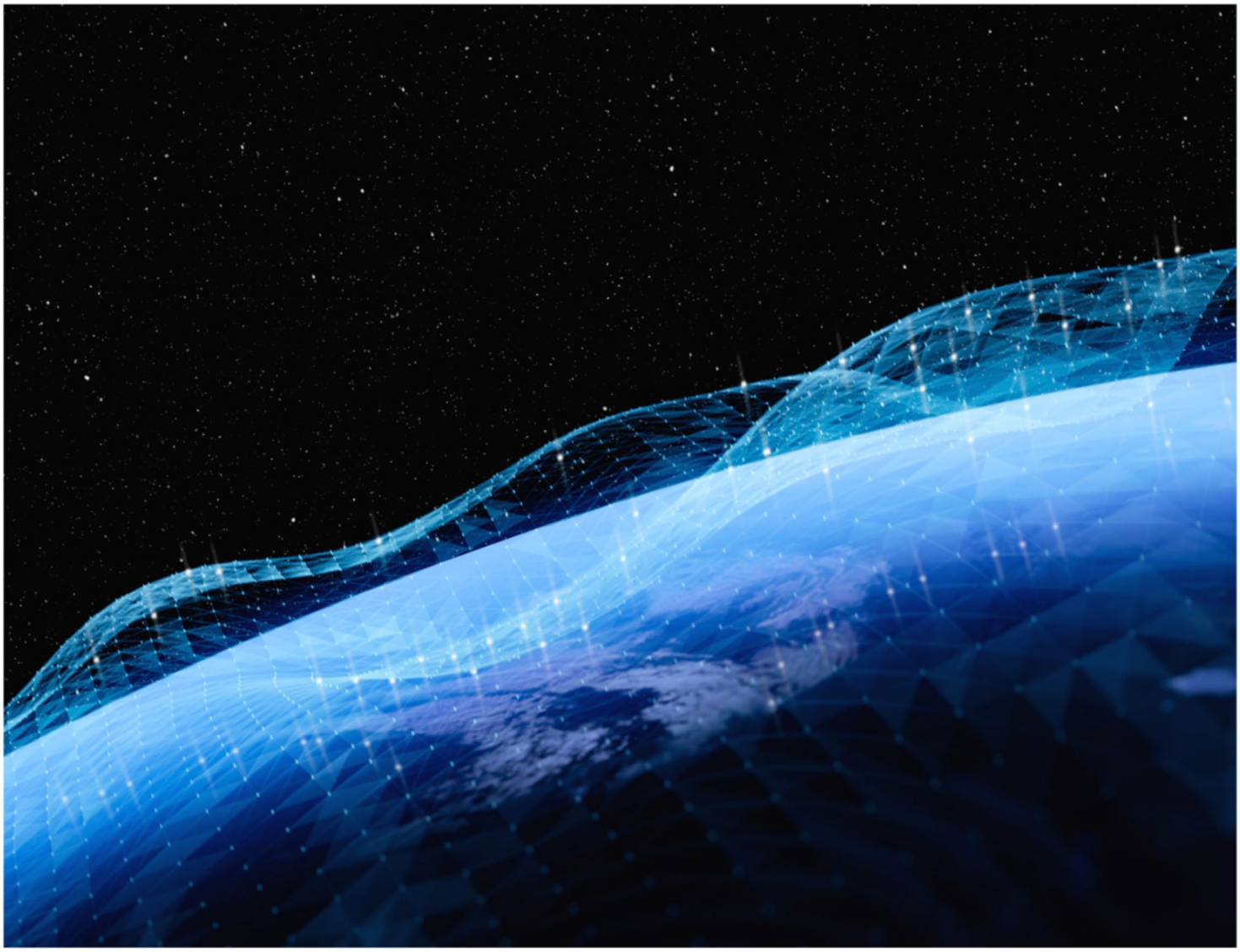
GBBC
Global Blockchain Business Council

INSIGHT REPORT

# GLOBAL STANDARDS MAPPING INITIATIVE (GSMI) 2.0
## STANDALONE REPORT

# GLOBAL TAXATION

November 2021



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## Contributors

Jeff Saviano (co-chair)

Nick Davies (co-chair)

Anna Wylie (GSMI fellow)

Airi Jansen-Uueda

Anders Hjorth Agerskov

Anita Patel

Anna Romanova

Ariana Kosayn, CFA

Autumn (Yiqiu) Wang

Deninis Post

Duncan Onduru

Emmanuelle Ganne

Gavin Artz

Gladys Kitony

Ivan Lazarov

Jaspreet Sidhu

Jonathan Leigh Pemberton

Jonathan Simcock

Kunal Pandit

Lance Thompson

Magnus Jones

Michael Clare

Nathalia Oliveira Costa

Navroop Sahdev

Pradeep Mahalingam

Prof. Dr. Jeffrey Owens

Sue Probert

Syed Farhan Shakeel

Thomas Hardjono

Varsha Singh

# Introduction

Tax is fundamental to the operation of any modern social system - a vital aspect of the relationship between citizen and state. A catalyst for this report was an article published on Distributed Ledger Technology (DLT)[i] in January 2016, by the United Kingdom (UK) Government[ii]. In that paper the UK Government signaled that DLT "has the potential to redefine the relationship between government and the citizen in terms of data sharing, transparency and trust."[ii] Their article identified tax collection and a myriad of tax incidences (direct and indirect, domestic and international, individual and corporate) as a major use-case for DLT that governments should instigate and be actively involved with as the technology matures.

Our research revealed that DLT has evolved and is currently being applied across many areas in connection to fiscal transactions. Further details of the use cases of DLTs by various states and private enterprises can be found in the Appendix 1[iii]. These cases highlight the situations where a DLT solution is being embedded in tax determinations, administration, or collection procedures. Furthermore, the emergence of DLT should be examined within the context of the overarching taxation environment: continuous and rapid digitalization of the economy, development of digital decentralized business models, and expeditious innovation within the technological sector that is piercing through institutions and organizations. A clear need for public – private parties' cooperation has manifested. A result of such need can be seen already, in the tax applications of DLT systems. For example, legislation had to adapt to the altering environment, as the example of most recent work by Organization for Economic Co-operation and Development (OECD) showed us. Therefore, we see that DLT solutions should be driven by public and private cooperative partnership. Taking these findings further, we view DLTs as breaching the gaps between private and public actors, aiming to bring organizational boundaries closer - or blur them altogether. However, we acknowledge that technological advances and challenges are not static. We treat them as a living organism that is now developing - and will keep developing.

### *Scope of this report*

This report examines the current state across the globe for domestic and international applications of DLT in tax administration, assesses where efforts to standardize and ensure interoperability of systems can be concentrated, and recommends how tax authorities can generate significant value, realized by governments and taxpayers alike. There are some

fundamental issues for individual states and their governments to consider, as the world becomes more distributed and less reliant on central, fiat systems. Many of these matters are beyond the scope of this report. There are also many issues relevant to the wider tax professional community. Distributed systems mean that tax administration can be affected in a more real-time, transparent, and cooperative way, which has implications not just for sovereign tax administrations, but for all stakeholders with an interest in taxation, including those who advise taxpayers on compliance and planning.

