Government services and digital identity

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Introduction and scope

The theme of this paper is the use of blockchain and distributed ledger technology for government services, and digital identity in relation to those. The scope for the state-of-the-art is global, but conclusions and recommendations focus on the significance and barriers in the European context.

We assume general familiarity with blockchain and smart contract technology. For the purposes of this document, the essential features are that a blockchain has no central data controller or storage, and that it is an append-only immutable record store with reliable timestamping. More specific details, such as consensus mechanism, which vary from one blockchain network to another, are omitted.

Stakes

"Blockchain's benefits—of security, efficiency, and speed—are readily applicable to public sector organizations, and the technology's potential helps explain why so many government leaders are actively exploring its uses in government. Indeed, blockchain experiments in the public sector are accelerating globally."[1]

The emergence of blockchain technology offers significant opportunities for the provision of decentralised services in a trustless or low trust setting, with decentralisation in particular being relevant for cross-border applications. Secure blockchain identity systems could have a large effect in the EU context. However, there are also significant risks, given the open and immutable nature of blockchain records. Data protection, privacy and accountability are difficult issues in all blockchain applications, but particularly so if one of the actors is a government. Extra attention to these risks is important when it comes to digital identity; as the default guarantors of personal identity, it is reasonable to presume that government initiatives in this space will carry extra weight, and consequently extra responsibility compared to private initiatives.

Themes

The use cases, proposals and initiatives described in this paper can be grouped into four broad themes depending on the benefits brought by the use of blockchain in each case. These themes are **trust, verifiability, transparency** and **efficiency**. Several scenarios fall under multiple themes, and the themes themselves are to some degree interdependent.

1. **Trust** The lack of centralised control over the records in a blockchain coupled with trustworthy execution of code in the form of "smart contracts" mean that blockchains can

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[1] https://www2.deloitte.com/insights/us/en/industry/public-sector/understanding-basics-of-blockchain-in-government.html

serve as a backend ensuring that records be trusted and accepted as impartial. Data in blockchain records cannot realistically be edited post-publication, and the output of smart contracts cannot be influenced by trusted or untrusted agents, given the immutability of contract code. All the use cases discussed here can involve a natural lack of trust between parties, including governments, and thus can be supported by blockchains.

2. **Verifiability** The ability to verify the contents of records is fundamental to a number of government use cases, including identity, asset registries, voting, finance, and certification. Verification is supported by cryptographic guarantees of immutability, and digital signing and immutable storage of public keys.

3. **Transparency** Regulation, openness and transparency of both data and processes can be supported by the use of blockchains for documentation – the redundant sharing of data across all nodes in a typical public blockchain network, strong identity frameworks and transaction immutability allow easy and trustworthy tracing and audit of activities, relevant, for example, for identity, medical processes, financial and currency use, spending and procurement.

4. **Efficiency** Blockchains are often used for disintermediation; many tasks can be carried out reliably without a need for other parties to be involved. Disintermediating government services could lead to increased efficiencies due to increased automation. This theme forms part of the motivation for ongoing work on identity, registries, patient records and access, voting, banking and regulation, taxation, foreign aid and certification.

Identity management

Digital identity is effectively the core use case for blockchains for government services, spanning all others discussed here. Providing or interpreting proof that individuals are who they claim to be, and are the subjects of government records, are the prerequisites for the provision of services, recognition of rights or title, or of duties required or fulfilled. It is no great surprise, then, that identity has received a great deal of attention from governments globally as an application of blockchain. Identity is an important question for many scenarios, public or private, but more so for the context of interactions with a state; property, health, voting, finance and taxation, education, and so on, all have significant relevance for an individual's life, and there are major, often legal, implications for interactions between individuals and government in these areas.

Traditionally, of course, and currently, in most cases, the guarantor of a person's identity is their national government, with registers of birth, marriage and death, national identity cards and passports used to track, verify and demonstrate identity in state-individual interactions, and, with third-party trust in governments, in private interactions too (for example, the use of a passport as proof of identity in taking out a loan). Online, identity is typically controlled by the different services with which it is used – the same person has different identities, in the form of login accounts, with different services (e.g., a Facebook account, Google account, etc.). Recent events

with Facebook[2] have shown some of the risks of allowing private companies to control identity provision, permitting user activity to be tracked in detail across many sites. In blockchain development, the focus is on "self-sovereign" identity[3], in which an individual controls and guarantees their own identity, and others can verify or endorse claims about it directly with the individual. Individuals have control over what claims can be verified in this way. In practical terms, this model is effectively a more privacy-aware implementation of the traditional paper-based approach: the individual presents a particular credential which they possess to a service, which can choose to accept it or not based on the degree to which it trusts the guarantor of that credential. In paper terms, the credential might be a passport guaranteed by a government; in digital ones, it might be a zero-knowledge proof[4] backed by a blockchain identity service which is endorsed by a government. A zero-knowledge proof is a means of providing a trustworthy guarantee that a particular claim holds without the requirement to disclose the evidence for that claim. For example, an individual may present a proof of the claim that they are a citizen of a particular country, endorsed by that country's government – a claim which can be checked by any service which needs to know, without needing to disclose any sensitive data. The extra privacy-awareness stems from the fact that showing a passport reveals all of the information in the passport, whereas a zero-knowledge proof reveals only that the claim being tested is verified.

While these methods could generally be implemented *without* the use of a blockchain, to do so would require identity systems to be hosted somewhere trustworthy, which would tend to lead to, if not require, centralisation to some degree (under the assumption that most individuals would not choose to run their own hosting infrastructure).

The most developed government use of blockchain identity services is in Estonia, with the e-Identity ID card[5] which is deployed on the KSI Blockchain[6], but trials are ongoing or in development in Switzerland[7], Finland[8], India[9], Japan[10], the USA[11] and UNICEF[12]. In most of these cases, the aim is to provide identity services to the initiating government's own citizens, but the Finnish trial is noteworthy as it uses blockchain to provide identity in the form of debit cards to refugees: a vulnerable group who typically cannot make use of traditional paper-based identities. The UN is also trialling provision of refugee identities using blockchains in a collaboration with Accenture and

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[2] https://blog.mozilla.org/firefox/cross-site-tracking-lets-unpack-that/

[3] https://bitsonblocks.net/2017/05/17/a-gentle-introduction-to-self-sovereign-identity/

[4] https://medium.com/@argongroup/on-zero-knowledge-proofs-in-blockchains-14c48cfd1dd1

[5] https://e-estonia.com/solutions/e-identity/id-card/

[6] https://guardtime.com

[7] https://medium.com/uport/zug-id-exploring-the-first-publicly-verified-blockchain-identity-38bd0ee3702

[8] https://cointelegraph.com/news/finland-solves-refugee-identity-with-blockchain-debit-cards

[9] https://www.wisekey.com/press/wisekey-and-the-government-of-andhra-pradesh-india-announce-collaboration-to-bring-security-to-block-chain-and-fintech-projects/

[10] https://www.secureidnews.com/news-item/digital-id-japan-powered-blockchain/

[11] http://www.govtech.com/data/Illinois-Announces-Key-Partnership-in-Birth-Registry-Blockchain-Pilot.html

[12] https://www.ictworks.org/united-nations-agencies-using-blockchain-technology/#.Wuhijn8h1hE

Microsoft[13]. The refugee case is an extreme example of a general identity problem which blockchains can address. Paper-based identity systems cannot be used across borders here because the government which would usually serve as a guarantor may be hostile, unreachable or may not exist as a functioning entity. But even in less traumatic cases of international movement, the reliance on an individual's home government could be lessened by a secure digital identity service based on blockchain, reducing the number of parties involved in an interaction and potentially increasing efficiency and trust.

To compare with non-blockchain-based government identity services, the France Connect platform[14] is a nationally-deployed single-sign-on (SSO) service enabling French citizens to access government services. France Connect is a federated SSO platform in which Identity Providers (e.g., individual government ministries with which a citizen already has a digital account) provide identification and authentication services to France Connect, which then provides a common identity to Service and Data Providers, who individually determine whether a France Connect authenticated user has the authorisation to access the relevant service or data respectively. France Connect is a centralised service based on the OpenID[15] and OAuth 2.0[16] standards; the linking of user identities across services is controlled by France Connect, which also therefore controls which data is shared about a user with each service. The promise of blockchain-based identity services is that they can dispense with the need for such centralisation, and pass control over data sharing to users instead.

Issues with blockchain identity include privacy and refutability. On occasions where a citizen does not wish to be identified, is there an alternative? If a blockchain solution is trusted, or sold as providing stronger guarantees than paper-based services, do issues such as identity fraud not become even worse? And how can an immutable public record be reconciled with the right to be forgotten as enshrined in Europe's new General Data Protection Regulation (GDPR). In general, interactions between the blockchain and the GDPR rights are unclear, from both a technical and legal standpoint, across all use cases.

As stated earlier, identity underpins very many of the other use cases of blockchains for government services, and is a prerequisite for their meaningful implementation. Without an identity system, it is impossible to implement asset registry, educational certification, medical record, and financial systems, and it is hard to see how many transparency and voting applications could be implemented without some underlying identity guarantee – even if (in the case of voting, for example), there is also a need for anonymity; the right to vote, and vote only once, must be confirmable. The lack of standard tested solutions in the area of identity may be hindering further development of government blockchain in general.

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[13] http://fortune.com/2017/06/19/id2020-blockchain-microsoft/
[14] https://joinup.ec.europa.eu/document/france-connect-id-federation-system-simplify-administrative-processes
[15] https://openid.net
[16] https://oauth.net/2/

Identity systems are, of course, not only applicable to people, but also to objects, enabling therefore trusted representation of relationships between people and other entities.

Government services

Connecting to the themes discussed above, the use cases to which blockchain is being applied by governments fall into broad categories, of trust and verification of records, and improving transparency, with efficiency improvements as a motivation throughout. Of course, these categories are not independent, and often both goals apply to the same use case. Trust and verification divides further into securing assets and certification of contents.

