7. Blockchains in ISA² - Study and piloting activities

Study: Blockchain for Digital Government

Assessment of pioneering implementations in public services

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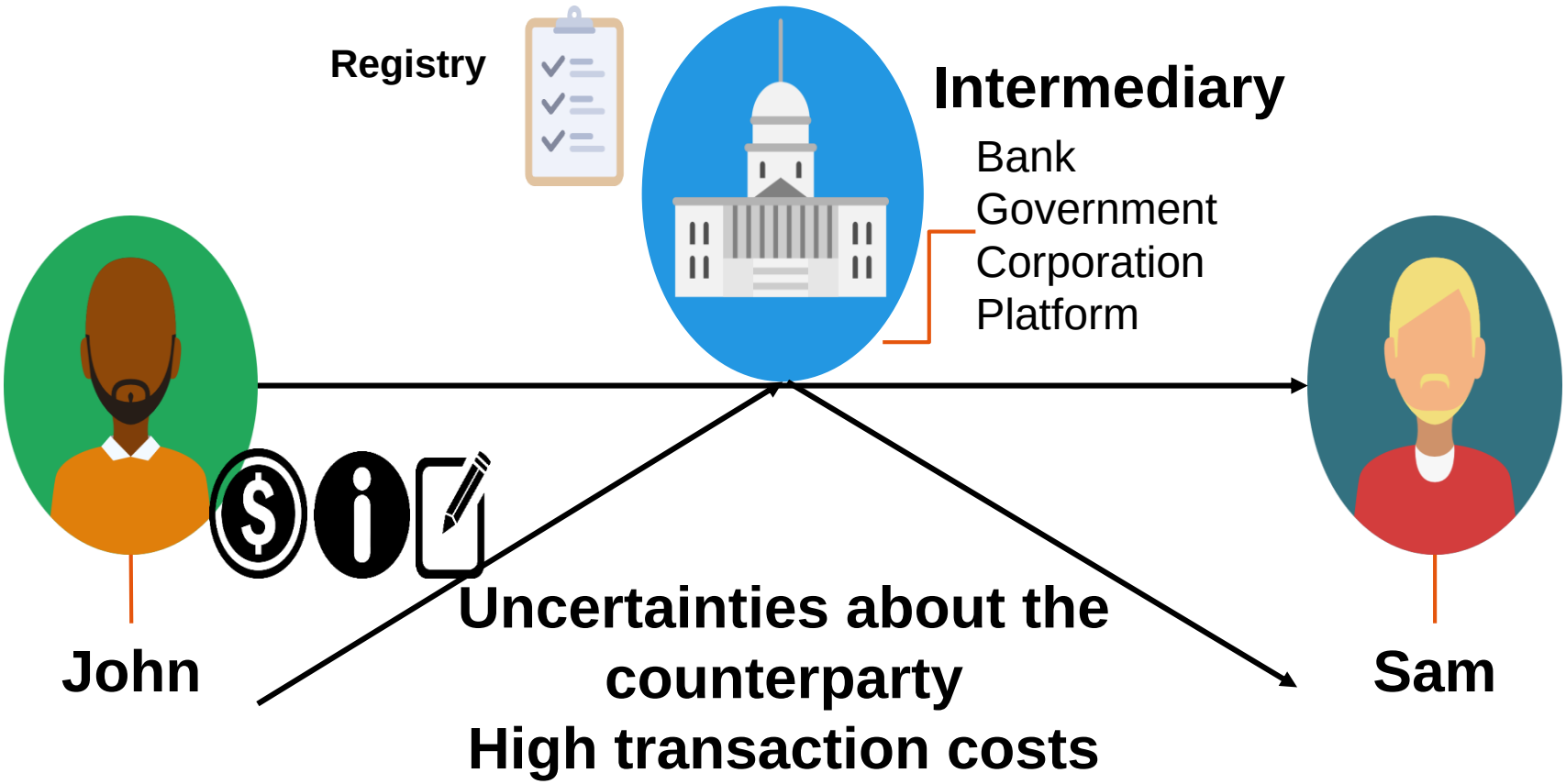
ISA² Coordination Group - 24/10/2018

