements met?

DLT can increase privacy and security of data by utilizing cryptographic techniques and decentralized network architecture. In a DLT network, data is stored across multiple nodes, making it difficult for a single entity to access or manipulate the data without consensus from the network, which enhances the security of the data.

HAVE YOU ENSURED…?

Are privacy and security requirements formally documented into the project design phase? Are these then formally reviewed and approved by a legal expert? Are these based on a risk assessment and are these externally tested or verified?

Good to know

When FundingBox deployed DLT in Public Funding Distribution Processes for competitive open calls, security and privacy requirements were formally documented in the project and based on a risk assessment. These requirements were formally reviewed and approved by Fundingbox Legal Team and project leaders, verified independently, and the implementation result was certified and transparently communicated to interested parties via the privacy policy.

BACK TO THE INSTITUTIONAL CHALLENGES INDEX

Token

4 # Legal compliance

Is processing built on compliance with standards?

The disruptive characteristics of DLT need to be adapted to respect current law. Best practice DLT implementation must therefore be checked for legal compatibility.

HAVE YOU ENSURED...?

Is processing is built on DLT GDPR compliant systems? Is your DLT project NIS compliant?

Have you considered eIDAS requirements?

Good to know

GDPR is Europe's new data privacy and security law, which sets out detailed and numerous requirements organizations around the world must comply with. Other important considerations for legal compliance are NIS on cybersecurity and for secure cross-border transactions. For more details, see NIS Directive and eIDAS Regulation.

Token

4 # Government trust

Has DLT led to greater citizen trust in government?

DLT can be configured in different ways, and can be used to try to increase trust in government, for example, by using a "trust by design" approach.

HAVE YOU TRIED…?

Considering different DLT configurations and identifying the one that is likely to be more inclusive to the general public with the time of producing greater citizen trust?

Good to know

Experimental vignettes deployed by University of Cantabria in Leuven and Santander tested public servants' views on the effect of DLT on citizens' trust. Results differed according to the case. For Leuven, public servants believed citizens' trust would improve if DLT was configured to further involve citizens. However, in Santander, public servants' perceptions about the effects of DLT on citizens' trust were not affected by the configuration of DLT. For more details, read the article.

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4 # Citizen participation

Are citizens or end–users participating more in governance?

DLT can be used in the public sector to increase the intensity of citizen participation in public service co-creation and use by creating transparent and secure platforms for citizen engagement and feedback. By leveraging the decentralized and tamper–resistant nature of DLT, citizens can have a greater role in shaping and monitoring the delivery of public services, such as through the use of voting systems or citizen engagement platforms.

HAVE YOU TRIED…?

Calculating the number of end users or citizens participating in your service prior to DLT adoption, and setting a target for after DLT adoption? Then, analysing the outcome and comparing this to your targets.

Good to know

According to Greek law, when public funding is awarded to the public sector, some of this must be used to improve e-voting. Katerini Municipality used DLT in e-voting to increase the intensity of citizen participation in the voting process and thus trust among the actors involved. For more details, see the TOKEN Use Cases.

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Further Reading

Cagigas, D.; Clifton, J.; Díaz-Fuentes, D. and Fernández-Gutiérrez, M. (2021):
"Blockchain for Public Services: A Systematic Literature Review | IEEE Journals & Magazine | IEEE Xplore"
IEEE Access, 9: 13904–13921.

Cagigas, D.; Clifton, J.; Díaz-Fuentes, D; Fernández-Gutiérrez, M.;
Echevarría-Cuenca, J. and Gilsanz-Gómez, C. (2022):
"Explaining public officials' opinions on blockchain adoption: a vignette experiment."
Policy and Society, 41(3): 343–357.

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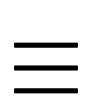
Feedback?

Was this Toolkit of use to your public service
when implementing DLT? How? How could it be improved?
What results did you have?

We welcome your feedback!

SEND YOUR COMMENTS

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Join the discussion and come work with us towards making the vision a reality.

Be part of the conversation and join the Community

JOIN DLT4GOV COMMUNITY

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Partners

FIWARE Foundation e.V.	FundingBox Accelerator SP Zoo	Interuniversity Microelectronics Centre	Vlaam Instituut Voor De Logistiek VZW	Information Technologies Institute
Demos Helsinki	Infrachain A.S.B.L.	Municipality of Santander	University of Cantabria	Municipality of Katerini

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#trustworthiness #transparency #privacy #efficiency

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