Trust and verification

Asset registries are receiving a great deal of attention, with initiatives or trials being conducted by Sweden[17] and the UK[18] within the EU, and many countries globally, including India[19], Georgia[20], Ghana[21], and Russia[22], among others. A trial in Honduras[23] seems to have stalled, possibly due to issues with the underlying (non-digital) land registry system[24]. In some ways, an asset registry is the easiest use case to implement. Blockchains were originally designed to provide a trustable register of assets (cryptocoins) in a trustless and decentralised model; adapting to other kinds of asset to gain the same benefits is relatively simple, by adding a means to link identities of assets with identities of individuals, with transactions representing transfer of assets between individuals. Finance-related initiatives are being undertaken by the UK (with a deployed system for gold trading with Royal Mint Gold[25]), with trials of payment and cryptocurrencies in Russia[26], Venezuela[27] and the United

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[17] https://cointelegraph.com/news/swedish-government-land-registry-soon-to-conduct-first-blockchain-property-transaction

[18] https://www.coindesk.com/uk-land-registry-plans-test-blockchain-digital-push

[19] https://www.cnbc.com/2017/10/10/this-indian-state-wants-to-use-blockchain-to-fight-land-ownership-fraud.html
https://www.coindesk.com/andhra-pradesh-partners-with-chromaway-to-develop-blockchain-land-registry/

[20] https://www.forbes.com/sites/laurashin/2017/02/07/the-first-government-to-secure-land-titles-on-the-bitcoin-blockchain-expands-project

[21] https://www.forbes.com/sites/rogeraitken/2016/04/05/bitlands-african-blockchain-initiative-putting-land-on-the-ledger/

[22] https://www.coindesk.com/russias-government-test-blockchain-land-registry-system/

[23] https://medium.com/@BCDiploma/honduras-end-of-land-title-fraud-thanks-to-blockchain-technology-fc7aede49998

[24] https://www.newamerica.org/international-security/future-property-rights/blog/blockchain-for-property-rights-georgia/

[25] https://rmg.royalmint.com/

[26] https://www.coindesk.com/regional-government-russia-test-blockchain-payments

[27] https://www.aljazeera.com/news/2018/02/venezuela-petro-cryptocurrency-180219065112440.html

Arab Emirates[28], and with experiments in Japan[29], Singapore[30] and Australia[31] extending to banking and trading services. Beyond finance, interest has been shown in energy markets in the UK[32], US[33] and Chile[34]. In each of these cases, the goal appears to be regulatory – to reduce fraud and increase trust in markets for the particular asset concerned – and efficiency – to be able to guarantee the trust without the cost of manual systems for doing so. Initiatives relating to energy also attract interest in opening up new potential markets, in terms of disintermediated peer-to-peer trading of renewable energy, avoiding the market centralization effects of small energy producers (e.g., domestic solar) having to sell via an intermediary energy supplier.

Less specifically asset-focused are the projects for what we might call record certification – using blockchains to provide a government-supported guarantee that the contents of a particular record of some value has not been tampered with, and genuinely contains the record it purports to contain. The general method of doing this is to add an entry to the blockchain either directly containing a record, or a hash of it with the actual record stored elsewhere. The (immutable) timestamp on the blockchain entry coupled with its contents permit the integrity of the record to be verified automatically. Non-blockchain implementations of the same approach can be vulnerable to tampering of either data, hash, or timestamp. Tamper-proof blockchain-based voting systems are being tested in various contexts in eight countries, including Estonia[35] in the EU, with the aim of widening access to voting (e.g., to serving military), increasing trust in the democratic process and promoting electronic voting systems. Educational certification has also been given a lot of attention, as in, for example, the UK's Institute of Coding[36] project, and Malta's higher education BlockCerts trial[37], using blockchains to allow automatic verification of educational accreditation, with the aim of reducing costs and time in recruitment as well as academic fraud, and, in the common government role of regulators of academic standards, setting blockchain accreditation standards. Outside the EU, the Kenyan[38] and Indian[39] governments are carrying out trials of blockchain-based educational certification.

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[28] https://www.coindesk.com/emirates-nbd-enlists-uae-central-bank-blockchain-check-trial/
https://themerkle.com/uae-and-saudi-arabia-collaborate-on-new-central-bank-digital-currency-research/
[29] https://www.secureidnews.com/news-item/digital-id-japan-powered-blockchain/
[30] https://govinsider.asia/smart-gov/singapore-government-builds-blockchain-system-to-protect-banks/
[31] https://uk.reuters.com/article/us-asx-blockchain/australias-asx-selects-blockchain-to-cut-costs-idUKKBN1E037R
[32] http://www.powerengineeringint.com/articles/2017/09/london-tech-firm-electron-gets-government-funding-for-grid-blockchain-project.html https://uk.reuters.com/article/us-centrica-blockchain/uk-energy-supplier-centrica-to-trial-blockchain-technology-idUKKBN1I117G
[33] https://www.coindesk.com/us-government-lab-blockcypher-tap-blockchain-for-p2p-energy-transactions/
[34] https://www.coindesk.com/chile-to-use-ethereums-blockchain-to-track-energy-data/
[35] https://www.reuters.com/article/nasdaq-blockchain/nasdaq-successfully-completes-blockchain-test-in-estonia-idUSL1N1FA1XK
[36] https://instituteofcoding.org
[37] https://www.coindesk.com/maltas-government-putting-academic-certificates-blockchain/
[38] https://cointelegraph.com/news/kenyan-government-uses-ibm-blockchain-to-prevent-academic-certificate-fraud
[39] https://factordaily.com/degree-certificates-india-blockchain-project/

Certification of objects as well as people is a focus of attention too. In particular, food standards regulation is a prime candidate for blockchain approaches, enabling more sophisticated quality certification, by straightforward access to quality certifications at each step of food production accessible directly to retailers and consumers. A trial is taking place in Dubai in this area[40].

Countries such as Estonia[41], Sweden[42], and the UK[43], as well as several US states[44], have shown interest in the use of blockchains to certify patient medical records, where data integrity is of vital importance and in which, particularly in a multi-provider healthcare system, there can be multiple sources of input to a single record. Using blockchain to guarantee immutability of health records also provides a clear audit trail in for accountability of medical decision-making. Clearly, the biggest issue in this scenario is data protection: healthcare data stored on a blockchain must be encrypted, clearly, but what extra precautions need to be taken to handle the risk of private key exposure?

Transparency

The append-only nature of an immutable ledger makes it useful for tracking processes as well as more static data. In a public chain using open data, these attributes allow blockchain-based systems to be used to improve the transparency of government activities and services. In particular, various trials are underway in regulatory scenarios. In terms of implementation, this is essentially the combination of trusted verifiable records (over time, in the case of process transparency) with open data.

Several of the financial trials mentioned earlier, in Japan, Singapore and Australia, also serve to apply blockchains to banking and financial regulation, with the goal of improving trust and transparency in such regulation with open decision-making recorded on a ledger. The UK (in Gibraltar[45]) and Malta[46] are investigating blockchains for regulation of gambling industries. Transparency in government spending can be supported by blockchains to ensure public accountability for the use of government funds. For example, Canada[47] and Mexico[48] are using

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[40] https://www.ibm.com/blogs/blockchain/2018/02/one-nations-move-to-increase-food-safety-with-blockchain/

[41] https://www.ibtimes.co.uk/guardtime-secures-over-million-estonian-healthcare-records-blockchain-1547367

[42] http://www.himss.eu/himss-blog/nordic-way-blockchain-healthcare

[43] https://www.telegraph.co.uk/business/business-reporter/blockchain-trial-in-healthcare/

[44] https://statetechmagazine.com/article/2017/09/state-led-healthcare-pilots-seek-demonstrate-value-blockchain-0 https://www.itij.com/story/114064/us-healthcare-blockchain-pilot-starts

[45] https://www.reuters.com/article/us-gibraltar-regulator-blockchain/gibraltar-launches-financial-services-license-for-blockchain-idUSKBN1E81JO

[46] https://cointelegraph.com/news/malta-gaming-authority-proposes-blockchain-gaming-guidelines-testing-sandbox

[47] https://globalnews.ca/news/3977745/ethereum-blockchain-canada-nrc/ https://futurism.com/canadas-blockchain-trial-transparency-government-funding/

[48] https://www.coindesk.com/mexico-tests-blockchain-track-public-contract-bids

blockchains to handle public funding programmes, while Denmark[49], the US, and the UN[50] are testing them for the recording of spending on foreign aid and refugee support.

Processes relating to procurement and supply chain also benefit from a great deal of openness and auditability. The US[51] and China[52] are investigating blockchains for the handling of supply chain traceability.

Finally, and distinct from the health records case discussed earlier, there are initiatives underway in multiple US states[53] for handling public medical processes – for example, handling the licensing of medical professionals, particularly when moving between administrations.

Efficiency

The goal of efficiency is primarily a tacit one behind many of the initiatives for trust, verification and transparency; the ability to achieve these goals in a trustworthy manner in a completely digital environment could potentially offer efficiency improvements over existing paper-based approaches. These improvements are a motivation for moving to digital services in general. The particular advantages of blockchain are its abilities to offer the guarantees described above without the need to run and maintain a central management infrastructure to the same degree as a traditional digital model.

As well as infrastructure management costs, there are also possible efficiency savings based on the sharing of services across sectors of government. For example, a decentralised identity service which enables multiple branches of government to use the same platform for citizen identity can reduce the costs of each individual branch running its own account service. Again, such arguments can also be applied to digital services which do *not* use blockchain; the possible efficiency saving is located in the sharing of services rather than the distributed ledger model itself (as with, e.g., France Connect). There may in practice, however, be an effect on efficiency from the fact that blockchain nodes, if running nothing else significant, can be either identical, or significantly closer to one another in terms of configuration than different servers in more traditional set-ups – since no one blockchain node has any particular privileges or roles different from any other, they are rather more interchangeable, which may lead to savings.