As DLT matures, many of the professionals involved in this report believe that the conclusions of the UK report[iv] are becoming increasingly pertinent globally. Many of the rules and principles that underpin modern tax systems are non-compatible with, and are less relevant to, the way in which people contract, transact, and interact. There needs to be greater research and analysis performed in both national and international forums on the implications of DLTs. Tax professionals should broaden their understanding of innovative technologies and the systems they enable. They need to focus on how they should be responding, on behalf of their public and private sector stakeholders, to the risks and opportunities presented by this transformational technology. The report is organized as follows:

**Digital Identity** - while clearly not a tax-specific issue, any attempt to introduce distributed and automated systems for data assurance and exchange must be founded on the firm assurance of personal and organizational identity and authority of actors participating in those systems. This group focused on enhanced digital identity in a distributed world and how Tax Administrations can adopt such systems to ensure identity is a critical element of fair taxation.

**Legislative and Regulatory Challenges** - the fundamental design of most taxation systems is based on legislation enacted a long time ago. To maintain vital state revenue flows, much of the response by governments to the introduction and adoption of innovative technology systems for generating and assuring tax events in modern economies has been by ensuring alignment to important legislative/regulatory principles. This group explored the impact of a new distributed world upon existing legislative/regulatory frameworks and suggested some means of responding more strategically to ensure tax systems remain fair and robust.

**Tax Data Models** - in an increasingly complex world, tax events will continue to proliferate and be evidenced within a variety of existing and new technology systems. But how those events

are appropriately “twinned” in the digital world and consumed as data by tax authorities, needs to be standardized to optimize the effectiveness and interoperability of distributed systems. The group considered what models for data and metadata can and should be established.

**Governance** - as the technology continues to advance in both functionality and security, there is a material risk that the governance aspects for the use of blockchain in tax, especially in international tax, will not advance commensurate with the rapid ascension of the digital technology. The group considered what governance aspects would best align the needs of current, and essentially centralized, domestic and international tax systems with the distributed nature of the technology.

**Privacy and Transparency** - the group explored privacy and transparency issues in the application of distributed systems, specifically in tax functions. The group provided lessons from other (non-tax) distributed systems and recommended key design features to address privacy and transparency concerns.

Each group produced three deliverables; (1) an initial assessment of the current position and the critical questions that remain unanswered; (2) an analysis of the specific topics unique to the particular group, and; (3) identification of gaps in global understanding of the implications for tax administrations of greater use of blockchain based systems. Additionally, groups recommended practical next steps so that the report would be as useful as possible to tax professionals commencing or proceeding with distributed system experimentation or adoption. These recommendations are included in the group reports summarized below.

***Outlook on future developments and goals for future work -*** As DLT based systems are evolving, our aim with this report is to start the conversation, provide recommendations in relevant areas on points to consider when considering whether to embed DLTs within tax scenarios. We also aim to expand this report by; researching how initiatives operate cross-border; promoting stakeholder involvement in the process; deepening the dialogue with relevant stakeholders in the ecosystem on DLT application, and; improving governance of tax related blockchain solutions.

## Digital Identity

Consistent with many online services, such as shopping, banking and social interaction, our expectation of real-time, secure, and convenient digital public services has significantly increased. Digital identity plays a key role in how taxpayers interact with the world around them and serves as a foundation for the protection of privacy and security. As technology systems have evolved, the tools to establish and protect one's identity have also evolved. Simply put, digital identity assurance is critical to fair, just, and efficient taxing systems.

Too often, the foundation of new identity systems has remained the same; a siloed approach with centralized databases holding vast amounts of personal information, with citizens having to repeatedly re-establish their credentials for a variety of purposes at different technology access points. This inefficient approach has been revealed over recent years as prone to cyber-attacks and data breaches. Costly efforts have been initiated to ensure accurate and secure identities. As long as confidential information is maintained in centralized repositories, future attacks and breaches are inevitable.

DLT introduces the prospect of a new approach to Digital identity, referred to as Self Sovereign Identities (SSI). This approach is more decentralized (or federated), and thus is less prone to attack as it doesn't rely on a single data repository. Further, SSI mechanisms place the user much more in control of their data, and with more autonomy on how, when, and with whom it is shared. Further development in DLT can create verifiable credentials (VCs), decentralized identifiers (DIDs) and digital identity systems that can be more interconnected, digital and flexible, and thus provide much better outcomes to both taxpayers and tax administrations.

Consideration was given to the current, variable, global landscape where countries have different models for taxation based on the structure of their state, e.g., tax incidences at national, state/provincial and/or municipal levels. As a result, digital identity approaches and technology adoption vary across the globe.

We are conscious that identities established in countries of origin or residence also need to interoperate with, and be recognized by, similar systems in other jurisdictions. DLT provides the opportunity for these systems of identity not only to interoperate but also to reinforce each other

as different states and entities can contribute to the total assurance and authority attached to a given identity (personal or legal entity). This flexibility, ease of adoption and control by users to share their digital credentials across the jurisdictions to ensure appropriate taxation rules are applied are, as suggested below, achievable through the sensible application of DLT.

***Key recommendations:***

1. **Tax as a prime use-case.** Tax administrations, either through their own resources or via more generic government DID service providers, can re-use and leverage existing Know Your Customer (KYC) approaches of private sector financial service providers. A cross-government approach is desirable, including at all layers, national, sub-national and municipal, and we believe that the tax administration use-case for such a system could be an effective exemplar for this multi-layer approach. This includes a standardized digital identity framework and roadmap for implementation that supports the necessary technical development and resource management. Additionally, this will ensure tax requirements are aligned with other governmental service delivery functions, across tax, trade, social services, justice, welfare distribution, government supported utilities, etc. This framework should be supported by the selection of sufficient technical tools, to ensure data security, integrity and availability expectations are met. Various state databases containing and collecting digital identity information can be well managed and diminish the incidence of actual data exchange using distributed ledger technology. As this approach matures, DLT based systems will help to ensure the transparency, cost effectiveness, integrity, and high credibility of data management processes.

   We also urge Tax Administrations to consider:

   I. Principles of multi-jurisdictional adaptability and scalability of digital identity systems.
   II. Data accessibility and control by the appropriate data stakeholders. Optimal system design will ensure that new data participants and stakeholders relying upon the DID system should achieve desired benefits.[v]
   III. The ease by which DIDs can be asserted and assured will have to be straightforward across the various levels of government (KYC approach).
   IV. In cryptography, it may not be best for a protocol designed for one specific purpose to be leveraged indiscriminately for another purpose.

2. **Interoperability.** Tax is just one DID governmental use-case, but because of the importance of taxation to state economies, a proper DID tax foundation could serve as the foundation upon which other government DID applications could depend. If an assured identity system works for the financial arrangements between government and citizen, then others, for welfare/pensions, health data management, and broader governmental service access, can work in similar interoperable fashion. As a key component of interoperability, infrastructures for digital identity systems should also support pseudonyms while maintaining the necessary confidentiality, integrity, authenticity, assurance, and robustness.

   Organizations need to collaborate to ensure tax data is accurate in capture and transit with proper security measures in place. This will help in appropriate tax risk analytics and reporting measures. In addition, this will reduce (but never eliminate) potential fraudulent tax related activities where different identities are established and verification and validation can be challenged.

