Financing Climate Futures

RETHINKING INFRASTRUCTURE

OECD Case Study
KEY FINDINGS

Blockchain Technologies as a Digital Enabler for Sustainable Infrastructure

The transition to a low-carbon future requires a visionary reassessment of infrastructure systems and services, from their interaction with consumers all the way through planning, procurement, financing, construction, and operations. Embracing new technologies that enable drastic reductions in greenhouse gas (GHG) emissions will be a crucial element to a successful transition. Emerging distributed ledger technologies (DLT), such as blockchain, have the potential to improve current processes and systems by acting as a digital enabler across the infrastructure value chain.

Innovation in infrastructure services like transportation, energy and water – which account for a significant amount of global emissions – could have a substantial impact on reducing emissions. But this requires game-changing approaches to reimagining how a low-carbon transition could be accomplished, at low-cost, and in an equitable way. The core properties of blockchain and other DLT can enable deeper technological integration, standardisation, and the possibility of new business models. Their potential for integration with other important digital technologies like the internet of things and artificial intelligence could have profound implications for traditional infrastructure services.

A case study report from the OECD identifies key areas where blockchain is already impacting the provision of sustainable infrastructure services, and presents four original case studies where blockchain could unlock value across the infrastructure life cycle. A roadmap for public and private sector actors provides guidance on bringing ideas to life through pilot programmes. The technology's potential advantages and disadvantages are outlined, along with implications for policy makers.

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Why blockchain?

Fundamentals of blockchain technology

The core competencies of blockchain technology -- transparency, data auditability, privacy, value transfer, and process efficiency and automation -- can be leveraged to drive the systemic changes needed to deliver sustainable infrastructure. The properties of decentralised trust and immutable records enable real transfer of ownership. While it was only possible to copy data via the internet in the past, blockchain accelerates the move to an "internet of value". This enables intangible or tangible assets like currencies, shares, infrastructure securities, data, or obligations like contracts to be exchanged, without the need for intermediaries, via the trusted ledger.

When thinking about blockchain, carbon neutrality is not the first thing that comes to mind. Bitcoin, blockchain's first application, is widely known as an environmental polluter, consuming massive amounts of energy and emitting vast amounts of CO_2 in order to validate transactions and sustain the network. However, concerns of this nature hold true only for specific applications of the underlying technology. Depending on network architecture and choice of protocols, blockchain can be deployed in more energy-efficient ways. For example, private blockchains using algorithms like proof-of-authority (PoA), when set up properly, do not consume more energy than traditional database solutions.

Blockchain as a digital enabler across the infrastructure value chain

Blockchain technology could unlock **new sources of financing** and mobilise existing industry pledges to carbon reduction through establishing new financing platforms. A clear objective is to lower the cost of capital for infrastructure projects, along with improved liquidity, transparency, and expanded access to finance.

Secondly, the technology could bring **visibility to alignment** with sustainability goals by enabling countries and stakeholders to track data and information on infrastructure projects. Blockchain-enabled platforms are a way to standardise data, assess asset performance, and enhance compliance (such as to sustainability or ESG standards), which may be further augmented when they are integrated with remote sensors (internet of things), or linked to deep analytics like artificial intelligence applications.

Thirdly, it can enhance **awareness and access** by acting as a transaction-enabling infrastructure of new market models. This can incentivise and increase institutions' and consumers' willingness and ability to contribute to building long-term sustainability, driving also changes within industries to adapt to the shifting demands of consumers.

An array of possible use cases

The role of blockchain in the context of sustainable infrastructure is considered to be far beyond enabling efficient data collection, monitoring, reporting and steering services. The technology can potentially also address the key challenges and opportunities in supporting mitigation and adaptation-related activities, especially in the energy, transport and agriculture industries, as shown in Figure 1. Use cases are clustered in categories of action that contribute to addressing the three main opportunities already described.