A developed example of cross-sector use of blockchains has been established in Estonia, where the "X-Road" platform[54] allows government services to share and access data across departments – for

https://www.gob.mx/cms/uploads/attachment/file/269552/Folleto_blockchain_HACKMX_oct2017_v6.pdf

[49] https://medium.com/digital-diplomacy/blockchain-for-foreign-policy-and-development-aid-86c092412c6

[50] https://www.coindesk.com/united-nations-sends-aid-to-10000-syrian-refugees-using-ethereum-blockchain/
https://www.ictworks.org/united-nations-agencies-using-blockchain-technology/

[51] https://cointelegraph.com/news/us-government-implements-blockchain-programs-to-improve-transparency-and-efficiency-expert-blog

[52] https://pdfs.semanticscholar.org/24cd/eb7d7421012c2fdd362b8e2816c105b7071f.pdf

[53] https://gcn.com/articles/2018/02/05/illinois-blockchain.aspx http://medscient.com

example, allowing police to check driving licence details with no need for a physical licence. The Estonian government claims that the use of X-Road saves Estonians over 800 years of working time every year[55], and the system has since been adopted in Finland, Azerbaijan, Namibia and the Faroe Islands, with a recent trial of cross-border data exchange taking place between Estonia and Finland.

The precise quantification of savings from blockchain specifically is in general not yet known, and will require further research as the various initiatives are deployed at larger scales. It appears in general that efficiency is a secondary motivation for most of the work in this area, with trust and openness providing most of the appeal of blockchains for governments.

Technologies

Technical details of the approaches being used by the various ongoing initiatives are sparse. Most of the information about government trials with blockchains is in the form of press releases or high-level news stories without technical depth. It is possible to infer platform choices from technology partners, but generally very little else is published about implementation. The majority of the cases cited in this document appear to be based ultimately on either the Bitcoin[56] or Ethereum[57] blockchains, with some use of Hyperledger or other blockchains such as KSI[58], WISeKey[59] or Dash[60], and of platforms such as Ubitquity[61] or BlockCypher[62] which aim to be agnostic of the underlying chain technology. The primary differences relate either to application support (for example, convenient APIs), or, more fundamentally, to the distinction between permissioned and permissionless blockchains. On a permissionless blockchain such as the public Bitcoin or Ethereum platforms, anyone can create a node and join the network, and anyone can create transactions or blocks, subject to consensus, and access the raw record data. On a blockchain which supports permissioning, such as Hyperledger[63], it is possible to control each of these aspects of access to the platform and permit only certain users or servers to interact with, view, or add data.

Permissioned blockchains have obvious advantages in terms of ease of handling private data, as they can be restricted in access only to those users who have a legitimate reason to access it. However, there can be a trade-off: a network which limits the addition of new nodes or uses a controllable consensus mechanism (e.g., Proof of Authority, in which the right to add new blocks is given to a fixed and centrally chosen list of nodes) can be more centralised, with at least possible consequences

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[54] https://www.ria.ee/en/introduction-of-xroad.html
[55] https://e-estonia.com/solutions/interoperability-services/x-road/
[56] https://www.bitcoin.org
[57] https://www.ethereum.org
[58] https://guardtime.com
[59] https://www.wisekey.com/the-wisekey-blockchain/
[60] https://www.dash.org
[61] https://www.ubitquity.io
[62] https://www.blockcypher.com/
[63] https://www.hyperledger.org

for trust and efficiency. Approaches can be taken to minimise this: for example, the Agora voting system[64] is based on a two-layer blockchain model, with a permissioned blockchain used for the majority of transactions, and a permissionless blockchain (specifically, Bitcoin) used to certify the immutability of records in the permissioned layer.

Relevance to European context

The majority of ongoing developments in governmental use of blockchain are within single countries, with very few in a cross-border context. Successful implementation of blockchain systems for government services and digital identity have the potential for significant impacts on the lives of European citizens even at the member state level, but of course this potential could be amplified much further if handled appropriately across the European Union.

The EU relies on common understandings and regulations across many sectors and between all member and associated states. If the security, transparency and efficiency goals of ongoing blockchain initiatives are successful within a country, it is likely that they will be as, or even more so, successful on a continental scale. In particular, consider blockchain systems relating to the exchange of goods and services between countries. Of the use cases discussed so far, currencies, banking and regulation, funding and procurement seem highly relevant to the Digital Single Market, with the addition of energy markets and certification for, e.g., food safety relevant also in the physical case.

The free movement of people across the EU brings with it the need for citizens to interact with and use government services outside their countries of origin, in many or all of the contexts in which those services are accessed by citizens of the host country. Asset registries, currency, healthcare, voting, taxation and education are not only needed within a country, but also, more specifically, between countries, to account for the (common) situation in which an individual needs to access services across borders.

As an association of states, as well as a large government entity in its own right, the EU also has a need to ensure transparency in cross-border contexts, as well as in the context of Union processes and spending themselves.

Cutting across all of these contexts, as with use cases, is the question of identity, and ensuring that the right services can be accessed by the right individuals at the right time. Digital identity in particular is increasingly important as the opportunities to access services without any travel or physical presence increases. The European eIDAS (Electronic Identification and Trust Service[65]) established a regulatory framework for digital identity and trust across Europe in 2013, but was established before the more recent developments in blockchain technologies, and does not take into account the model of self-sovereign identity which they make possible.

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[64] https://agora.vote/Agora_Whitepaper.pdf?v0.3
[65] https://ec.europa.eu/digital-single-market/en/trust-services-and-eid

Open questions

The primary observation to stand out from a survey of existing work in this area is that the average level of readiness is extremely low, and technical details are sparse. Almost all of the initiatives referred to above are trials, or planned trials, with very few production systems in use. Estonian government services are perhaps the most notable exception, at a comparatively high level of development and use, and with more transparency when it comes to implementation details. Thus the main open questions to arise are simple: are there any issues slowing down adoption of blockchain technologies for government, and what measures can be taken to reduce them? Which of these particularly apply in the European context? The slow development of blockchain-based government services can be attributable to several of the following factors, but it is unknown, in general, to which, and to what degree?

Known barriers

Some of the difficulties facing adoption of blockchain systems for government are already known or can be easily anticipated.

- **Interdependence:** the requirement for services to have a reliable identity system as an underpinning is a recurring theme. Further, more possibilities would be open if interacting services could use compatible identity services, so that an individual can pass between services easily. The latter is perhaps a bigger barrier than the former as it requires coordination between implementations. Given the pivotal role of identity, this may be the highest priority issue to be overcome.
- **Legacy harmonisation:** any new technology platform is likely to need to integrate with existing legacy systems. When it comes to government services in particular, there is often a need to integrate not only technically, but also legally: for example, Sweden's existing (paper-based) land registry has specific status in law as an official record; the blockchain Lantmäteriet project therefore requires changes to the law in order for it to be on a similar legal basis[66]. In the EU context, there are likely to be requirements for synchronisation between member states on how to accommodate blockchain-based services in legislation which is relevant to cross-border and EU-level activities. The effect of this is likely to be time to adoption of services rather than blocks to their adoption at all. From the Honduran land registry case cited earlier[67], there is also a need to ensure that the existing systems function well to begin with; blockchains are not a magic bullet.
- **Technical interoperability and maturity:** many of the initiatives discussed have the same or similar services implemented on different blockchain platforms in different countries. The

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[66] https://cointelegraph.com/news/swedish-government-land-registry-soon-to-conduct-first-blockchain-property-transaction

[67] https://www.newamerica.org/international-security/future-property-rights/blog/blockchain-for-property-rights-georgia/

question then arises of how to address interoperability between them when operating across borders. Blockchain technologies are young, and rapidly developing. Instabilities in software and standards are to be expected, and naturally affect uptake and impact. While there is a risk of addressing interoperability and standards too early in the adoption of new technologies before they stabilise, there is also a risk of addressing them too late, when multiple competing standards are too widely established to be easily harmonized.

- **Data protection and privacy:** data on a public blockchain is widely distributed. Different choices as to how data is stored on a blockchain (encrypted, or hashed and stored off-chain, and so on) can have consequences for the enforcement of data protection rights and privacy. This is particularly important if solutions emerge outside the EU; adaptation to the European context will require careful attention to GDPR-compliance. Given the apparently global visibility of GDPR regulations in digital industries, there is likely a comparatively low risk that non-compliant or non-adaptable solutions will be widespread.

Unknown barriers

Given how many of the initiatives described are very early in their development, it is highly likely that difficulties will arise, or are already being encountered, which do not fall into the above categories. It is also reasonable to presume that applications for similar use cases will run into similar problems. However, much of the publicly available material about many of the initiatives is in the form of announcements or news stories, with few technical details and little discussion of problems, making it difficult to identify paths to success or failure, or opportunities to learn from others' mistakes.

Conclusion and potential actions

Based on the findings here, the following actions are recommended to promote the most effective use and take-up of blockchain-based systems across the EU:

- Establish, at a policy level, the requirements and constraints on a blockchain-based digital identity system, either to operate directly across member states, or to define legal and technical interoperability standards for national digital identity systems, extending or adapting the existing eIDAS legislation. Early development of policy and standard requirements could make later interoperability significantly easier. There is a potential drawback of early standardisation, before the landscape settles. To mitigate this, attention will need to be paid to adaptability.
- Identify where legal harmonisation will be required in order to support identity government services on blockchain, and where the Commission can support this harmonisation across the EU. Given that legal processes can often be slow, early identification of these requirements will be beneficial.
- Establish open communication channels (e.g., within the Forum) specifically to encourage the sharing of best practices, and especially of issues, between existing implementation

projects for blockchain-based identity and government services, and encourage projects to take part.