   If the government or stakeholders are interested in launching a digital identity initiative, this report recommends an evaluation of existing solutions. For example, the government user may wish to consider the Modular Open Source Identity Platform (MOSIP), as an example of an open digital identity system already deployed in the market.[vi]

In all of the above recommendations, it is important that various organizations, such as governments and private institutions, have the foresight to invest in the development and deployment of advanced digital identity blockchain-based technology, coinciding with the regular and systematic advancement of new tax policies.[vii]

## Legal and Regulatory

Most tax legislation predates the sort of distributed systems enabled by DLT. If the full benefits of the technology are to be realized, not just in tax but with respect to any government program or process, there needs to be a thorough analysis of the existing legal and regulatory barriers. Any successful project, moreover, depends not only on mapping the issues but also on

appropriately addressing the barriers. Governments and businesses must work together, public and private, to ensure the legal and regulatory regime is fair and relevant. Applying blockchain in an international context introduces a further layer of complexity related to the need for some degree of global alignment across jurisdictions.

***Key recommendations:***

1. **Address the challenges stemming from the legal/regulatory framework**

   Review the existing legal framework and group rules by the following classifications; execute on the designated actions:

   I. Rules that are redundant in the context of blockchain e.g., physically certifying documents. These redundant rules should be repealed and substituted with new rules that are specifically relevant to blockchain infrastructure (see below).

   II. Rules that impose barriers but are necessary e.g., protection of fundamental individual rights, such as privacy. Appropriate actions may include recognizing the interests protected by the legal framework through innovative technology - e.g., Zero-Knowledge Proofs (ZKP) protecting privacy within transactional tax regimes, such as VAT and withholding taxes.

   III. Rules that include a significant element of subjectivity or ambiguity and therefore prevent binary outcomes on the basis of quantifiable objective factors - e.g., anti-avoidance rules. See below for appropriate actions.

   Explore options for addressing legal ambiguity:

   I. Technological - determine whether the current state of natural language processing (Artificial Intelligence) capabilities can adequately analyze legal provisions and case-law with sufficient precision.

   II. Legal - consider introducing binary objective criteria that triggers rebuttable legal presumptions, the outcomes of which can be revisited at the request of the authorities or the taxpayer.

   Provide for a possibility to review outcomes in case of dispute resolution and embed such possibility in the blockchain system - e.g., by having a trusted party that can implement changes.

2. **Identifying the challenges that arise in cross-border situations**

   Divergent legal frameworks across jurisdictions leading to different legal qualifications of similar fact patterns.

   I. Technological solution - explore the technical feasibility of smart contracts accounting for different legal frameworks across jurisdictions, depending on a protocol that attributes jurisdiction to tax to a given country(ies).
   II. Legal solution - coordination of the legal framework, thus ensuring greater consistency (especially feasible within regional integrated blocks such as the European Union (EU)).

   International Exchange of Information under Article 26 of the Organization for Economic Co-operation and Development (OECD) Model Tax Convention[viii] or the Directive on Administrative Cooperation (DAC) rely on communication only between tax authorities, excluding the possibility for direct exchange between private parties and foreign authorities.

   I. Legal solution - amend the Exchange of Information rules, allowing for direct data sharing between private parties and foreign authorities. This may be achieved on a bilateral or multilateral basis when the contracting jurisdictions have mutual trust in one another.
   II. Technological solution - automatic exchange of information in real-time between tax authorities, based on a blockchain solution.

3. **Quality of data and its impact on legal responsibility; the quality of the output of the blockchain system is entirely dependent on the quality of the data input**

   Importance of standardized data, especially for cross-border data exchange; consider alignment to a global standards organization, such as the National Institute of Standards and Technology (NIST) or the Organization for the Advancement of Structured Information Standards (Oasis).

   Importance of intermediaries - e.g., banks, telecommunication providers, other digital platforms, etc. with robust KYC programs, for providing the necessary data.

Determination of legal responsibility when the data provided is dependent on a due-diligence standard - e.g., due diligence commensurate with the activity in banking or financing activities.

4. **Necessary to ensure that any tax-DLT system is compliant with General Data Protection Regulation (GDPR) or similar government data act.** Prohibition of decision making by automatic means - e.g., Article 22 of the GDPR - need to provide a possibility for human review and adjudication (human in the loop).

   ‘Right to be forgotten’ - possibility of erasure; determine whether such principles may undermine the immutability of the blockchain.

   Private data - explore the possibilities afforded by Zero-Knowledge Proof advanced cryptographic capabilities[ix].

5. **Alignment with competition law.** Although this point is beyond the strict taxation scope of this report, there is a need to, longer term, monitor industry-commercialized blockchain based taxing systems for the incidence of competition amongst DLT systems. It will be important to analyze the different means of validating transactions and the possibility of systems containing commercially sensitive data being used for illegal price setting and anti-competitive behavior. Consider; the non-discrimination of validation of transactions; interoperability with competing blockchain systems; exchange of commercially sensitive data leading to price setting, etc.

# Data Model for Tax

This section aims to commence the discussion in the area and highlight certain questions or points of attention when considering a data model for Blockchain Tax applications. Decentralized ledger technology could enable a government to effectively administer the revenue collection process to match increasing globalization and digitalization of the world’s economy. A decentralized data model serves as the medium required for the information to flow and be collected automatically. First, a decentralized solution may decrease the amount of continuous effort currently needed to monitor, administer, and police compliance with tax obligations. A blockchain solution necessitates an upfront fixed investment with variable, but

controllable, future maintenance costs. Second, a decentralized data model is especially conducive to preventing information altering. Therefore, it could assist in tackling tax avoidance incidents and equip policymakers with enhanced data transparency and traceability. Improved transparency will also support better policy design decisions.

Further, businesses and individuals gain an easy and efficient way of filing taxes. Decentralized data infrastructure brings clarity and simplicity to what, at present, is a confusing and challenging process. A decentralized data model does not translate into higher taxes, but rather offers a more efficient means of taxation that, in turn, yields advantages for tax authorities and taxpayers alike.

***Key recommendations:***

1. **Data Framework.** When designing a data framework for Blockchain adoption in Tax, the following four points should be appraised:
    I. **Consensus protocol**: The two most prominent consensus protocols currently available are: Proof-of-Work (PoW) or Proof-of-Stake (PoS). They have their own benefits and costs, so when designing a data infrastructure, the decision on which mechanism to deploy should involve a robust cost-benefit analysis. PoW miners solve a cryptographic mathematical puzzle,[x] with a side effect of large electricity consumption. PoS allows validators to mine if they deposit a share of the protocol tokens, but with a side effect of validators with higher stakes having more influence over the network.[xi]
    II. **Coordination of data ingestion**: Coordination is a key component in the process of fulfilling a data model; however, Blockchain, by design, is a decentralized system that brings trust-less nodes together. The technology itself facilitates multi-stakeholders (nodes) coordinating and validating transactions. Pilot programs are advised in order to stress-test the developed data infrastructure and ingestion processes.
    III. **Associated costs to consider**: Questions to address should include, but are not limited to; timing, whether onboarding of the historical data from previous years into the new form of a data model is required. If not, how would the old data model be compatible with the new data model in case there is a need to access and act upon prior year data? It is also paramount to assess the estimated costs

associated with educating the taxpayers on how to use the system and administer tax filings on such a system.

IV. **Security and Systematic Risk Management**: A multi-phased process should be developed in the unfortunate scenario of data leakage, data hacking, or other form of systemic failure. The first phase should be an immediate technical response to mitigate the risk. The second phase should consist of the following actions or programs, executed in parallel or series; communication plan, compensation programme aligned to the data breach, and a legislative/regulatory framework pre-developed to protect and support the affected parties.