The JRC study for ISA²

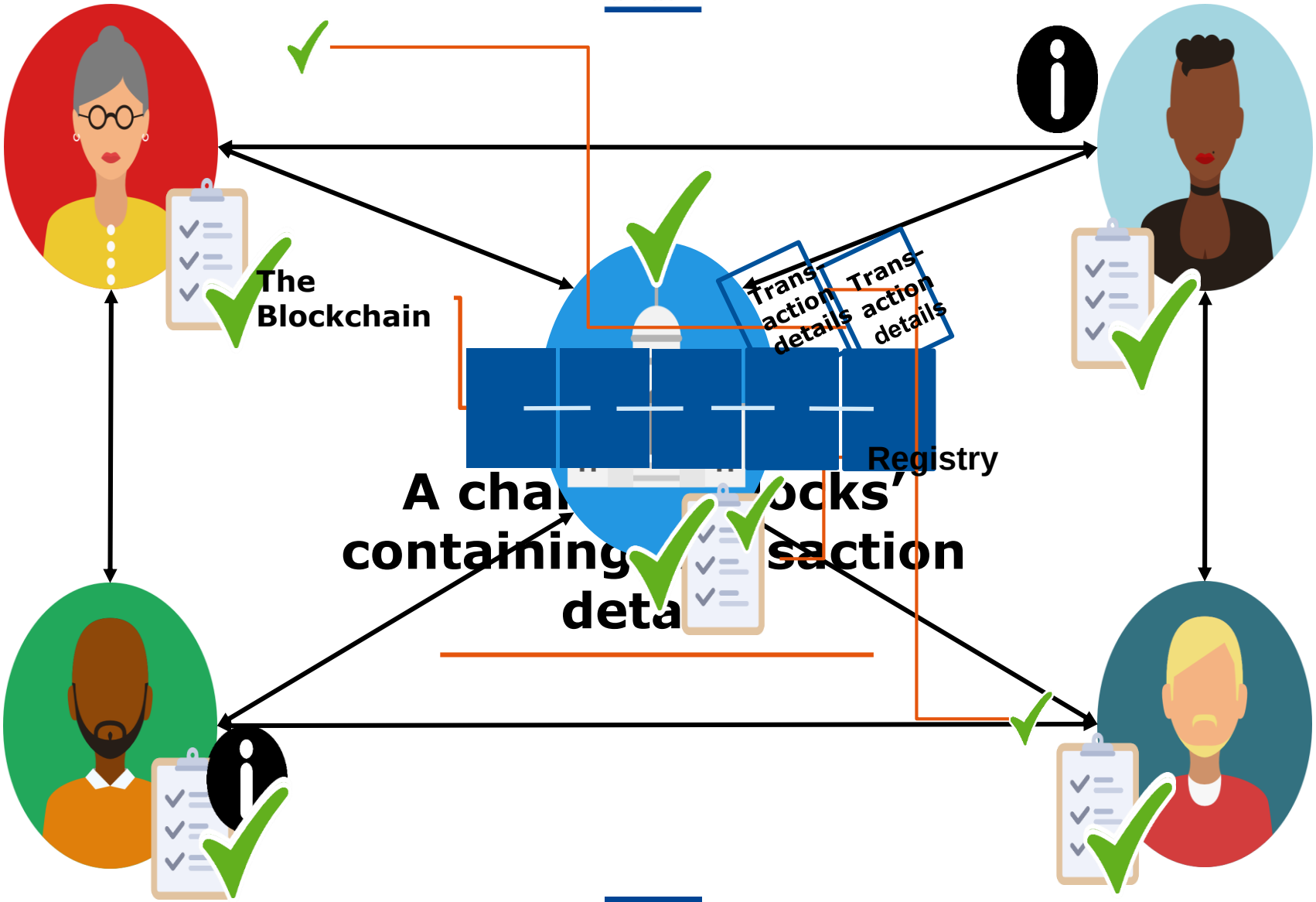
Blockchain has a great potential for governments, yet it is hyped and current implementations are scarce and immature

- **What is blockchain and what are governments currently doing with this technology?**
- **What benefits does it bring for Digital Governments?**
- **What policy actions are needed?**

What is blockchain technology?