- Identify clear guidelines, following the GDPR report of the Forum, on the requirements and best practices for blockchain-based identity and government services to be GDPR-compliant and privacy-protecting by design.
- Support research, innovation and development for identity services in particular and blockchain-based government services in general via programmes relating to the Digital Single Market and the Horizon 2020/Horizon EU programmes.

Appendix A - Use Case Resources

National Identity Management Systems

France Connect - https://franceconnect.gouv.fr/ - For comparison with a non blockchain digital identity system

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Estonia: identity management - http://fortune.com/2017/04/27/estonia-digital-life-tech-startups/ and their own page https://e-estonia.com/solutions/e-identity/id-card/

Developers of e-Identity

These e-Identity solutions are provided by the following Estonian companies:

- **SK ID Solutions** ID-card, Mobile-ID, Smart-ID, digital signature Visit website
- **Raul Walter** ID-card Visit website
- **SignWise** digital signature Visit website
- **Politsei- ja Piirivalveamet** ID-card Visit website
- **Telia** Mobile-ID Visit website
- **Nortal** Mobile ID, eID Lifecycle Management, Public Key Infrastructure, digital signature, eID Authentication, Data encryption with eID Visit website

Find out more about the services and know-how of the Estonian IT sector

Book a Visit to talk about Estonia blockchain tech: https://e-estonia.com/showroom/#booking

Tech: KSI Blockchain - Guardtime (https://guardtime.com/)

Maturity: Deployed

Contact: https://guardtime.com/about#contact **Email**: office@guardtime.com

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Switzerland - Zug: https://medium.com/uport/zug-id-exploring-the-first-publicly-verified-blockchain-identity-38bd0ee3702 - Dec 7th 2017

Using uPort - says their system is GDPR compliant. Trial Done.

"In the coming months the City of Zug is planning to organise workshops with the public to determine what the first use case implementations will look like. One possibility may be to conduct public surveys ("Umfrage") on general topics, which constitute a crucial part of the Swiss political process and an important first step in how uPort could be used for systems like e-voting."

Zug digital identity website: https://stadtzugid.zg.ch/ **Email**: einwohnerkontrolle@stadtzug.ch

Kolinpl., 6301 Zug, Switzerland

stadtzug.ch

+41 41 728 15 15

Tech Company: Consensys - uport.

India: https://www.wisekey.com/press/wisekey-and-the-government-of-andhra-pradesh-india-announce-collaboration-to-bring-security-to-block-chain-and-fintech-projects/

"**Geneva, Switzerland – September 6, 2017** – WISeKey International Holding Ltd (SIX: WIHN), a leading Swiss cybersecurity and IoT company announced today a collaboration agreement with the Government of Andhra Pradesh, the seventh largest state in India, to explore implementation of blockchain technology POCs as pilot projects in various departments. "...

"The WISeKey Platform can be used to enhance the security of Citizens' Identity, position citizens at the center of gravity of Government services using the WISeKey PKI based Blockchain technology as the solution to secure government-recorded data."

"WISeKey Digital Identity BlockChain Platform selected by BBC as one of the Five African tech trends to look out for in 2018" - (https://www.wisekey.com/press/wisekey-digital-identity-blockchain-platform-selected-by-bbc-as-one-of-the-five-african-tech-trends-to-look-out-for-in-2018/)

Maturity: Pilot - announcement (https://globenewswire.com/news-release/2017/09/06/1108031/0/en/WISeKey-and-the-Government-of-Andhra-Pradesh-India-announce-collaboration-to-bring-Security-to-Block-Chain-and-Fintech-Projects.html)

Tech Company: WISeKey Blockchain (https://www.wisekey.com/the-wisekey-blockchain/)

Route de Pré-Bois 29, P.O. Box 853

CH-1215 Geneva 15, Switzerland

Phone: +41 22 594 3000

Fax: +41 22 594 3001

Email: info@wisekey.com

Finland: Finland Solves Refugee Identity with Blockchain Debit Cards (issued to asylum seekers and immigrants) - https://cointelegraph.com/news/finland-solves-refugee-identity-with-blockchain-debit-cards

https://medium.com/world-economic-forum/finland-has-created-a-digital-money-system-for-refugees-ba1fe774ee1c (14th Sep 2017)

"MONI has developed a prepaid debit card that circumvents the need for a bank account or identity papers. The card is linked to a unique digital identity stored on a blockchain"

Maturity - Implemented - work started approx 2015
https://www.raconteur.net/finance/governments-building-cryptocurrencies
Tech Company: MONI https://moni.com/company/

United Kingdom Offices   Finland Offices

MONI Ltd   MONI Nordic Ltd

London WC1N 2EB   Yliopistonkatu 5
10 John Street   00100 Helsinki
United Kingdom   Finland

Email: hello@moni.com

UN - Blockchain to Store Education Records at UNICEF (2016)
https://www.ictworks.org/united-nations-agencies-using-blockchain-technology/#.Wuhijn8h1hE
"UNICEF is investing in the South African start-up 9Needs to develop the open source digital identity and personal information platform "Amply". The system uses blockchain infrastructure and smart contracts to strengthen the registration, contracting, information and management systems of early childhood development programs. It helps children access services such as education, health care, social benefits."

Tech Company: 9Needs - became Trustlab (http://unicefstories.org/2016/11/14/9needs-connected-development-building-amply-a-web-of-trust-for-children)

Trustlab Studio 16A Newmarket Street, 2nd Floor, Castle Mews Building, Cape Town, WC, 8001, South Africa
Email: admin@trustlab.tech

Japan: "Digital ID in Japan to be powered by blockchain" (30th October 2017)
https://www.secureidnews.com/news-item/digital-id-japan-powered-blockchain/
(See also banking services)
https://www.thepaypers.com/digital-identity-security-online-fraud/japanese-banks-to-develop-shared-id-system/770153-26 (26th Sept 2017)

"The Financial Services Agency (FSA) and various financial institutions in Japan have teamed up to develop a shared ID system. Three large Japanese banks will be taking part in the project: the Bank of Tokyo-Mitsubishi, Sumitomo Mitsui and Mizuho Bank. "

FSA:
https://www.fsa.go.jp/en/
Financial Services Agency
The Central Common Government Offices No. 7
3-2-1 Kasumigaseki, Chiyoda-ku, Tokyo, 100-8967 Japan
Email: equestion@fsa.go.jp

USA: Illinois Announces Key Partnership in Birth Registry Blockchain Pilot
http://www.govtech.com/data/Illinois-Announces-Key-Partnership-in-Birth-Registry-Blockchain-Pilot.html
"Recognizing that identity — and, now, digital identity — begin at birth, the state will explore using these technologies to create "a secure 'self-sovereign' identity for Illinois citizens during the birth registration process," it said in the announcement."

Maturity: Pilot
Tech: Expected to use Sovrin Foundation's publicly available distributed identity ledger
Tech Company: Evernym - Utah https://www.evernym.com/
Article by Evernym: https://medium.com/evernym/the-three-models-of-digital-identity-relationships-ca0727cb5186
The Three Models of Digital Identity Relationships: How self-sovereign identity is different, and why it's better.

Email : support@evernym.com

Registries - Land Registry (Property Registry, Business/Corporate Registry)

Sweden: Land Registry -

MAR 07, 2018 Swedish Government Land Registry Soon To Conduct First Blockchain Property Transaction:https://cointelegraph.com/news/swedish-government-land-registry-soon-to-conduct-first-blockchain-property-transaction

"Sweden's land-ownership authority, the Lantmäteriet, is soon expected to conduct their first Blockchain technology property transaction after two years of testing"... "Lantmäteriet first started testing Blockchain technology in 2016, completing their second stage of trials in March 2017. By July 2017, the Swedish land registry was using Blockchain to register land and properties on the Swedish Blockchain startup ChromaWay's private Blockchain network, albeit on a *"small scale,"* according to Snäll."

Maturity: Pilot project - Testing started 2016 - soon to be used for first 'volunteers'
Tech: Using ChromaWay's (https://chromaway.com) private blockchain technology which they call Postchain (https://github.com/chromaway)

Phone: +46 (0)8 506 363 38
Email: info@chromaway.com

UK: UK Land Registry Plans to Test Blockchain in Digital Push
https://www.coindesk.com/uk-land-registry-plans-test-blockchain-digital-push/
https://hmlandregistry.blog.gov.uk/2017/12/18/world-leading-through-digital-transformation/ (18th Dec 2017)

Verifying a secure digital mortgage service:
https://hmlandregistry.blog.gov.uk/2017/7/28/verifying-secure-digital-mortgage-service/

GOV.UK Verify overview:
https://www.gov.uk/government/publications/introducing-govuk-verify/introducing-govuk-verify

Maturity: Planning a trial

Ukraine: Ukraine Moving Land Ownership Records onto Blockchain Platform to Fight Corruption (4th Oct 2017)https://cryptovest.com/news/ukraine-moving-land-ownership-records-onto-blockchain-platform-to-fight-corruption/

The Ukrainian government will begin blockchain land registration trials in October (6th Jan 2018) https://www.coinmis.com/the-ukrainian-government-will-begin-blockchain-land-registration-trials-in-october/

Tech Company: BitFury Group Ltd https://bitfury.com/ **Email**:media@bitfury.com
Lots of offices around world including one in London:
Level39, One Canada Square
Canary Wharf, London, E14 5AB
United Kingdom

Maturity: Pilot

India: https://www.cnbc.com/2017/10/10/this-indian-state-wants-to-use-blockchain-to-fight-land-ownership-fraud.html
https://www.coindesk.com/andhra-pradesh-partners-with-chromaway-to-develop-blockchain-land-registry/
"The Indian state of Andhra Pradesh is working with startup ChromaWay on a land registry pilot that uses blockchain to track the ownership of property." (Oct 10, 2017)

https://analyticsindiamag.com/how-andhra-pradesh-is-emerging-as-indias-blockchain-hub/ (2018 article)

Maturity: Pilot
Tech Company: ChromaWay (https://chromaway.com)
ChromaWay AB
Centralplan 15
S-111 64 Stockholm
Sweden
Phone: +46 (0)8 506 363 38
Email: info@chromaway.com

Brazil: Ubitquity Used to Test Pilot Blockchain Land Registry in Brazil: (27th Jan 2018)
https://www.bitsonline.com/ubitquity-test-blockchain-land/

"The University of British Columbia's research program on blockchains, released a study that analyzed a test pilot they conducted on blockchain tech with respect to land registry. The case study was performed in Brazil with the help of Ubitquity, a startup that specializes in blockchain solutions for real estate."