**2. Governance Data Model**

I. The focus will be on the governance of the blockchain system itself since it significantly shapes the development of the data model infrastructure. Governance of the decentralized data model could be divided into two general themes (on-chain data governance and off-chain governance) with three associated layers (off-chain community, off-chain development, and on-chain protocol).[xii] In order to design an efficient blockchain tax data infrastructure, it is important to recognize that off-chain components do not exist in isolation from their on-chain counterparts, since both elements are mutually dependent, and thus should be designed in unison.

**3. Intersection of Artificial Intelligence (AI) and Blockchain**

I. AI brings sophisticated data analytics to tax to optimize compliance and effectively transform tax into an innovation hub, while generally empowering the tax function.[xiii] Blockchain offers transparent, validated, and structured data sources necessary for AI model building and deployment. AI (machine learning) systems partnered with Blockchain can produce new insight to substantially improve information security, system scalability, fraud reduction, and governance.[xiv]

# Governance

A tax related blockchain infrastructure will require special governance arrangements. The automation of tax data reporting has historically focused on streamlining processes within the

tax administration and improving the interface between taxpayers and the tax administration. Governance arrangements are needed to effectively guide the interaction between the taxpayer and the tax administration. The critical roles of each party should be clearly defined and built into the Information Technology (IT) infrastructure, along with the appropriate incentive mechanisms that will enhance the long-term viability of the DLT system by encouraging participation by a multitude of stakeholders.

A set of principles should underpin the governance of a tax related blockchain infrastructure. The tax ecosystem encompasses a wide variety of actors. Considering the potential impact of tax related blockchain solutions on all relevant stakeholders, it is important at the outset to define a set of shared principles that reflect the aspiration of the members of the ecosystem and serve as guidelines in developing blockchain solutions.

***Key recommendations:***

1. **Delivering mutual tax certainty.** The overriding objective of a tax-based blockchain infrastructure is to deliver - faster - tax certainty for both the taxpayer and tax administration. This means that there should be certainty around: (i) the identity of those operating on the ledger; (ii) the fact that the taxable event has occurred as recorded in the chain; and (iii) all relevant information is included in order to automatically assess the tax implications.[xv]

2. **Protecting taxpayer's rights.** The protection of taxpayer's rights is a fundamental and critical element. This effort should, inter alia, be focused on such issues as a robust dispute resolution mechanism, appropriate guidance on burden of proof, identity management, and digital inclusiveness - e.g., equal (de facto) access to the system for all taxpayers.

3. **Providing an integrated value proposition.** Distributed ledger technologies will also require clarity about when it is acceptable to use data for purposes other than those for which the data was initially provided. Thus, it would be important to: (i) avoid establishing siloed systems when an integrated system is more effective; (ii) consider including services of value to the taxpayer, even if they are not tax related; (iii) embed information requirements from other government entities rather than establishing parallel systems;

(iv) avoid replicating existing processes found in paper based or legacy IT systems, and (v) define the integrated value proposition for both private and public stakeholders when participating together in an ecosystem.

4. **Applying the principle of 'subsidiarity' when selecting a platform.** Taxation is incidental to economic transactions. Therefore, a blockchain based tax platform may not be the best general purpose technology option if there exist current solutions in the market, typically around financial and other transactions, where taxation can be effectively incorporated. For example, it may be more efficient to embed taxation into a digital payment, commerce, or supply chain solution rather than establishing an entirely new tax system. Hence, existing solutions in the market should be considered first.

5. **Ensuring the resilience of the blockchain.** Tax related blockchain systems will require: (i) a very high degree of uptime; (ii) effective authentication of the actors operating on the blockchain; (iii) a robust information security arrangement, including protection of commercial secrets; (iv) predictability in change management since the system interfaces with other systems within and outside the tax administration; (v) capacity to train users and handle complaints and queries, (vi) monitoring of the system, and (vii) a proper dispute resolution mechanism.

6. **Promoting participation and inclusion of multiple stakeholder classes in system design and development.** Longer and more intensive, participatory processes are likely needed to effectively design blockchain systems because they, by their very nature, link systems and business processes. Therefore, multiple stakeholder classes should be represented in the governance structure of the DLT system (participation) and decision-making rights should be carefully considered to ensure all relevant and material stakeholder classes are represented by a governance member with a recognized, and valued, decision-making vote. The discourse should in any case address the following seven governance dimensions: system development/ or maintenance roles; participation incentives; membership; communication amongst stakeholders; decision-making (the crux of any governance model); initial system formation and launch; and context-specific rights and obligations of the stakeholders.

7. **Establishing a governance board/framework.** The aforementioned governance elements need to be included in an overarching governance framework and associated board where all relevant stakeholders are properly represented. Special governance arrangements will likely include: (i) earlier, longer, and more intensive consultations processes to understand how the blockchain systems interact with existing processes in the public and private sectors; (ii) a robust change management mechanism since upgrades to the blockchain system are likely to have ripple effects across all actors in the economy; (iii) a process for encouraging and processing unsolicited proposals; and (iv) a program to foster a vibrant conversation across the ecosystem addressing needs of the multi-stakeholders.

   While there are few tax related DLT systems with robust and carefully constructed governance models from which to leverage, there are several technology-laden systems impacting a multitude of stakeholders with impressive governance models to leverage. Consider, for example, the Global Vaccine Alliance (GAVI)[xvi] for a nuanced and precise governance model, DHIS2[xvii], an open-source digital health information system for a streamlined governance model uniquely tied to a university (University of Oslo), and Mojaloop[xviii], an open-source software payment system employing a fairly recent foundation model across an efficient mix of public and private sector actors.

## Privacy and Transparency

DLT enables a new way of conceiving of taxation and opens an opportunity to rethink the traditional balance between privacy and transparency across tax policy, law, and process. Digital technology, significant growth in data, and the ability to store, manage and transmit that data is providing an opportunity to rethink privacy and transparency in relation to taxation, separate from any historic constraints. DLT confronts us with decision points not based on the technology itself, but based on community expectations regarding privacy and transparency. Making choices about where the balance is placed will influence decisions concerning how and what technology will be implemented, as well as choices regarding associated policy and process.

Whilst digital technology is enabling better tracking and reporting of economic activity, fundamentally the concept of taxation and the associated administrative burden has remained

unchanged. DLT can free institutions, the economy and society to rethink deeply embedded paradigms in relation to taxation outside of the traditional constraints of data collection and management.

Privacy and transparency can be seen as two ends of a spectrum and depending where on the spectrum one chooses the pivot point, will result in a system that is driven more by privacy or transparency. Privacy and transparency should also be qualified by the subject (person or organization) at issue, the entity bequeathed with the authority to enforce privacy and transparency, and the scope of the tax-related data being made private or transparent e.g., all DLT data; only cross-border transaction data; etc.. Technologies such as Zero-Knowledge Proof technology may also play a key role here. Applying ZKP-technology, one party (the prover) can prove to another party (the verifier) that they know a value x, without conveying any information apart from the fact that they know the value x. Privacy preserving technologies like ZKP-technology may adhere to compliance with required privacy standards and legislation, although further development of this technology may be needed.

***General recommendations:***

1. **The future is decentralized.** DLT initiates an inevitability toward greater decentralization. It is recommended that a position of maximum decentralization be the starting point for mapping principles of privacy and transparency, as well as mapping the present to future state.