What is blockchain technology?



The technological characteristics of blockchain introduce a unique set of benefits:

Technological characteristics	Benefits
Transactions are shared on a **distributed ledger** which shares content across multiple parties	Transactions are **easily trackable and auditable.** Ledger provides **single source of truth.** Complex workflows involving many parties and transactions are **automated**
Blockchain updates entries in an **append-only** way and links it to previous transactions	The **irrevocable** ledger cannot be changed - this insures **data integrity and accuracy**
Transactions are verified via a peer-to-peer **consensus mechanism** which ensures a common truthful ledger	Centralized parties are no longer needed to assure transaction validity - there is a change of power towards the ecosystem (e.g. citizens)

JRC project for ISA²

- **Motivation**
  - Blockchain:
    - Shifted to mainstream
    - Largely overhyped
  - Research:
    - Mostly speculative
    - Almost nothing on public sector
- **Value added**
  - Build on empirical evidence – landscape analysis
  - Focus on costs and benefits
  - Use structured methodologies – strategic analysis
- **Objectives**
  - Deep dive into seven blockchain implementations in the public sector
  - Examine the relevance of blockchain for EU-wide Digital Government services
  - Develop potential courses of action to enable innovation and utilize the potential of blockchain technology for Digital Government services in the EU

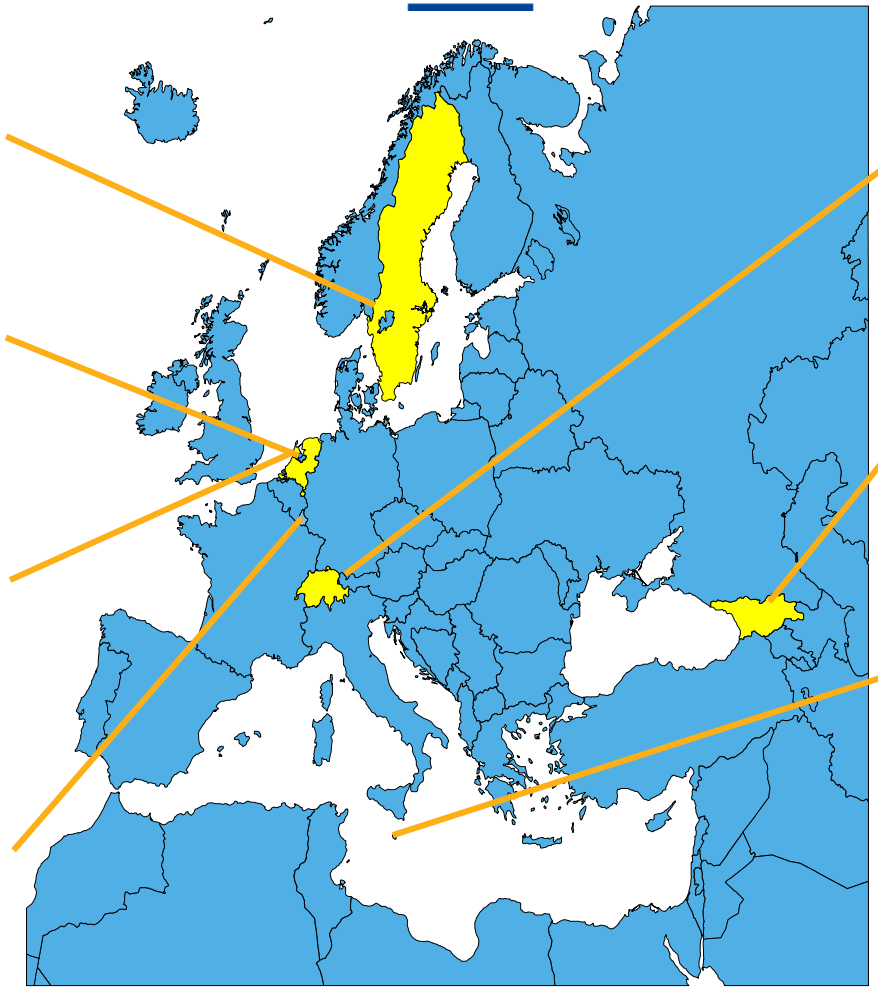
Case Studies Sample

Land Title Registry In The Blockchain (Sweden) // Enabling real-estate transfer using a smart contract workflow