Maturity: Pilot - completed? - study released by University of British Columbia analysing the pilot. Tech Company: Ubiquity (https://www.ubitquity.io) which use Bitcoin "Our blockchain in use is Bitcoin, however we're 100% compatible with Ethereum, Hyperledger, and MultiChain in an effort to remain fully blockchain-agnostic."

Ubiquity:
Address: 300 Delaware Avenue, Suite 210-A, Wilmington DE, 19801, USA.
Telephone : 1+ (331) BITCØIN [248-2046]
Email Us: info@ubitquity.io

Vermont City Pilots Land Registry Record With Blockchain Startup (23rd Jan 2018)
https://www.coindesk.com/vermont-city-pilots-land-registry-record-with-blockchain-startup/

Blockchain Is Gaining Ground On Land Registry Systems (25th Jan 2018)
https://bitrazzi.com/blockchain-gaining-ground-land-registration-systems/
"- Sweden, Brazil, India, and now Vermont: Blockchain-based land registry is common to all"

Maturity: Pilot
Tech: Public Ethereum - provided by Propy (https://propy.com/) - documents refer to Smart Contracts
Challenge: "This pilot will push the limits of blockchain technology as it applies to secure and efficient means for real estate transactions with the added layer of storing land management data affordably. Lowering cost was a big incentive for the city of South Burlington to evaluate blockchain technology and run this pilot." (https://blog.propy.com/propy-announces-first-us-pilot-with-vermont-23ec0b2d3b11)

Email: info@propy.com

Honduras Land Registry - "Honduras: end of land title fraud, thanks to blockchain technology." - https://medium.com/@BCDiploma/honduras-end-of-land-title-fraud-thanks-to-blockchain-technology-fc7aede49998

Maturity: Pilot - stalled (according to https://www.newamerica.org/international-security/future-property-rights/blog/blockchain-for-property-rights-georgia/)
Tech: Bitcoin - using Factom, an open source decentralized ledger which is secured by the Bitcoin Blockchain (https://s3.amazonaws.com/ipri2016/casestudy_collindres.pdf)

Georgia: Land Registry on the blockchain - https://www.forbes.com/sites/laurashin/2017/02/07/the-first-government-to-secure-land-titles-on-the-bitcoin-blockchain-expands-project/#1784b21e4dcd

Maturity: Pilot moving now to full implementation.
Tech: Via company called Bitfury (http://bitfury.com) - private blockchain whose transactions are publically secured on Bitcoin

Email: media@bitfury.com

Ghana: Land ownership - https://www.forbes.com/sites/rogeraitken/2016/04/05/bitlands-african-blockchain-initiative-putting-land-on-the-ledger/#20ebc6187537

Maturity: Pilot
Tech: OpenLedger blockchain (https://openledger.info/) - employed by Bitland (www.bitland.world)
Contacts: http://www.bitland.world/contact-bitland/

Russia: Russia's Government to Test Blockchain Land Registry System (20th Oct 2017)
https://www.coindesk.com/russias-government-test-blockchain-land-registry-system/

Maturity: Planned Pilot in July 2018

Japan: Japan Could Place Its Entire Property Registry on a Blockchain (22 June 2017)
https://www.ccn.com/japan-place-entire-property-registry-blockchain/

Maturity: Trial in summer 2018

Dubai: Dubai Land Department becomes world's first government entity to conduct all transactions through Blockchain technology; move part of 'Dubai Blockchain Strategy' launched by Shaikh Hamdan bin Mohammed and led by Smart Dubai (2nd May 2018)
https://gulfnews.com/business/property/dubai-has-world-s-first-government-entity-to-conduct-transactions-through-blockchain-network-1.2101819

https://www.coindesk.com/dubai-land-department-launches-blockchain-real-estate-initiative/

Maturity: Production?

Dubai Land Department:
Phone: +971-8004488
Email: info@dubailand.gov.ae
Contact form: https://www.dubailand.gov.ae/English/Pages/Contact-Us.aspx
Address: Dubai Land Department: Dubai – Deira, Bni Yas Road
P.O.Box: Dubai 1166
Makani: 30404 94991
United Arab Emirates

Healthcare

Estonia: "E-health system. The X-Road interconnects hospitals, clinics, and other organizations. It implements a unified Electronic Health Record that supplies medical practitioners with information about patients' health while protecting their privacy. For example, the "e-prescription" system allows doctors to create prescriptions and make them immediately available to pharmacies. Patients can then collect their medicines directly from the pharmacy without having to visit the doctor for a hard copy of the prescription." (1)

https://www.ibtimes.co.uk/guardtime-secures-over-million-estonian-healthcare-records-blockchain-1547367

"In Estonia, patients own their health data and hospitals have made this available online since 2008. Today, over 95% of the data generated by hospitals and doctors has been digitized, and blockchain technology is used for assuring the integrity of stored electronic medical records as well as system access logs.

e-Health solutions allow Estonia to offer more efficient preventative measures, increasing the awareness of patients and also saving billions of euros. Each person in Estonia that has visited a doctor has his or her own online e-Health record, containing their medical case notes, test results, digital prescriptions and X-rays, as well as a full log-file tracking access to the data.

Therefore, doctors can access their patient's electronic records, no matter where they are and make better informed treatment decisions." https://e-estonia.com/

Maturity: Deployed (https://www.digilugu.ee)

Tech: KSI Blockchain (https://guardtime.com/)   **Email**: office@guardtime.com

             Nortal: https://nortal.com/contact-us/   **Email**: info@nortal.com

             Helmes: https://www.helmes.com/   **Email**: info@helmes.com

Estonia General Contact: https://e-estonia.com/showroom/

US healthcare blockchain pilot starts (5th April 2018)

https://www.itij.com/story/114064/us-healthcare-blockchain-pilot-starts

"Five US healthcare organisations – Humana, Multiplan, Quest Diagnostics and UnitedHealth Group's Optum and UnitedHealthcare – have announced that they will be working together to launch a blockchain technology-driven pilot programme to improve data quality and reduce administrative costs associated with changes to healthcare provider demographic data."

Maturity: Planned pilot

Tech: "It's not clear at this time whether the pilot would involve an existing platform or the development of a wholly new one. UnitedHealth and Humana did not immediately respond to requests for further information." https://www.coindesk.com/us-insurance-giants-unitedhealth-humana-launch-blockchain-pilot/ (3rd April 2018)

UK's first trial of blockchain in healthcare (22nd March 2018)
https://www.telegraph.co.uk/business/business-reporter/blockchain-trial-in-healthcare/
"Medicalchain is teaming up with the Groves Medical Group to pilot a blockchain platform for patients" (to be piloted at 4 medical centres)

Maturity: Pilot starts July 2018
Tech: Uses Medicalchain blockchain platform (https://medicalchain.com/en/) - based on Hyperledger Fabric (https://medicalchain.com/Medicalchain-Whitepaper-EN.pdf)

Contact: https://medicalchain.com/en/contact/ - online form

US: State-Led Healthcare Pilots Seek to Demonstrate the Value of Blockchain (27th Sept 2017)
https://statetechmagazine.com/article/2017/09/state-led-healthcare-pilots-seek-demonstrate-value-blockchain-0" With the aim to test how blockchain can improve medical processes, both **Delaware and Illinois** announced proof-of-concept blockchain pilots this August."

Maturity: Delaware - pilot between The Medical Society of Delaware and healthcare technology startup Medscient
Illinois - Pilot completed (https://gcn.com/articles/2018/02/05/illinois-blockchain.aspx) Illinois Department of Financial and Professional Regulation (DFPR) worked with Hashed Health (https://hashedhealth.com/) on a health provider registry. The pilot leveraged a blockchain-based registry to streamline licensure and credentialing information sharing about health care workers.

Tech: Delaware - Blockchain provide by Medscient (no details) http://medscient.com/
Illinois - Provided by Hashed Health (https://hashedhealth.com/)

A **Nordic** way to blockchain in healthcare (26th Feb 2018)
http://www.himss.eu/himss-blog/nordic-way-blockchain-healthcare

"CareChain is Swedish blockchain initiative, aiming at implementing a national blockchain for health data, also making it possible for citizens to regain control over their health data, and for managing their consent dynamically, and in compliance with the relevant GDPRs provisions."

Also article mentions "MyHealthMyData project, funded by the EU under the H2020 research programme"

Maturity: CareChain (https://www.carechain.io) - startup founded March 2017 and looking for partners

MyHealthMyData (http://www.myhealthmydata.eu/) - EU funded H2020 running from 2016 to 2020.

Tech: CareChain - They are members of the Enterprise Ethereum Alliance and follow closely the use case work being done in the HyperLedger Healthcare Working Group

MyHealthMyData: unsure what blockchain they are using

Email: info@carechain.io

Why bother with blockchain in healthcare? (Feb 9th 2018)
https://medium.com/iryo-network/why-bother-with-blockchain-in-healthcare-bda05f24e118
"The **European Interoperability Framework** describes interoperability in healthcare addressing not only technical and semantic layers but also the process, organizational and legislation layers. "
"Blockchain in Healthcare - It is believed that this technology will have a profound effect on healthcare, especially on medical data management, drug development, supply chain integrity, claims and billing management, medical research and data security."