2. **Put citizens in control.** To enable the balance between privacy and transparency to evolve as technology evolves, maintaining a social license to innovate is important. It is recommended that safe, secure and easy to use custodial solutions be provided so citizens can own their identity keys and build a partnership approach amongst responsible authorities and citizens, whereby a clear balance is considered between providing the relevant data necessary for taxation purposes and maintaining privacy and control from a citizen's/taxpayer's perspective.

***Specific recommendations:***

3. **Policymakers should leverage the power of smart contracts to mirror existing legal, regulatory, and contractual restrictions on data usage and sharing.** There are opportunities for public and private sector actors to launch proofs of concept and pilots with DLT systems that adhere to current legislative, regulative and contractual limitations. Thereby not entering the privacy or transparency debate, but instead to design new DLT systems that comply with existing laws and contractual restrictions.

4. **Consider the use of Non-Fungible Tokens (NFT).** NFTs provide the opportunity to establish that data is unique and immutable, the true ownership of the data, and the permissions that are associated with that data. The ability to locate meta attributes around the data, and verify the data as being unique, could be a way of balancing privacy and transparency in a way that is comfortable to citizens or businesses and enables them to make decisions about costs and benefits of sharing their data, while recipients of the data can be assured of its validity and ownership.

5. **Policymakers should consider the introduction of an Immutable Notarization Blockchain for Taxation Data.** One key challenge in the potential utilization of blockchains and DLT technology for greater transparency in the digital taxation domain concerns the data privacy of relevant entities who participate in the DLT network. In many cases, transactions between parties are considered to be confidential to these parties, with the government - e.g., its taxation authority, possibly being the sole third party legally permitted to further query into the transaction details. In these use-cases, there is an inherent tension between the benefits of DLT technology for transacting parties and the danger of loss of privacy of the parties in utilizing the technology. Thus, blockchains and DLT technology must continue to develop in order to address these privacy concerns.

   However, one potential blockchain application is to retain only the minimal trace of the transaction, by way of capturing on the blockchain only the cryptographic hash of the transaction records, thereby ensuring privacy. This is known as a “hash-only blockchain,” a digital notarization blockchain which functions much the same way that

legal notaries do - e.g., human notaries. In addition, many DLT systems do not permit the sharing of large amounts of data in the first place, which has already led to blockchain systems where hashes of data are included on-chain rather than the actual data itself.

When two transacting parties arrive at a taxable event - e.g., payment is delivered off-chain, both parties compute the cryptographic-hash of their relevant documents and evidence of the payment. They then utilize the blockchain to store only these hash/digest values together with the appropriate record-identifier. Each party retains their complete data records in their respective private databases (off-chain). In this case, the blockchain acts as a decentralized automated notary that keeps an immutable list of these hash values for the relevant records, thus preventing parties from modifying their data records, i.e., prevent post-event cheating. Relevant government authorities can later request these transaction data records from the relevant parties, and re-compute the cryptographic-hash values for these records and compare these hash values against those found on the blockchain. This provides assurance that none of the parties have illegally modified these data records after the taxable event has occurred.

6. **Tokenized currency that can execute governance requirements associated with transactions could enable a broader range of taxable events or could enable a more targeted approach to taxable events.** Programmable Money enables the idea of smart contracts to be embedded directly into the currency itself. A complete accounting of the transaction could occur at the time of the transaction. This could be accomplished by programming a tax office approved corporate policy into the transaction or making the amount of tax due so small as to be negligible on a per transaction basis. In any event, the central role of a taxation authority could be drastically reconfigured, and risks associated with the implementation of new transaction and currency systems reduced. This could enable significant privacy regarding a transaction as the need to track transactions back to individuals or corporations is not required. Equally, programmable money offers opportunities for transparency of governance associated with transactions, making taxation more equitable.

To conclude, the road to the future will not be a straight line, but rather an implementation of DLT that optimizes current systems under current regulatory regimes while the technology

systems, regulation and social licenses are understood and built to enable an entirely new way of conceiving of taxation.

## Conclusion

There is no doubt that DLT is here to stay and signs are that its application across finance, tax, trade and other settings where many actors in a system need access to assured real-time data about a transaction is increasing. Governments have the option, of course, of stepping back and letting the market take its course. That way, if DLT is not fit for purpose and cannot be implemented at scale and in compliance with existing frameworks, it will fade away and a lot of time and trouble will have been saved.

This working group believes that better effort should be directed to further developing and applying blockchain technologies, in general, across certain key use-cases, including tax. For tax specifically, we suggest all involved in tax administration, domestic and international, public and private, need to engage with this breakthrough technology and understand what it means for the tax systems that support the financial and societal stability of our nation states. We hope our report and recommendations suggest some principles for how this important work can be taken forward in quick and practical form.

# Appendix 1 - GSMI 2.0 - Global Taxation Working Group - Tax and Blockchain Based Systems Summary

| GSMI 2.0 - Global Taxation Working Group<br>Tax and Blockchain Based Systems | | | | |
|---|---|---|---|---|
| Initiative | Name/Type of initiative | State/Non-State Actor | Summary | Links to further information |
| 1 | VAT refunds for tourists | Thailand | In Thailand VAT refund has been introduced for tourists via a web-based application. The application is estimated to increase tourist spending by 10% and has reduced the VAT refund period from 1 month to 1-3 days. Furthermore, the use of the application will reduce the need for paper documentation providing greater transparency and will help reduce the number of fraudulent refund claims.<br><br>Another initiative implemented by Thailand to help combat fake invoicing is their use of blockchain to track VAT payments. This has been a significant issue in Thailand and now with the ability to verify invoices using blockchain technology it has become more difficult to commit fraud through VAT payment by false invoicing. | https://www.bangkokpost.com/business/1838339/blockchain-led-vat-refund-app-in-global-debut#:~:text=The%20roll%2Dout%20of%20the,said%20Finance%20Minister%20Uttama%20Savanayana.<br><br>https://www.ledgerinsights.com/thai-government-blockchain-vat-bonds-procurement/<br><br>https://www.avalara.com/vatlive/en/vat-news/thailand-blockchain-vat-refunds.html<br><br>https://www.tourismthailand.org/Articles/plan-your-trip-vat-tax-refund |
| 2 | Keyless signature infrastructure (KSI) used to verify data integrity in government records | Estonia | E-Tax is the electronic tax filing system established by the Estonian Tax and Customs Board in which blockchain powers the underlying technology. Currently 98% of tax declarations in Estonia are filed online (which takes around three to five minutes). KSI allows citizens and governments to verify the integrity of their records on government databases. It also makes it extremely difficult to perform illegal acts inside the government networks. KSI's ability to harbour citizens' data securely and accurately has helped Estonia to launch digital services such as e-Business Register and e-Tax. | https://www.pwc.com/gx/en/services/legal/tech/assets/estonia-the-digital-republic-secured-by-blockchain.pdf<br><br>https://e-estonia.com/solutions/business-and-finance/e-tax/<br><br>https://www.independent.co.uk/news/science/estonia-digital-republic-online-voting-blockchain-b912567.html |
| 3 | Digitalising invoices to reduce fraud | China | Blockchain is being used for invoices in Shenzhen, with the aid of Tencent, to combat tax evasion. The technology provides a legally valid digital receipt which can be used to prove purchase of goods and services. Blockchain has enabled the digital invoice to be traceable and data secure which aids in the prevention of the circulation of false invoices. | https://www.tencent.com/en-us/articles/2000006.html<br>https://www.ledgerinsights.com/china-shenzhen-blockchain-tax-invoices/<br>https://www.coindesk.com/tencent-partners-with-city-authority-to-combat-tax-evasion-with-blockchain<br>http://www.sz.gov.cn/en_szgov/business/news/content/post_8675244.html |