Stadjerspas (The Netherlands) // Providing allocated discount vouchers to citizens using a blockchain-based infrastructure

Pension Infrastructure (The Netherlands) // Creating a single, blockchain-based infrastructure for citizens, governments and companies to mange pensions

Infrachain (Luxembourg) // Building a governance layer to ensure compliance and service levels in (public) blockchain implementations



Blockchain-Based E-ID's (Switzerland) // Connecting government ID's with blockchain addresses to enable self sovereign identities

Exonum Land Title Registry (Georgia) // Using blockchain to provide citizens with a digital certificate of their land title(s)

Academic Credential Verification using Blockchain (Malta) // Accessible verification of academic credentials using a public blockchain infrastructure

Multiple selection criteria

Methodology

Case Study assesment framework	
	1. Project characteristics
	2. Functionalities
	3. Governance
	4. Usage
	5. Technical architecture
	6. Costs
	7. Benefits

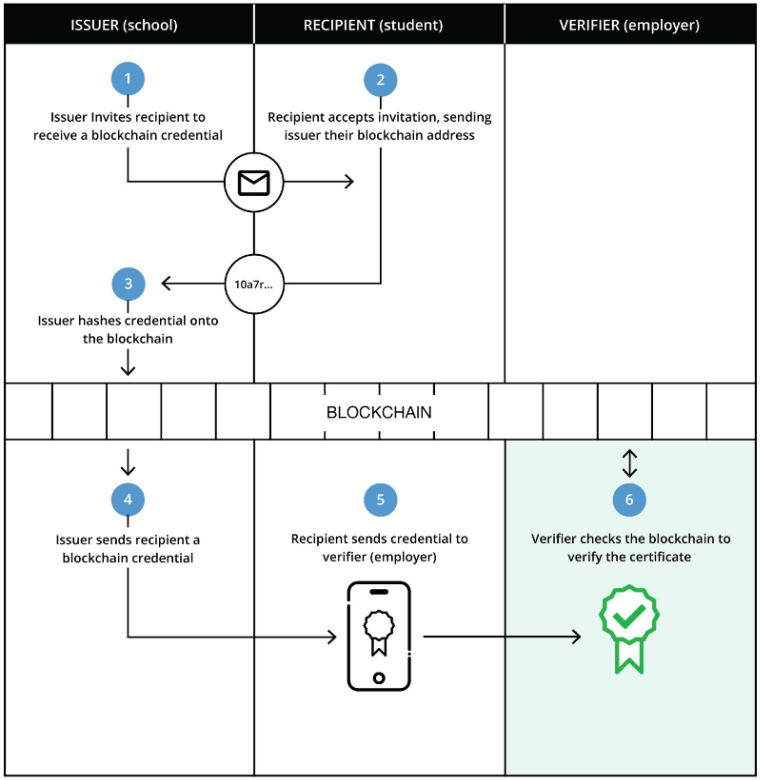
- **Analytical scope**:
  - Case study analysis
  - Scale-up analysis
  - Policy actions

• Example 1 record management

European Commission

What governments can do with blockchain? Blockcerts Academic Credentials

- Characterisation:
  - Blockchain technology used to receive and share individual records and prove their validity to third parties
  - Public permissioned blockchain serves as a permanent ledger which records lifelong learning achievements
  - The Blockcerts app provides a wallet where the citizen has full ownership of their records
  - The Maltese government is exploring the expansion of the current project to also include credentials for refugees