Blockchain technology and low-carbon infrastructure

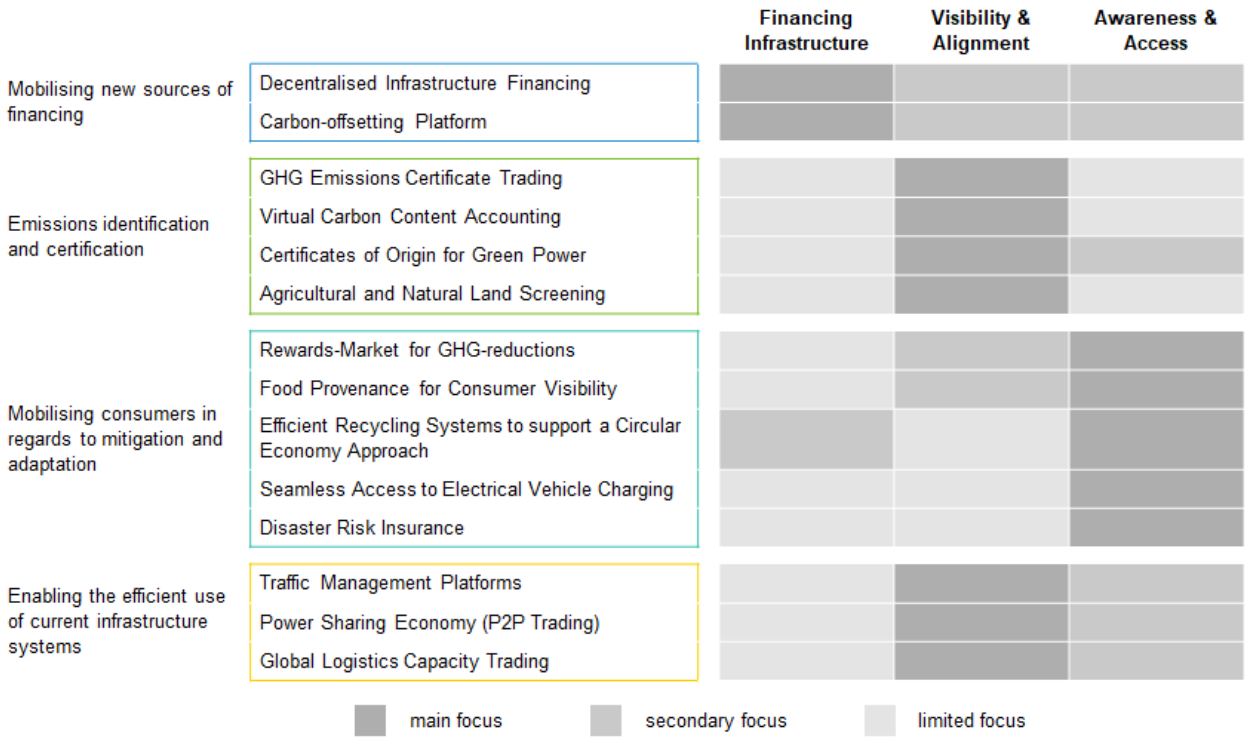
Implications for policy makers

Blockchain technology offers potential in building collaborative platforms and network systems, which can help in the achievement of country investment goals, including for the low-carbon transition. However, a number of policy actions are needed to facilitate the development of blockchain-based solutions in a safe and fair way.

A general lack of education and knowledge regarding its principles and drawbacks is observed in the market. Applying new technologies, especially in untested markets, poses risks which need to be compared with benefits. Proper technical set-up is crucial for addressing challenges in network scalability and processing speeds, and to reduce security risks. This makes increasing fact-based knowledge and training of relevant decision makers essential to fulfilling the technology's potential. Policy makers should take initial steps to address legal and regulatory issues related to the use of blockchain technology. As many of these issues reach across borders, the international coordination of policy actions is needed. Some specific actions include:

- Promote an openly accessible, standardised "toolbox" and education materials on blockchain that will facilitate further research and development in the field. In this way, countries and their private and public research institutions can be supported in developing or building on blockchain solutions.
- Knowledge transfer to developing economies will be key to generating buy-in from related stakeholders. Use case concepts and technologies can be jointly validated through research-based collaborations and partnering with public and private organisations.
- Clarify regulatory treatment, particularly in the realm of securities law, tax law, the legal recognition of data stemming from blockchain databases, as well as data privacy and consumer protection. A closer collaboration between governmental regulators and the wider blockchain ecosystem consisting of actors in the private sector could be considered.
- Relevant national and international organisations may initiate and govern dedicated working groups of selected technology providers and industry representatives to study the potential benefits and challenges of blockchain. Community platforms created by international organisations also help to drive the exchange of information and experiences. Examples include: the OECD Blockchain Policy Forum, the OECD Blockchain Policy Centre (www.oecd.org/daf/blockchain), and the recently launched OECD Sustainable Infrastructure Policy Initiative.

Figure 1. Relevant use cases to support climate mitigation and adaptation



Case studies for blockchain and infrastructure

Infrastructure investment has long been a key theme in global fora such as the G7, G20, and APEC where policy work increasingly focuses on quality infrastructure to support inclusive growth. The 2018 G20 Roadmap to Infrastructure as an Asset Class addresses ways to improve the overall investment environment for infrastructure. This work, combined with OECD work on infrastructure, data and performance measurement, and finance, yields key policy objectives relevant to the blockchain context. These include building greater standardisation in infrastructure across the asset lifecycle, managing risks in infrastructure through risk mitigation and identification, the mobilisation of data from public and private sources, and diversifying sources of finance, particularly through capital market channels. The forward-looking case studies presented in the report describe potential DLT applications that are closely aligned with these objectives.

Case study 1 - A **decentralised financing infrastructure** could enable the full spectrum of investors to invest directly in sustainable infrastructure through a blockchain-based platform, transforming illiquid assets into tradeable digital assets and increasing financing flows for sustainable development. Two financing methods are proposed: projects that issue security tokens where investors receive a return on investment according to project performance; and a utility token through which purchasers receive access to future services provided by the infrastructure project. Tokenisation of infrastructure also enables automation of processes and reduced reliance on intermediaries, with reduced cost of administrative functions.

Case study 2 - **Emissions certificate trading systems** could be made more efficient by providing transparency and reliable data through a global blockchain layer. This helps to effectively control quota rules, certificate circulation, promote market integrity and robust carbon accounting while also automating transactions and increasing overall efficiency. Regulatory, compliance, and administrative functions can be codified in the system, creating a transparent book of accounts on emissions. A blockchain-enabled platform could also link treaty-level registries in support of the Paris Agreement, particularly relating to Articles 2.1c and 6.

Case study 3 - A **blockchain-based infrastructure contract management system**, which verifies and tracks the valid and legally binding versions of contracts in infrastructure projects, could immensely improve transparency in current multi-party contract agreements. Involved parties adopting such IT systems can benefit from the certainty of knowing which contract version is valid, and review the conditions at any given time, leading to more streamlined and automated processes. This solution would work in tandem with existing IT environments, like document management systems, enabling a high amount of security for sensitive documents, while providing a trusted single view on multi-party contracts.

Case study 4 - An underlying blockchain base protocol layer could allow decentralised applications to be built by any organisation to support the **governance, alignment and monitoring of various infrastructure standards**. Decision makers, including investors, require access to genuine, standardised, and up-to-date information on infrastructure assets. This could include data on financial performance, but also on ESG criteria or climate-related disclosures. Given that existing data is fragmented and may be unaligned with climate objectives, a blockchain-enabled platform would provide the digital backbone needed to support data transparency for sustainable infrastructure development, while also enabling automated compliance checks, data standardisation, and integration with other digital technologies like deep analytics (artificial intelligence) and remote sensors (internet of things).

Background

The report "Financing Climate Futures: Blockchain Technologies as a Digital Enabler for Sustainable Infrastructure" is part of the Financing Climate Futures: Rethinking Infrastructure initiative, a collaborative effort between the Organisation for Economic Co-operation and Development, the UN Environment and the World Bank Group.

Contacts Joel.Paula@oecd.org; Timothy.Bishop@oecd.org

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