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| Initiative | Name/Type of initiative | State/Non-State Actor | Summary | Links to further information |
| 4 | Smart contracts created between employers and employees to reduce inefficiencies in payroll taxes | Netherlands | The Netherlands designed a proof of concept to remove inefficiencies in payroll tax through application of smart contracts. By creating a smart contract between the employer and employee, where the employer remits gross payments into the system and using smart contract technology the payroll taxes due are calculated. In this proof of concept the taxes will be automatically paid to the government and the employee will receive the net payment. | http://www.britacom.org/gkzljxz/dzqk/202012/P020201229609118824967.pdf<br>https://www.iota-tax.org/sites/default/files/publications/public_files/disruptive-business-models.pdf |
| 5 | Transformation Program and Action Plan | Serbia | Serbia launched the Transformation Program and Action Plan in 2015 with the aim of creating a modern and efficient administration focused on digitalisation. As a result, up-to-date data can be used to create a more in-depth profile of a taxpayer allowing for irregularity in taxpayers behaviour to be detected.<br><br>Additionally, the Ministry of Finance in Serbia has published a legal framework to govern blockchain technology and trading with cryptocurrencies allowing VATCoin to become legal tender. | http://www.britacom.org/gkzljxz/dzqk/202012/P020201229609118824967.pdf<br>http://mduls.gov.rs/en/notifications/study-on-the-feasibility-of-using-blockchain-technology-in-public-administration-of-the-republic-of-serbia/<br>https://www.serbianmonitor.com/en/ministry-of-finance-publishes-draft-law-on-digital-assets/https://www.srbija.gov.rs/view_file.php?file_id=2321&cache=sr<br>https://www.purs.gov.rs/sw4i/download/files/cms/attach?id=5299 |
| 6 | E-Wallet/ Tax Wallet | Kazakhstan | Kazakhstan introduced an e-wallet (tax wallet) in 2020 which can be accessed using a smartphone. The e-wallet has reduced the number of refunds and collection orders as the technology involved enables the removal of inaccurate payments and penalties.<br><br>The government is also working towards producing an app using DLT for self-employed individuals to register quickly online as a taxpayer via face ID, register business transactions, and automatically calculate and pay taxes without reporting. This is due to be released this year. | https://egov.kz/cms/en/articles/tax_wallet_service<br>http://www.britacom.org/gkzljxz/dzqk/202012/P020201229609118824967.pdf |
| 7 | Taxpayers Personal Web-Portal | Georgia | Georgia's Revenue Service aims to create a taxpayer friendly environment through digitalisation. On the Revenue Services Taxpayers Personal Web-Portal there is a range of online services such as e-filing, e-application, e-invoice, e-waybill and e-complaint. The utilisation of e-invoice | https://dor.georgia.gov/taxes/georgia-tax-center-help/online-tax-services |

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| Initiative | Name/Type of initiative | State/Non-State Actor | Summary | Links to further information |
| | | | allows for transactions carried out by taxpayers to be tracked and traced. This has eased the administrative process as the electronic system allows VAT invoices to be attached to the appropriate e-tax return forms allowing them to be filed electronically. Blockchain technology has been used to authenticate certificates of origin for custom purposes. | http://www.britacom.org/gkzljxz/dzqk/202012/P020201229609118824967.pdf |
| 8 | Finnish Tax Administration: (1) Digital payment guarantee, (2) use of QR codes, (3) tracking taxes on real estate transactions | Finland | The Finnish Tax Administration have been exploring a variety of ways of improving efficiency through blockchain and DLT platforms:<br><br>- The Finnish Tax Administration, alongside Kela, TietoEVRY, the Financial Supervisory Authority of Finland and Borenius Attorney, have developed a proof of concept for smart money. Smart money is a digital payment guarantee which can be used through mobile applications or payment cards. It is best suited to circumstances in which payments are targeted to a particular usage. The proof of concept focused on its use in rehabilitative psychotherapy. However, the collaborators are looking to expand the concept further into different industries.<br><br>- The Tax Administration has been investigating using the QR codes printed in receipts to enable the direct recording of tax information.<br><br>- Additionally they have been collaborating with banks on using blockchain to track taxes on real estate transactions. | https://www.kela.fi/web/en/news-archive/-/asset_publisher/lN08GY2nlrZo/content/the-social-insurance-institution-of-finland-to-test-a-new-type-of-digital-smart-money<br><br>https://www.tietoevry.com/en/campaigns/2020/smartmoney--a-conditional-digital-payment-guarantee/<br><br>https://www.tietoevry.com/en/newsroom/all-news-and-releases/other-news/2020/03/smart-money-leads-the-way-to-more-customer-friendly-and-transparent-services/<br><br>Owens_de_Jong__2017__Taxation_on_the_Blockchain.pdf<br><br>https://www.ciat.org/blockchain-in-tax-administrations/?lang=en<br><br>https://medium.com/the-capital/can-ai-disrupt-real-estate-and-construction-industrieswith-blockchain-in-finland-877c7700f74 |
| 9 | Digitalising receipts/ e-krona | Sweden | The use of blockchain is being trialled by the Swedish government to digitise receipts, non-resident income tax, and customs duties. The Riksbank, in partnership with Accenture, has initiated a pilot project for a central bank digital currency, the e-krona, to serve as a digital version of the Swedish krona by using blockchain technology. | https://www.ciat.org/blockchain-in-tax-administrations/?lang=en<br><br>https://www.legal500.com/guides/chapter/sweden-blockchain/<br><br>https://www.riksbank.se/en-gb/payments--cash/e-krona/<br><br>https://www.digitala-kvitton.se/<br><br>https://github.com/lteam1337/digital-receipts |