How the blockchain can be applied in healthcare (20th March 2018)
https://www.econsultancy.com/blog/69883-how-the-blockchain-can-be-applied-in-healthcare

Voting

Estonia: Piloting blockchain-based solutions for voting - (stock exchange - not government)
https://www.reuters.com/article/nasdaq-blockchain/nasdaq-successfully-completes-blockchain-test-in-estonia-idUSL1N1FA1XK

Tech Company: **Cybernetica** i-Voting, TIVI (https://cyber.ee/en/e-government/i-voting/) **Email**: info@cyber.ee
https://e-estonia.com/

West Virginia Piloting Blockchain Voting App in Senate Election: (Mar 29, 2018)
https://www.coindesk.com/west-virginia-piloting-blockchain-voting-app-in-senate-election/
White Paper about pilot: "The effort comes as a result of technological obstacles that absentee voters from the military have encountered with the current "cumbersome" system, according to Warner."
"https://gallery.mailchimp.com/8f557e1c6ac0b5aa70dfd4c00/files/4b0e5aad-c98d-4387-b9cd-c05bedaef2a5/Secure_Military_Mobile_Voting_Solution.pdf

https://sos.wv.gov/News-Center/Pages/Military-Mobile-Voting-Pilot-Project.aspx
Press release by: Mike Queen - Deputy Chief of Staff/Communications Director
304-558-6000
Email: mqueen@wvsos.gov

Maturity: Trial with service personnel

Sierra Leone Pilots Blockchain-Based Voting for Political Elections (March 22, 2018)
https://www.nasdaq.com/article/sierra-leone-pilots-blockchain-based-voting-for-political-elections-cm938309
"Although the use of blockchain technology in Sierra Leone's presidential election earlier this month was initially overblown , the vote did utilize distributed ledger technology in a pilot test for use in a national government vote."

Tech Company: Agora (https://agora.vote/) **Email**: hello@agora.vote
https://medium.com/agorablockchain/agora-official-statement-regarding-sierra-leone-election-7730d2d9de4e

Maturity: trial in election

Moscow introduces blockchain e-voting (5th Dec 2017)
https://www.smartcitiesworld.net/news/news/moscow-introduces-blockchain-e-voting-2365
"Moscow has announced a pilot project to implement blockchain in its electronic voting system based on Ethereum smart contracts platform. Local government authorities of the Russian capital claim it will be the first city in the world to implement blockchain in e-voting on such a large scale."
https://www.finextra.com/pressarticle/71806/moscow-to-pilot-blockchain-platform-for-e-voting

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Colombia Blockchain Voting for Peace https://www.oecd.org/gov/innovative-government/embracing-innovation-in-government-colombia.pdf

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Brazil "Brazilian Electoral System to Use Ethereum Blockchain Network" -
https://www.newsbtc.com/2018/01/08/brazilian-electoral-system-to-use-ethereum-network/ and
https://btcmanager.com/brazil-looks-merge-political-processes-ethereum-blockchain/

Australia: Australia to Make Blockchain Voting App a Global Democratic Movement (30th June 2016)
https://cointelegraph.com/news/australia-to-make-blockchain-voting-app-a-global-democratic-movement

Australian startup - voting in United Nations
https://www.smartcompany.com.au/startupsmart/news-analysis/voting-blockchain-startup-horizon-state-locks-partnership-united-nations-gears-partnerships/

Blockchain Elections: So Hot Right Now (3rd April 2018)
https://cryptoslate.com/blockchain-elections/

Research Papers

A conceptual secure blockchain- based electronic voting system - research paper
http://aircconline.com/ijnsa/V9N3/9317ijnsa01.pdf
Issues and Effectiveness of Blockchain Technology on Digital Voting
https://www.ripublication.com/ijems_spl/ijemsv7n1_04.pdf

Russia: Blockchain Will Be Used To Protect 2018 Presidential Exit Poll Data (6th March 2018)
https://cointelegraph.com/news/russia-blockchain-will-be-used-to-protect-2018-presidential-exit-poll-data
"A Russian polling research center will use Blockchain to monitor exit poll results for its 2018 presidential elections held later this month"

Tech Company: 2chain
Maturity: Planned trial in 2018

Secure Banking Services etc.

Japan Digital ID - (30 October, 2017) - But specifically for Banking
https://www.secureidnews.com/news-item/digital-id-japan-powered-blockchain/
"The Financial Services Agency of Japan, one of the country's main regulators, is working with three financial institutions—Bank of Tokyo-Mitsubishi UFJ, Sumitomo Mitsui and Mizuho—on a shared digital ID system based on blockchain." ... to allow users to more easily swap accounts between banks

Maturity: Planned Trial
Partners:
Financial Services Agency of Japan: https://www.fsa.go.jp/en/   **Email**: equestion@fsa.go.jp
Bank of Tokyo-Mitsubishi UFJ: http://www.bk.mufg.jp/global/
Sumitomo Mitsui: http://www.smbc.co.jp/global/
Mizuho: https://www.mizuhobank.com/index.html

Singapore: Introduced a blockchain system to protect banks from fraud in interbank transactions - https://govinsider.asia/smart-gov/singapore-government-builds-blockchain-system-to-protect-banks/

Singapore: Singapore's Government Blockchain Experiment Is a Road to Regulatory Understanding (20th Feb 2018)
https://cointelegraph.com/news/singapores-government-blockchain-experiment-is-a-road-to-regulatory-understanding

Partners: R3
Tech Platform: "R3, IBM and ConsenSys were engaged to provide support on the respective DLT platforms of Corda, Hyperledger Fabric and Quorum. Microsoft was engaged to support the deployment of the prototypes on Azure Blockchain."
Tech Company: Accenture https://www.accenture.com/ca-en/blockchain-index
Maturity: Prototyping
                "The rolling out of project Ubin has been ongoing since late 2016 and is still in its opening phases."

Phase 2 report:
http://www.mas.gov.sg/~/media/ProjectUbin/Project%20Ubin%20Phase%202%20Reimagining%20RTGS.pdf

Australia: Australia's ASX selects blockchain to cut costs (6th Dec 2017))
https://uk.reuters.com/article/us-asx-blockchain/australias-asx-selects-blockchain-to-cut-costs-idUKKBN1E037R "The decision to replace the Clearing House Electronic Subregister System (CHESS) on Australia's main bourse follows two years of testing of distributed ledger technology, also known as blockchain."

Tech Blockchain: Hyperledger (?)
                      https://hub.digitalasset.com/press-release/digital-asset-opens-developer-program
                      DAML (Digital Asset Modeling Language) to replace smart contracts
Tech Company::   Digit Asset https://www.digitalasset.com/
Maturity: Planned Pilot

Digital Currency / Payments

Why governments are building their own cryptocurrencies (27th March 2018):
https://www.raconteur.net/finance/governments-building-cryptocurrencies

Venezuela: Venezuelan President Announces 'Petro' Oil-Backed Cryptocurrency (4th Dec 2018)
https://www.coindesk.com/venezuelan-president-announces-petro-oil-backed-cryptocurrency/

What is Venezuela's new petro cryptocurrency? (23rd March 2018)
https://www.aljazeera.com/news/2018/02/venezuela-petro-cryptocurrency-180219065112440.html

Tech Blockchain:	NEM https://nem.io - unique, build from scratch, Java.
	Contact form on website
	Proof of Importance (PoI), a bit like POS
Maturity:	Happening

Venezuela's offer to India: Buy crude oil at 30% discount but through cryptocurrency
https://www.businesstoday.in/current/economy-politics/venezuela-offer-to-india-buy-crude-oil-at-30-pc-discount-but-through-cryptocurrency/story/275948.html

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Russia: Blockchain payment system - (20th Feb 2018) https://www.coindesk.com/regional-government-russia-test-blockchain-payments/
"Vnesheconombank (VEB), the Russian state-owned development bank, has inked a deal with the regional government of Kaliningrad to pilot a new blockchain-based payment system."

Maturity: Planned Pilot

United Arab Emirates: Central Bank Operations
Cheque fraud https://www.coindesk.com/emirates-nbd-enlists-uae-central-bank-blockchain-check-trial/
Own blockchain currency https://themerkle.com/uae-and-saudi-arabia-collaborate-on-new-central-bank-digital-currency-research/

http://www.arabnews.com/node/1208631/business-economy 14th Dec 2017)

"Saudi Arabia and the UAE are working on the launch of a digital currency that could be used for transactions between the region's banks by using blockchain"

Maturity: Planned

UK. Royal Mint Gold (RMG®) - The New Digital Gold Standard
https://www.royalmint.com/invest/bullion/digital-gold/
"RMG – a new, cost-effective, convenient and secure way to hold, transact and trade physical gold using blockchain technology."

Tech Blockchain: Based on Bitcoin
Tech Company: Prova/Bitgo - https://www.provachain.com/
https://github.com/BitGo/prova
                    Prova's development is led by BitGo, CME Group, The Royal Mint, and
          AlphaPoint.
Maturity: Production (/Trial ?):https://explorer.rmgchain.info/

Contact: Contact form on website URL above.

Government Funding

Canada: Canada trialing use of Ethereum blockchain to enhance transparency in govt funding - https://globalnews.ca/news/3977745/ethereum-blockchain-canada-nrc/ (21st Jan 2018)

https://futurism.com/canadas-blockchain-trial-transparency-government-funding/ (26th Jan 2018)

Tech Blockchain: Ethereum - public chain
Tech Company: bitaccess: https://www.bitaccess.ca/company
Tech Name: Catena Blockchain Suite (https://explorecatena.com/)
    github:https://github.com/explorecatena
    api: https://api.explorecatena.com/
    See spending data live: https://explorecatena.com/search
Maturity: Trial

Contact:
Email: listed on Catena Blockchain Suite website which is an email to the tech company enterprise@bitaccess.ca

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Mexico "Tests Blockchain to Track Public Contract Bids" -
https://www.coindesk.com/mexico-tests-blockchain-track-public-contract-bids/
https://www.gob.mx/cms/uploads/attachment/file/269552/Folleto_blockchain_HACKMX_oct2017_v6.pdf
"The winner project is a Blockchain system that allows the public tender process to be reliable, adding the factor of citizen participation and ensuring that the winner project of the process is the one that generates the greatest social benefit."