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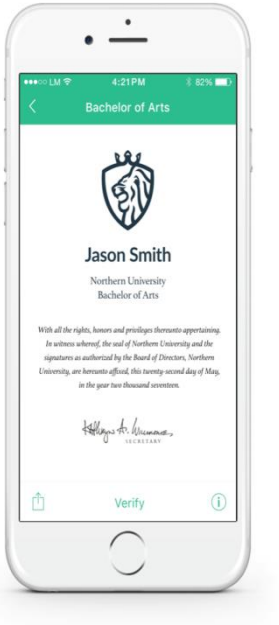
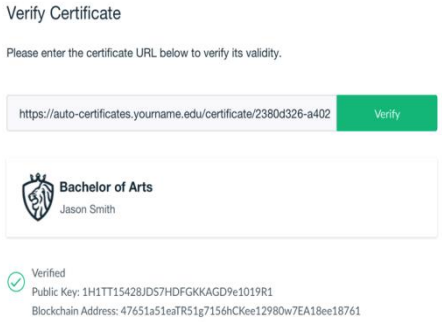
- **Example 1**
  record management

European Commission

Blockcerts Academic Credentials

- Qualitative benefits:
  - Ownership of complete records
  - Selective disclosure
  - Platform agonistic, open standard
- Efficiency gains and savings:
  - Convenient storage and quick sharing
  - No hard copies
  - No payment to issuers for accessing and verification of credentials
  - No waiting time for verification by issuers
  - Third parties can individually verify each certification using mobile app or web interface
- Inhibitors to deployment:
  - Legality of blockchain credentials
  - Legality of blockchain-based validation





Source: Blockcerts.org

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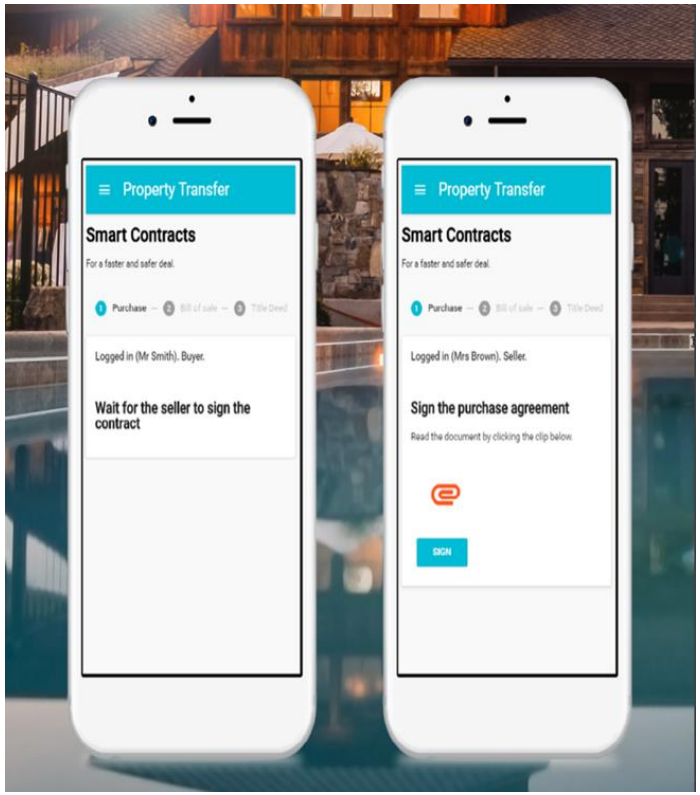
- **Example 2 automation**

European Commission

What governments can do with blockchain? Blockcerts Academic Credentials

- Characterisation:
  - End to end transaction facilitation with smart contracts
  - Based on private permissioned blockchain technology but easily integratable with legacy systems of ecosystem participants
  - Land registry and banks are directly involved into workflow