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| Initiative | Name/Type of initiative | State/Non-State Actor | Summary | Links to further information |
| 10 | Data sharing platform (bCPF) | Brazil | The federal tax administration of Brazil has implemented a blockchain system known as bCPF (blockchain tax file number), with the objective of sharing data from the Registry of Taxpayers/Individuals (CFP) between tax and regulatory institutions of the three levels of government (federal, state, and municipal). | https://lawsofbrazil.com/2018/11/29/blockchain-adopted-by-brazils-tax-authority/<br>https://www.ciat.org/blockchain-in-tax-administrations/?lang=en<br>ordinance-determines-that-the-federal-revenue-service-shall-adopt-a-data-sharing-mechanism-through-permitted-blockchain<br>https://www.serpro.gov.br/menu/imprensa/Releases/serpro-desenvolve-rede-blockchain-para-a-receita-federal |
| 11 | Single Tax Registry - Federal Register (RUT) | Argentina | Argentina has implemented a Single Tax Registry – Federal Register (RUT). This tax simplification mechanism allows taxpayers remitting Gross Income Tax to observe, in the same way, the formal requirements needed to register for tax. The use of blockchain enables data to be exchanged between AFIP, COMARB and the acceding jurisdictions securely through an advanced encryption system, protecting taxpayers rights. | https://www.argentina.gob.ar/economia/politicatributaria/armonizacion/registrounicotributario<br>https://www.ciat.orffdg/blockchain-in-tax-administrations/?lang=en |
| 12 | Blockchain platform for interest free payments during COVID-19 pandemic | Russia | During COVID-19 the Russian Federal Tax Service launched a platform using DLT through which banks could provide interest free loans to businesses from industries that were listed by the government as worst affected. The payments were then used to ensure staff salaries could still be paid. | https://bankingfrontiers.com/russia-makes-major-advances-in-blockchain-dlt/<br>https://www.legal500.com/guides/chapter/russia-blockchain/<br>https://home.kpmg/xx/en/home/insights/2020/04/russia-government-and-institution-measures-in-response-to-covid.html |
| 13 | HMRC projects: (1) AEO pilot and (2) Withholding Tax and Tax Treaty administration | United Kingdom | Early Blockchain based pilots in the UK have focused on use cases where there are multiple stakeholders involved and blockchain has the potential, at least, to improve the speed and effectiveness of the creation of trust networks around specific entities or transactions. The HMRC AEO pilot looked to enable trust to be re-used by 28 agencies operating at the border while the HMLR pilot exemplified a similar approach around those entities- private and public – involved with a real estate transaction. | https://www.computerweekly.com/news/450426393/HMRC-builds-blockchain-proof-of-concept-for-UK-border>; HMLR pilot, <https://hmlandregistry.blog.gov.uk/2019/05/24/could-blockchain-be-the-future-of-the-property-market/ |

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| Initiative | Name/Type of initiative | State/Non-State Actor | Summary | Links to further information |
| | | | More recently, HMRC has been working on 2 “network”-type applications for blockchain in direct and indirect tax applications. The first was targeted at Withholding Tax and Tax Treaty administration on cross border dividend events and showed that a platform-based approach could work. The other, the Reducing Friction in International Trade project, has shown that data generated in the commercial sphere can be safely reused for Customs administration. | https://www.linkedin.com/posts/ernstandyoung_blockchain-activity-6826119035013349377-a1rz |
| 14 | HMRC project: Reducing Friction in Trade | United Kingdom | The user research work of the Reducing Friction In Trade project from HM Revenue and Customs is a proof of concept work to understand whether HMRC could use the blockchain technology to solve the problems in international trade, which would not only benefit the supply chain but also reduce cost in HMRC.<br><br>The research started from the end-to-end journey of Australian wine importing into the UK through 1-to-1 interviews with the businesses in the supply chain. The main focus is the weakness in the industry in relation to lack of mapping experience and the attitudes towards data sharing and blockchain technology.<br><br>The key findings indicated that blockchain technology could solve a reasonable number of existing problems (e.g. too much paperwork, too many systems to use, complicated procedures) and the businesses in the supply chain are generally positive towards blockchain technology. Meanwhile, HMRC needs to consider data security, simplicity and cost issues which could hugely affect the user attitude and behaviour. | https://lordchrisholmes.com/wp-content/uploads/2020/09/DLT-Update-2020-RFIT.pdf |
| 15 | eCO (electronic certificate of origin) | Singapore | In 2018, the Singapore International Chamber of Commerce (SICC) became the first chamber to offer a blockchain based eCO (electronic certificate of origin). Using vCargo Cloud's services, the SICC enables instant verification of COs using QR codes to exchange COs over a private blockchain network. This exchange prevents any attempt at fraud, tampering or third-party interference. | https://sicc.com.sg/certification/online-application/<br><br>https://devsol.etradeforall.org/singapore-international-chamber-of-commerce-launches-worlds-first-blockchain-based-e-certificate-of-origin/ |

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| Initiative | Name/Type of initiative | State/Non-State Actor | Summary | Links to further information |
| 16 | Cross border exchange platform | South Korea | The Korea Customs Service (KCS) is currently exploring the implementation of a blockchain based platform to integrate cross-border trade and international logistic flows, allowing for all logistic documents such as lading bills and credit letters to be stored digitally in a single place, accessible to all relevant parties.<br><br>KCS piloted a cross-border data exchange platform which used blockchain technology to enable the exchange of certificates of origin. The pilot allowed for certificates issued in Korea to be shared in real time with the Vietnamese Customs administration, Korean exporters and Vietnamese importers. It was found the high level of trust this technology creates was advantageous to developing cooperation between Customs administrations. | https://mag.wcoomd.org/magazine/wco-news-78/supporting-e-commerce-korea-customs-services-strategy/<br><br>https://mag.wcoomd.org/magazine/wco-news-88/korea-pilots-blockchain-technology-as-it-prepares-for-the-future/ |
| 17 | Emirates Blockchain Strategy 2021 | United Arab Emirates | In 2018, the UAE Government launched the Emirates Blockchain Strategy 2021. The government aims for 50% of government transactions to use blockchain technology by 2021. It has been predicted this will greatly lower operational costs. As part of this strategy, customers will be provided with unique identification numbers providing a secure chain for digital transactions, which may also include tax transactions. | Emirates Blockchain Strategy 2021 - The Official Portal of the UAE Government |
| 18 | TradeLens | IBM and Maersk | In 2018 IBM and Maersk collaborated to launch a blockchain-based platform, TradeLens. This follows the flow of cargo from source to destination and connects all parties involved in a shipment in real time, reducing the costs associated with international shipments significantly. It has allowed for the secure exchange of documents in real time, enhancing the ability of shippers to view their status, location and cargo. Such a platform could be expanded to apply to custom duties. | https://www.tradelens.com<br><br>TradeLens uses blockchain to help Customs authorities facilitate trade and increase compliance – WCO (wcoomd.org)<br><br>https://www.tradelens.com/post/looking-to-a-future-of-paperless-customs |
| 19 | Silsal | Maqta Gateway | Maqta Gateway, an Abu Dhabi Ports subsidiary, introduced its own blockchain-based application in 2018, Silsal. This system records and extracts details of the transactions, enabling the real-time tracking of cargo and documents, reducing costs and time spent (particularly reduction in paperwork, calls and physical visits) and increasing security. In relation to bettering current taxation procedures, such a system could be applied to customs duties. | Abu Dhabi Ports launches blockchain technology for trade community \| Maqta Gateway® L.L.C. |