Tech Blockchain   Ethereum - Private?
Tech: HACKMX http://hackmx.mx/ - https://github.com/hackmx
Tech Name: Smart Tender
"Smart Tender uses a hybrid Blockchain system to ensure that any registered citizen can participate in decisions that could affect them and to be able to vote at a local, state or federal level, and at the same time allows certified evaluators to vote and rate proposals anonymously, preventing companies from contacting them to influence their decisions. "

Maturity: Prototype

Contact for tech company HACKMX:

Email: info@hackmx.mx
Contact form: on website
Address: Av Lago de Guadalupe KM 3.5, Margarita Maza de Juárez, 52926 Cd López Mateos, Méx.

Energy

Chile: Is Using Ethereum's Blockchain to Track Energy Data - (9th April 2018)
https://www.coindesk.com/chile-to-use-ethereums-blockchain-to-track-energy-data/
"Chile will use ethereum's blockchain as a way to record energy sector statistics, its government announced Thursday."..."The commission has already begun committing some data to the blockchain, including information about installed electricity-generating capacity, average market prices, marginal costs, hydrocarbon prices and compliance with laws requiring that renewables account for a certain share of electricity generation."

Tech Blockchain: Ethereum - public chain
Maturity: Pilot

US Government Lab Looks to Blockchain for P2P Energy (24th Jan 2018)
https://www.coindesk.com/us-government-lab-blockcypher-tap-blockchain-for-p2p-energy-transactions/
"Blockchain startup BlockCypher has partnered with a U.S. Department of Energy lab to develop solutions allowing energy transactions to be settled across multiple blockchains."

Tech Blockchain: dash cryptocurrency network https://www.dash.org/ - Based on Bitcoin
                       Dash Core Group Becomes First Legally DAO-Owned Entity
                  https://www.dashforcenews.com/dash-core-group-becomes-first-legally-dao-owned-entity/

Tech Company: BlockCypher https://www.blockcypher.com/
Maturity: Planning first test

Contact for tech company BlockCypher:
Email: contact@blockcypher.com

UK: Tech firm Electron gets UK funding for grid blockchain project (27th Sept 2017)
http://www.powerengineeringint.com/articles/2017/09/london-tech-firm-electron-gets-government-funding-for-grid-blockchain-project.html

Tech Blockchain: Ethereum + IPFS
Tech Company: http://www.electron.org.uk/ - https://github.com/bsdstudios/ethr
Maturity:

Contact for tech company Electron:
Email: info@electron.org.uk
Phone: +44 (0) 2070 961 519
Address: 86-90 Paul Street, 3rd Floor, London EC2A 4NE
Contact form: http://www.electron.org.uk/#contact

UK energy supplier Centrica to trial blockchain technology (30th April 2018)
https://uk.reuters.com/article/us-centrica-blockchain/uk-energy-supplier-centrica-to-trial-blockchain-technology-idUKKBN1I117G
"UK energy supplier Centrica to trial blockchain technology"

Tech Blockchain: Ethereum - The Exergy Token - public chain?
Tech Company: LO3 Energy https://lo3energy.com/ (Brooklyn Microgrid)
                      https://exergy.energy/wp-content/uploads/2017/12/Exergy-Whitepaper-v8.pdf
Maturity: Planning

Contacts:
Centrica - press office (see https://www.centrica.com/contact-us for all contact addresses):
Email: media@centrica.com
Phone: 01784 843000

Tech company LO3 Energy:
Email: info@lo3energy.com
Addresses: 573 Sackett Street, Brooklyn, NY 11217 and 1300 NW Northrup Street, Portland, OR 97209
Contact Form: https://lo3energy.com/contact/

Supply chain traceability / Foreign Aid

United Nations Sends Aid to 10,000 Syrian Refugees Using Ethereum Blockchain (14th June 2017)
https://www.coindesk.com/united-nations-sends-aid-to-10000-syrian-refugees-using-ethereum-blockchain/
https://www.ictworks.org/united-nations-agencies-using-blockchain-technology/#.Wuhijn8h1hE
(8th March 2018)

Tech Blockchain: Ethereum - Parity - private chain
Tech Company: Parity Technologies and blockchain big data firm Datarella.
                     Datarella: https://datarella.com/blockchain-solutions/
                     Codelegit: http://codelegit.com/ "Codelegit's mission is to bridge the gap
                     between technology and law by auditing the compliance of software code."

Maturity: Trial, completed 31st May 2017 with 10,000 individuals.
                     2nd trail with 100,000+ individuals planned for 2018

Contacts for tech company:
Datarella / Codelegit:
        Linkedin: CEO & Co founder Michael Reuter https://www.linkedin.com/in/michaelreuter/
        Addresses:
            -    Datarella GmbH, Oskar-von-Miller-Ring 36, 80333 München.
            -    Antoniego Słonimskiego 2, 80-001 Gdańsk, Poland

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Denmark: Denmark's Ministry of Foreign Affairs has released a new report that explores how blockchain to might be used in the distribution of foreign aid. (14th Dec 2017)
https://www.coindesk.com/denmark-government-could-tap-blockchain-for-foreign-aid-delivery-says-report/

Maturity: Study - http://um.dk/en/news/NewsDisplayPage/?newsID=823ED20B-EFF3-4B2A-89EB-D5BF3EC964B0

US: The Treasury Department is running a pilot program to determine whether Blockchain technology can be utilized for supply chain management

https://cointelegraph.com/news/us-government-implements-blockchain-programs-to-improve-transparency-and-efficiency-expert-blog

https://www.fiscal.treasury.gov/fsservices/gov/fit/fit_launches_innovative_pilot.htm

"FIT has also engaged a contractor to develop a prototype using blockchain, or distributed ledger technology, to track and manage physical assets (for example, computers, cell phones, and the like.) " .. "The pilot project will test whether the inventory of an agency's physical assets can be continuously monitored and reconciled in real time as the physical assets are transferred from person to person throughout the pilot."

Maturity: Pilot
Tech: No info

State Department:
"In maximizing the impact and accountability of foreign development/assistance, Blockchain technology may address corruption, fraud or misappropriation of funds and inefficiencies within the funding process"

Blockchain for foreign policy and development aid: The **US** and **Denmark** are looking at opportunities and challenges. (3rd April 2018)
https://medium.com/digital-diplomacy/blockchain-for-foreign-policy-and-development-aid-86c092412c6

United Arab Emirates: Dubai Food Safety and authenticity

https://www.ibm.com/blogs/blockchain/2018/02/one-nations-move-to-increase-food-safety-with-blockchain/

Maturity: Launched 2017 "Food Watch," (https://www.foodwatch.ae/) a digital platform that aims to completely digitize the food safety and nutritional information of all edible items served through the 20,000 or more food establishments in the emirate.
Tech: Hyperledger?

China: An Agri-food Supply Chain Traceability System for China Based on RFID & Blockchain Technology (2016 article)
https://pdfs.semanticscholar.org/24cd/eb7d7421012c2fdd362b8e2816c105b7071f.pdf

Maturity: Theoretical study?
Tech: Just referred to in the study as "blockchain technology"

Data Storage

New Zealand: To simplify the management of trusted information (5th Dec 2017)

https://www.cio.co.nz/article/630868/kiwi-tech-firms-deliver-blockchain-pilot-nz-government/

https://www.reseller.co.nz/article/630862/revera-combines-nyriad-deliver-blockchain-govt-pilot/

"Nyriad founder and CEO Matthew Simmons said the company's real-time blockchain storage technology was the first platform in the world that enabled public organisations to prove they were handling information in a way that satisfied strict security standards and facilitated real-time data sharing, openness, and collaboration."

Tech Company: Nyriad (https://www.nyriad.com/) and Spark, Revera (https://www.revera.co.nz/)

Maturity: pilot

Contacts for tech companies:

Nyriad:

Email: info@nyriad.com

Revera:

Email: enquiry@revera.co.nz

Phone: 0800 HOMELAND (46635263)

Contact web form: https://www.revera.co.nz/contact

India: Securing citizen data (8th Sept 2017)

https://www.ccn.com/indian-state-plans-blockchain-storage-citizen-data/

"Andhra Pradesh, the seventh largest state in India, has announced plans to launch blockchain pilot projects "in various departments" of the state government. Chief among the proof-of-concept pilots is its aim to secure citizen data on a blockchain platform."

Tech Company: WISeKey (https://www.wisekey.com)

Maturity: Proof of concept pilot

Contact for tech company WISeKey:

Email: info@wisekey.com

Phone: +41 22 594 3000

Address: Route de Pré-Bois 29, P.O. Box 853, CH-1215 Geneva 15, Switzerland

Russia: document transfer and storage (19th Dec 2017) https://cointelegraph.com/news/first-government-blockchain-implementation-for-russia

"Russia has officially completed its first government-level Blockchain implementation. The state-run bank Sberbank announced today that it is partnering with Russia's Federal Antimonopoly Service (FAS) to implement document transfer and storage via Blockchain."