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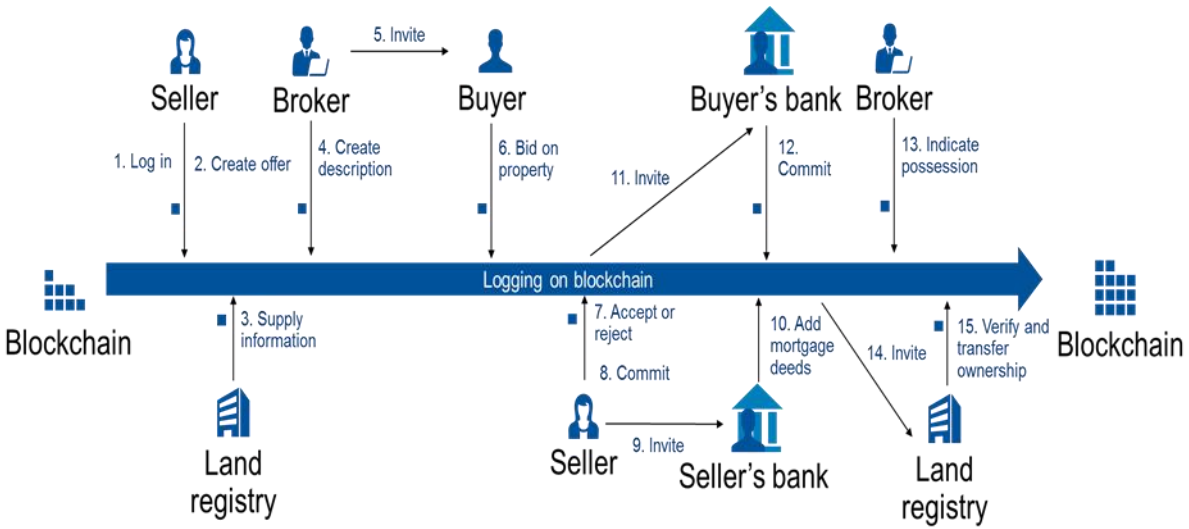
- **Example 2 automation**

European Commission

What governments can do with blockchain? Blockcerts Academic Credentials

- Benefits:
  - Reduce transaction time of weeks to hours (by 95%)
  - Removing the uncertainty of a different party intervening in the transaction
  - Improved mortgage handling; increased liquidity of assets
  - Reduced transaction costs by 90%
  - Quicker transfer of the title
  - Increased trust in high value market



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Benefits of Technology

Project	Quantitative benefits	Qualitative benefits
1. Exonum Land Title Registry	400 times faster registration of extract; reduction of operational costs (over 90%)	Improved transparency; high fault-tolerance; increased reliability of data
2. Blockcerts Academic Credentials	Lower operational costs; efficiency gains; lower integration costs;	Citizens' ownership of data, convenient storage; quick and selective sharing; identity and privacy protected; interoperability; open standard; no lock-in
3. Chromaway Property Transactions	Est. €100M/a; Reduced transaction time (over 95%); reduced transaction cost (90%); faster registration and transfer of land title;	Increased trust; higher liquidity of assets; improved market operation; improved resilience to record modification and fraud;
4. Uport Decentralised Identity	Lower administration cost; lower storage cost; lower infrastructure costs; efficiency gains for administration; efficiency gains for citizens	Citizens' ownership of data; reduced risk of cyberattacks;
5. Infrachain Governance Framework	Not applicable	Increased reliability and resilience; increased transparency and flexibility
6. Pension Infrastructure	Est. €500M/a; lower storage cost; efficiency gains for pension funds; efficiency gains for administration; lower transaction costs for citizens.	Increased transparency; increased security of data; increased transparency
7. Stadjerspas Smart Vouchers	Lower administration cost; efficiency gains for administration; lower transaction costs for citizens.	Improved allocative efficiency; improved auditability of public funds; increased security of data; increased resilience;

Scaling-up?

European Commission

Potential for scaling is affected by several factors:

Pilot Deployment Name	Benefits	Costs	Tech maturity	Policy priority	Institutional and legal compliance	Replication potential	Scaling potential
Exonum Land Title Registry - Georgia	○	◑	●	○	●	◑	○
Blockcerts academic credentials - Malta	●	◑	●	●	●	●	●
Land Registry the Blockchain in Sweden	●	◑	◑	○	○	◑	○
uPort Digital Identities – Switzerland	◑	◑	●	◑	●	●	●
Infrachain Blockchain Governance Project	◑	○	◑	●	●	●	●
Pension Infrastructure (PI)	●	○	○	◑	◑	◑	○
Stadjerspas Groningen	◑	◑	●	●	◑	●	◑

Legend	○ Low	◑ Medium	● High

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Conclusions

- Blockchain has a clear potential for digital governments:

Smart contracts and a shared ledger reduce red tape

Blockchain-based services generate efficiency gains and reduce administration costs