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| Initiative | Name/Type of initiative | State/Non-State Actor | Summary | Links to further information |
| 20 | Platform designed to prevent fraud in relation to commercial invoices | Etisalat | Abu Dhabi-based telecommunications company Etisalat has launched a blockchain-based platform, namely UAE Trade Connect (UTC), designed to prevent fraud in relation to commercial invoices. The platform has also helped prevent the duplication of invoices and promote data security by producing permanent transactional documentation. This group is convinced such a fraud detection system may have the potential to be leveraged by tax authorities. | https://iclg.com/ibr/articles/16377-uae-welcomes-new-blockchain-platform<br>https://www.linklaters.com/en/about-us/news-and-deals/deals/2021/may/linklaters-advises-etisalat-on-new-uae-blockchain-based-platform<br>https://www.etisalat.ae/b2bportal/business-app-store.html?c=402&sc=407&isRepositryData=true&locale=en |
| 21 | Blockchain promoting data sharing and process integration | DP World | DP World is planning to create a permissioned blockchain for beneficiary cargo owners and their trade-logistics business partners to advance the sharing of data and encourage greater integration. They aim to enhance trust within the trade-logistics community, allow for smart trade through digitalisation and data-driven decision-making and remove time spent requesting and verifying data. | https://www.dpworld.com/news/blogs/how-is-dp-world-using-blockchain-to-optimise-supply-chain<br>Inclusive Deployment of Blockchain: Case Studies and Learnings from the United Arab Emirates \| World Economic Forum (weforum.org) |
| 22 | TaxChain | Henkel and Siemens | TaxChain is a tool powered by blockchain technology which archives tax transactions in a blockchain. It allows individual taxpayers to become tax auditors and review how government entities are using their taxes. The individual's taxes must be traceable and clearly show how their taxes have been spent and by whom. This initiative is driven by the German companies Henkel and Siemens, but others are expected to join. | Blockchain Tax Declaration from Governments to the Taxpayer (taxchain.io)<br>https://v-next.buzzsprout.com/1009897/3833486-get-aboard-the-taxchain-digitizing-global-taxes-for-supply-chains-and-logistics-using-blockchain |
| 23 | Blockchain based payroll system | Futurice | Futurice have developed a blockchain-based Ethereum application which enables employees to record and be paid overtime and bonuses. The information recorded through the blockchain was shared with the payroll department ensuring transparency. The company found using this technology was a risky option due to the possibilities of cyberattacks however in comparison to non-blockchain based systems this application did provide greater security and was a less costly option. | Owens_de_Jong__2017__Taxation_on_the_Blockchain.pdf<br>https://futurice.com/blog/payroll-system-in-blockchain |

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| Initiative | Name/Type of initiative | State/Non-State Actor | Summary | Links to further information |
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| 24 | TaxGrid | Ernst & Young | TaxGrid is a global tax withholding solution that leverages blockchain technology to automate, decentralise and securely exchange tax and financial data whilst maintaining data privacy between financial institutions and government agencies. EY used a permission Ethereum network across multiple cloud providers including AWS, Azure and IBM Cloud to create a 'shared record book' of all dividend transactions occurring in the distributed network. | https://www.ey.com/en_us/tax/taxgrid |
| 25 | Real-time reporting system | Summitto | Using funding from the EU's Horizon 2020 project, Summitto, a Netherlands-based startup, has used blockchain technology to build a real-time reporting system upon which tax administration can rely to combat VAT fraud. On the system companies can register their invoices and report VAT. This information is time-stamped and therefore it will be very apparent if the data is altered making it easier to detect fraudulent behaviour and promote confidentiality. | https://www.ciat.org/ciatblog-blockchain-para-mejorar-la-recaudacion-del-iva-parte-2/?lang=en#_ftn9<br><br>https://news.bloombergtax.com/daily-tax-report-international/eu-inches-toward-blockchain-in-fight-against-vat-fraud-1<br><br>https://blog.summitto.com/posts/a_boost_for_modern_technologies_real_time_reporting_bundesrechnungshof/ |
| 26 | Global Trade Origin blockchain platform (Origin) | Ernst & Young | The Global Trade Origin blockchain platform (Origin) aims to increase trust and increase friction in global trade. It allows importers and suppliers to assert the country of origin of goods on a shared, distributed ledger. Producers can look upstream to their chain of suppliers to collect sufficient evidence to qualify their goods for preferential- and non-preferential treatment worldwide, whilst preserving privacy on commercially sensitive data. The platform also aims to support other types of certifications related to forced labor, conflict minerals or Kimberley diamonds. EY has completed a POC with a US based technology company to demonstrate the technology is working. The outcome of this POC has been presented at EY's (virtual) Global Blockchain Summit 2020. After the POC EY has continued the development of the solution and is now actively pursuing several pilots in this area. | https://pub.ey.com/content/ey-csg/public/2019/1911/1911-3312324/global-blockchain-summit/home/day2.html.html |

Disclaimer: The GSMI 2.0 Tax Working has made every effort to identify all blockchain and distributed ledger technology (DLT) projects that are connected to tax and/or customs/trade. In doing so, we have made some (arbitrary and perhaps subjective) choices with respect to the direct connection to tax and/or customs/trade. Also, not in all instances have we been able to make a distinction between the status of these projects (e.g., proof of concept, pilot, minimal viable produce (MVP), production), nor have we been able to verify to current status of these projects in all instances. Notwithstanding the aforementioned, this overview should by no means be considered to be exhaustive.

# Endnotes

[i] Generally, all blockchains are distributed ledgers, but not all distributed ledger systems are blockchains. For the purpose of this report the terms 'DLT' and 'Blockchain' are used interchangeably.

[ii] Science, Government Office for. "Distributed Ledger Technology: Beyond Block Chain." GOV.UK, GOV.UK, 19 Jan. 2016, www.gov.uk/government/news/distributed-ledger-technology-beyond-block-chain.

[iii] Appendix One - GSMI 2.0 - Global Taxation Working Group - Tax and Blockchain Based Systems Summary

[iv] Science, Government Office for. "Distributed Ledger Technology: Beyond Block Chain." GOV.UK, GOV.UK, 19 Jan. 2016, www.gov.uk/government/news/distributed-ledger-technology-beyond-block-chain.

[v] A balance needs to be established between self-sovereign identities and the fact that taxpayers want to take ownership of their data - and the required information they need to share with the tax administration.

[vi] For further details on MOSIP see: https://www.mosip.io/

[vii] Please see GBBC Digital Identity working group report for further information.

[viii] "Article 26 of the OECD Model Tax Convention on Income and on Capital and Its Commentary: Read Online." *Oecd*, read.oecd-ilibrary.org/taxation/implementing-the-tax-transparency-standards/article-26-of-the-oecd-model-tax-convention-on-income-and-on-capital-and-its-commentary_9789264088016-6-en

[ix] This form of proof allows for blockchain-based transactions to be verified whilst maintaining user anonymity.

[x] Gervais, A., Karame, G. O., Wüst, K., Glykantzis, V., Ritzdorf, H., & Čapkun, S. (2016). On the security and performance of Proof of Work blockchains. *Proceedings of the ACM Conference on Computer and Communications Security*, *24-28-Octo*, 3-16. https://doi.org/10.1145/2976749.2978341

[xi] Nguyen, C. T., Hoang, D. T., Nguyen, D. N., Niyato, D., Nguyen, H. T., & Dutkiewicz, E. (2019). Proof-of-Stake Consensus Mechanisms for Future Blockchain Networks: Fundamentals, Applications and Opportunities. *IEEE Access*, *7*, 85727-85745. https://doi.org/10.1109/ACCESS.2019.2925010

[xii] Rowan van Pelt., Slinger Jansen, Djuri Baars, and Sietse Overbeek (2021) Defining Blockchain Governance: A Framework for Analysis and Comparison, Information Systems Management, 38:1, 21-41, DOI: 10.1080/10580530.2020.1720046

[xiii] "How Artificial Intelligence will Empower the Tax Function" (*Ernst & Young* November 2020) https://www.ey.com/en_us/tax/how-artificial-intelligence-will-empower-the-tax-function accessed October 7, 2021

[xiv] T. N. Dinh and M. T. Thai, "AI and Blockchain: A Disruptive Integration," in *Computer*, vol. 51, no. 9, pp. 48-53, September 2018, doi: 10.1109/MC.2018.3620971.

[xv] It is recognised that there are some complex transactions for which this may not be possible, but these will be an exception to the general rule.

[xvi] https://www.gavi.org/our-alliance/governance

[xvii] https://dhis2.org/

[xviii] https://mojaloop.io/