Tech Blockchain: ?Ethereum
Maturity: Trial

United Arab Emirates: Dubai Blockchain Strategy (Dubai have set the goal of running its entire government on blockchain by 2020) (5th Oct 2016)
https://www.coindesk.com/dubai-government-documents-blockchain-strategy-2020/) -
"The Crown Prince of Dubai announced a strategic plan today that would see all government documents secured on a blockchain by 2020"

Dubai Sets Its Sights On Becoming The World's First Blockchain-Powered Government (18th Dec 2017)
https://www.forbes.com/sites/suparnadutt/2017/12/18/dubai-sets-sights-on-becoming-the-worlds-first-blockchain-powered-government/#60fde798454b
"Much of this enhanced productivity will stem from moving to paperless government."

http://www.smartdubai.ae/dubai_blockchain.php

Contact form: https://smartdubai.ae/en/Pages/ContactUs.aspx

Academic Certificates

India: Governance and digital certification of education degrees (6th February 2018)
https://factordaily.com/degree-certificates-india-blockchain-project/
"The pilot trials will begin soon and once that is successfully completed, the full-scale implementation will start. The plan is to start issuing digital certificates on the blockchain (IndiaChain) from the 2019 batch onwards,"
"Fake certificates are a big problem in India, which graduates over five million every year. "

Tech Company: Indian Institute of Technology, Bombay and colleges under the Delhi University
Maturity: trial with intention of going production in 2019

Contact for tech company:
Address: Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110 016, INDIA
Phone: 011 2659 7135
Email: webmaster[at]admin.iitd.ac.in

Malta's Government Is Putting Academic Certificates on a Blockchain (3rd Oct 2017)
https://www.coindesk.com/maltas-government-putting-academic-certificates-blockchain/

Tech Blockchain: Bitcoin (using Blockcerts - MIT - https://www.blockcerts.org/about.html)
Tech Company: Learning Machine Technologies (https://www.learningmachine.com/)
Maturity: Prototype/Pilot

Contact form for tech company: https://www.learningmachine.com/contact/

Kenya: Kenyan Government Uses IBM Blockchain to Prevent Academic Certificate Fraud (22nd Dec 2016) ?old https://cointelegraph.com/news/kenyan-government-uses-ibm-blockchain-to-prevent-academic-certificate-fraud

Tech Blockchain: Hyperledger Fabric (IBM)
Maturity: Planned Trial (in 2016!)

Kenya Govt Sets up Blockchain & Artificial Intelligence Taskforce! (16th Jan 2018)

https://kenyanwallstreet.com/kenya-govt-sets-blockchain-artificial-intelligence-taskforce/

Tax and Internal Revenue Monitoring

UK: How blockchain technology could improve the tax system (Feb 2017)
https://www.pwc.co.uk/issues/futuretax/how-blockchain-technology-could-improve-tax-system.html

Maturity: Report

China to Use Blockchain Technology in Tax Collection and Electronic Invoice Issuance - (15th Aug 2017) https://cointelegraph.com/news/china-to-use-blockchain-technology-in-tax-collection-and-electronic-invoice-issuance

Maturity: Planned

Other

Estonia: "Judicial and police functions. The "E-File" system uses the X-Road to connect the business processes of courts, police, public prosecutors, prisons, lawyers, and ordinary citizens. Similarly, the Ministry of Interior uses the "e-police" system to provide police officers with access to state registers such as the vehicle register. The police can use this system to check whether a vehicle has been reported as stolen, for example. Consequently, Estonian citizens do not need to carry a driver's license or vehicle documents, because authorities can verify such information online directly from the source." (1)

Estonia: "Registration services. The X-Road enables digital transactions in the following areas: residency; electronic declaration of taxes; validation of driving licenses and registered vehicles; application for child benefits and municipal day care; and exchange of documents among government agencies." (1)

https://e-estonia.com/

Maturity: In use

UK: Critical Infrastructure / Systems Integrity: e.g. Flood Defence, nuclear power, electricity distribution grid. - (smart cities)
https://blockchaincan.com/project/blockchain-can-protect-critical-government-infrastructure/

Maturity: Theoretical / Ready

Argentina: Argentine Government Uses Dapp To Timestamp Bulletins (October 13, 2017):
https://www.ethnews.com/argentine-government-uses-dapp-to-timestamp-bulletins

Maturity: Trial

Appendix B - General Resources

Government Services

Blockchains for Governmental Services: Design Principles, Applications, and Case Studies: https://www.ctga.ox.ac.uk/sites/default/files/ctga/documents/media/wp7_martinovickellosluganovic.pdf

Will blockchain transform the public sector? - Blockchain basics for government: https://www2.deloitte.com/insights/us/en/industry/public-sector/understanding-basics-of-blockchain-in-government.html - pdf version (https://www2.deloitte.com/content/dam/insights/us/articles/4185_blockchain-public-sector/DUP_will-blockchain-transform-public-sector.pdf)

Blockchain for Government (IBM Blog): https://www.ibm.com/blogs/blockchain/category/blockchain-for-government/

Blockchain Adoption in Government: https://medium.com/the-mission/blockchain-adoption-in-government-79c54a18c3c9

Governments Eye Blockchain in Their Creation of National Identity Systems: https://cointelegraph.com/news/governments-eye-blockchain-in-their-creation-of-national-identity-systems

Evolving Government: Insights from working with blockchain companies in government: https://www.fedscoop.com/evolving-government-insights-working-blockchain-companies-government/

Governments may be big backers of the blockchain: https://www.economist.com/news/business/21722869-anti-establishment-technology-faces-ironic-turn-fortune-governments-may-be-big-backers

Will Blockchain Disrupt Government Corruption?: https://ssir.org/articles/entry/will_blockchain_disrupt_government_corruption

Using blockchain to improve data management in the public sector: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/using-blockchain-to-improve-data-management-in-the-public-sector

How blockchain can help create better public services: https://betterworkingworld.ey.com/digital/how-blockchain-can-help-create-better-public-services

Blockchain for Social Impact:

https://www.gsb.stanford.edu/faculty-research/publications/blockchain-social-impact?utm_campaign=Revue%20newsletter&utm_medium=Newsletter&utm_source=Surrey%20Centre%20for%20the%20Digital%20Economy

Government departments consider using blockchain:

https://www.publicfinance.co.uk/news/2018/04/government-departments-consider-using-blockchain

European Parliament: How blockchain technology could change our lives

http://www.europarl.europa.eu/RegData/etudes/IDAN/2017/581948/EPRS_IDA(2017)581948_EN.pdf

Blackett Review - Distributed ledger technology: beyond block chain:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf

The government has quietly been testing blockchain technology for benefits payments:

http://www.cityam.com/245128/government-has-quietly-been-testing-blockchain-technology
   -
UK Digital Strategy for 2017:

https://www.gov.uk/government/publications/uk-digital-strategy/uk-digital-strategy

Bank of England eyes saving of 'tens of billions' by using blockchain technology for settlements:

https://www.computerworlduk.com/data/bank-of-england-pushes-forward-with-blockchain-technology-for-settlements-3657464/

Swiss Government Supports Launch Blockchain Task Force: https://www.coindesk.com/swiss-government-launches-blockchain-task-force/

Government of Netherlands implements 35 Blockchain Use cases and number grows:

https://www.unlock-bc.com/news/2018-02-20/government-of-denmark-implements-35-blockchain-use-cases-and-number-grows
   -
Gibraltar launches financial services license for blockchain: https://www.reuters.com/article/us-gibraltar-regulator-blockchain/gibraltar-launches-financial-services-license-for-blockchain-idUSKBN1E81JO

Malta's Government is Developing a National Blockchain Strategy:

https://www.coindesk.com/malta-government-blockchain-strategy/

Lykke Partners With Bangladesh Government: http://www.the-blockchain.com/2018/01/15/lykke-partners-bangladesh-government/

Digital Identity

Blockchain To The Rescue Creating A 'New Future' For Digital Identities:
https://www.forbes.com/sites/rogeraitken/2018/01/07/blockchain-to-the-rescue-creating-a-new-future-for-digital-identities/#1625e8225492

Microsoft - Decentralized Digital Identities and Blockchain – The Future as We See It:
https://cloudblogs.microsoft.com/enterprisemobility/2018/02/12/decentralized-digital-identities-and-blockchain-the-future-as-we-see-it/

The future of public service identity: http://www.reform.uk/wp-content/uploads/2017/11/The-future-of-public-service-identity-blockchain.pdf

Transforming digital identity into trusted identity:
https://www.ibm.com/blockchain/identity/

Sovrin™: A Protocol and Token for SelfSovereign Identity and Decentralized Trust:
https://sovrin.org/wp-content/uploads/2018/03/Sovrin-Protocol-and-Token-White-Paper.pdf

Estonia e-identity:
https://e-estonia.com/solutions/e-identity/id-card/

IBM and Maersk Are Creating a New Blockchain Company: http://fortune.com/2018/01/16/ibm-blockchain-maersk-company/

Everledger Diamond Tracking:
https://diamonds.everledger.io/

Big banks and telcos backing $185 M supercluster bid for national digital identity system:
https://www.itworldcanada.com/article/big-banks-and-telcos-backing-supercluster-bid-trying-to-revamp-identification-system/396894
and
Canadian banks are building a digital identity tool:
http://www.tearsheet.co/data/canadian-banks-are-building-a-digital-identity-tool

Open Identity System for the Decentralized Web uPort: https://www.uport.me/

ConsenSys explains self-sovereign identity on Ethereum at the United Nations:
https://www.ibtimes.co.uk/consensys-explains-self-sovereign-identity-ethereum-united-nations-1607068

Blockchain Identities for Lost Citizens:
https://media.consensys.net/blockchain-identities-for-lost-citizens-708e486ca24c

Blockchain identities should mix legacy data; don't ignore it, import it: http://qed-it.com/2017/08/blockchain-identities-should-mix-legacy-data-dont-ignore-it-import-it/

Two Blockchain Use Cases for Self-Sovereign Digital Identities:
https://www.ictworks.org/blockchain-use-cases-self-sovereign-digital-identities/#.Ws8dDMgh3MU

Digital Identity Solution Providers

Gravity (KYC Compliant Digital Identities with Gravity) - https://www.gravity.earth

BanQu (Economic Identities for Smallholder Farmers) - http://www.banquapp.com/

Civic App - https://www.civic.com/

SecureKey (backed by Canadian Banks) - https://securekey.com/

ID2020 - (Microsoft, Accenture, Rockefeller Foundation) - https://id2020.org/

MONI (asylum seekers in Europe) - https://moni.com/