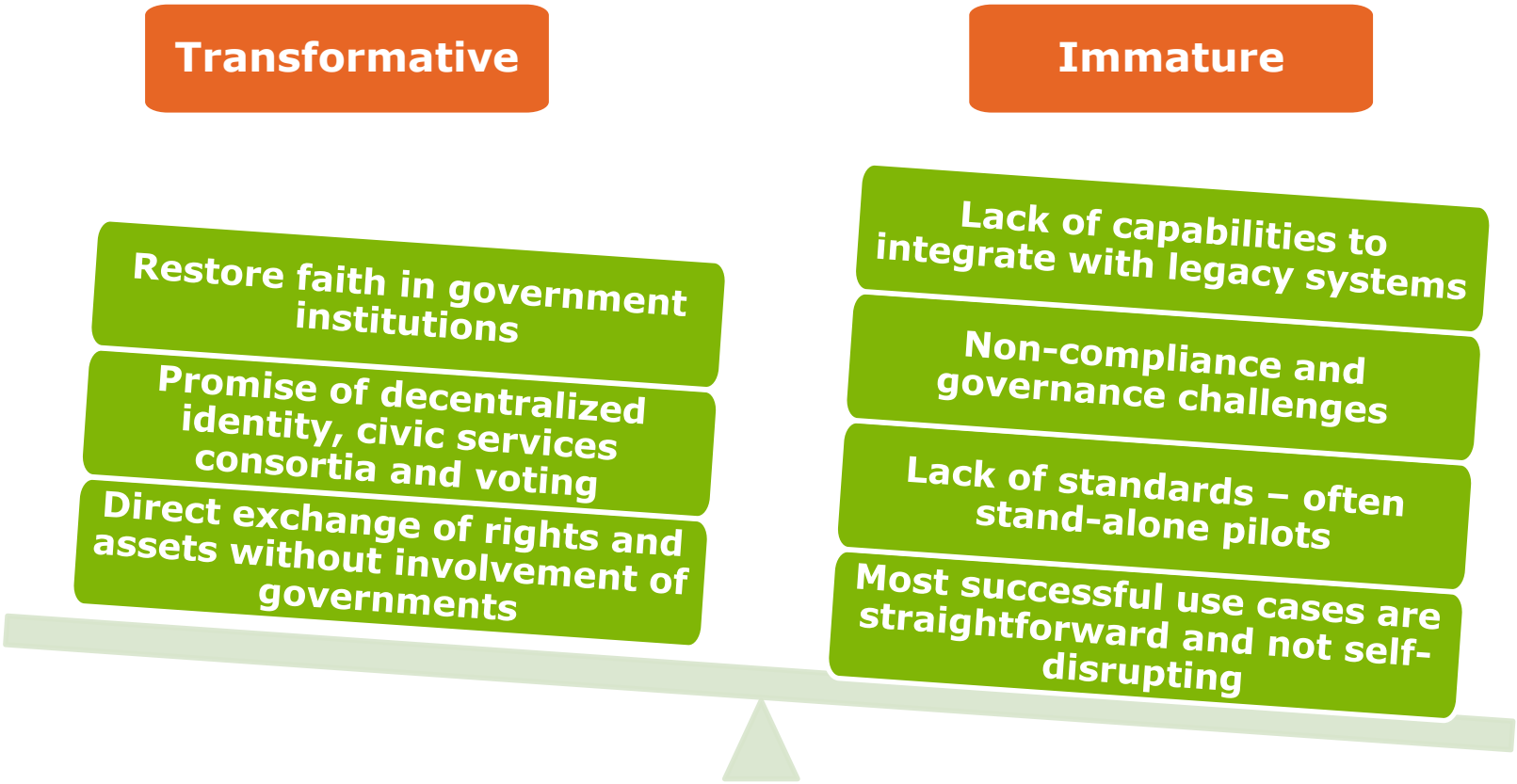
Increase in transparency, auditability and automation of administrative processes

Technology offers convenient interface and self-sovereignty

Enlarge trust of citizens and companies in governmental processes and recordkeeping

Conclusions

Blockchain is immature as a transformative technology for a number of reasons:



Conclusions

Policy actions to enable innovation and utilize the potential of blockchain

Potential Course of Action	1. Guidance and Knowledge Sharing	2. Pilot Development	3. Standards Definition	4. EU Blockchain Connection Building Blocks	5. Use Case-Based Dedicated Infrastructures
Goal	Expertise building	Development of high value pilots	Framing guidelines	Creation of building blocks that connect services using blockchain technologies across Member States	Creating dedicated infrastructures for use case type
Action	Sharing best practices on blockchain deployments between Member States Providing teaching programs to develop knowledge on the technology	Identify use cases and implementations in line with EU policy priorities Co-finance pilot projects using blockchain for digital government	Development of international standards Certification process to ensure compliance with security and privacy	Providing building blocks supporting the utilization of blockchains, such as certificates and identity management.	Defining or creating infrastructures most suitable for use case types, such as land title registries or tax systems

Blockchain@EC

ISA² supported activities

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ISA² Coordination Group - 24/10/2018

Motivation and objectives

- **Pilots: notarisation**
- **EU Blockchain infrastructure**
- **Learn and experiment**

Blockchain assessment tools

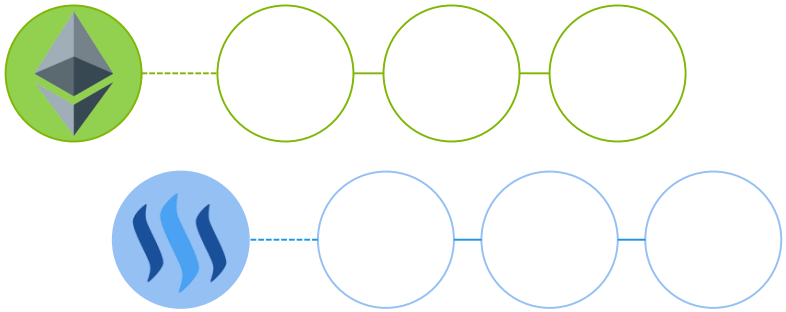
Which is the best blockchain protocol?

It depends…

- Use cases for blockchain technology – Deloitte study
- Blockchain protocol selection matrix – DIGIT's blockchain competence centre

Blockchain infrastructure I

- Setup of nodes → foundational nodes for different blockchains networks
  - Different protocols



- Using different infrastructures and resources
  - Public cloud providers
  - On premises

Blockchain infrastructure II

- Public EC blockchain – Ethereum (Ropsten test network) – Proof of Work (PoW) consensus
- Private EC blockchain (multiple cloud providers) – Ethereum – Proof of Authority (PoA) consensus (energy-efficient)
- Private blockchain network with Luxembourg (Centre des technologies de l'Etat - CTIE) – Ethereum – PoA
- Public permissioned blockchain network – Steem – Delegated Proof of Stake

Pilot: notarisation of documents

- Pilot goals:
  - Develop an efficient solution to notarise electronic documents
    - digital fingerprint (integrity)
    - proof of ownership
    - timestamp
  - Create reusable components
    - Smart contract (capable of dealing with large amounts of hashes +500000)
    - Notarisation API (ease access to the notarisation solution)
  - Reuse existing infrastructure
    - Deployed in EC's private blockchain
    - Deployed in private blockchain network with Luxembourg's CTIE

ISA² Blockchain action deliverables

- Guides to setup nodes and join existing networks
  - Ethereum
  - Steem
- Reusable components
  - Notarisation smart contract
  - Notarisation API

To be published in Joinup

- Operational private networks to support public sector use cases

Future actions

- Improve existing infrastructure components
  - blockchain protocols to support the agreed use cases under the European Blockchain Partnership (EBP)
    - future Blockchain building block under CEF
  - Assessment tools
  - Notarisation solution
  - Keep reusing the infrastructure
    - EFTG (European Financial Transparency Gateway) pilot - solution running on the Steem network connecting Member States' Officially Appointed Mechanisms (OAMs)
- New pilot: digitally signed diplomas
  - Alignment of EBP (5+ Member States support) and DG EMPL's Europass2 project

Questions?

ISA² programme

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Run by the Interoperability Unit at DIGIT (European Commission) with 131€M budget, the ISA² programme provides public administrations, businesses and citizens with specifications and standards, software and services to reduce administrative burdens.