



SUSTAINABILITY

Digital environment, the role of blockchain in sustainability

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Blockchain technology became available to the public in 2009 when Bitcoin was released.^[1] The technology used a vast amount of electricity, ^[2] the majority of which was consumed in the People's Republic of China, a country which relies on fossil fuels to produce most of its electricity.^[3] Blockchain technology, especially crypto asset^[4] mining, soon became synonymous with generating extensive carbon emissions as a result of the high electricity consumption that is associated with using blockchain technology.^[5] Despite the aforementioned, blockchain technology is characterised by its decentralised and immutable nature, which makes it secure and transparent as information stored on the blockchain cannot be altered by any single party.^[6] By adopting energy-efficient consensus mechanisms, leveraging renewable energy and implementing carbon offset solutions, blockchain is a powerful tool that can be used to achieve global sustainability goals and is applied in sustainability initiatives such as the carbon credits trade, waste reduction, and various sustainable projects. As blockchain technology continues to improve, so does its ever increasing capacity to facilitate the global transition to a more sustainable future.

Integrating sustainability into blockchain technology

The integration of sustainability into blockchain technology, a historically carbon intensive technology, is a groundbreaking shift in how industries can approach environmental responsibility and resource management. The decentralised, transparent and immutable

characteristics of blockchain technology promotes transparency as the information is available for all users to access,^[7] and is secure as would take the majority of the users of a network acting in concert to change the information.^[8] The process of adding information to the blockchain is also efficient as users are not dependant on inefficient central authority.^[9]

These characteristics of the technology make it a powerful tool to improve sustainability. Businesses using blockchain technology to adhere to sustainability standards can ensure a higher level of accountability and efficiency as the information stored is transparent to users and cannot be easily altered or manipulated. These benefits can be harnessed to improve the integrity and reliability of information in corporate governance by making practices like back dating impossible.^[10] The technology is also suitable for trading carbon credits to facilitate carbon offsetting, a practice which historically has been inconsistent with unreliable data and was susceptible to manipulation and fraud.^[11] The use of blockchain technology has made the process more efficient, transparent and reliable.

Changes are also being made to the technology itself to combat its energy intensive nature. Many cryptocurrencies, such as Bitcoin, make use of a proof of work system to verify transactions which by nature requires users to expend a large amount of computing power and electricity.^[12] In an attempt to become more sustainable, the alternative proof of stake was implemented by platforms like Ethereum which has reduced its electricity consumption.^[13]

The developments in blockchain have continued to increase its potential to enhance sustainable development and has shown that it can play a pivotal role in fostering a greener, more resilient future where environmental stewardship and economic growth can co-exist.

Sustainability tokens

Sustainability tokens are crypto assets designed to incentivise and fund environmentally and socially responsible initiatives. Various sustainability tokens have been developed over the years for the aforementioned purpose, including –

- the FishCoin token, a token issued by the FishCoin Project. The purpose of this project is to eliminate wastage in an industry where 89% of global wild fish stocks are overfished or fully exploited and approximately 60% of the seafood is discarded, lost or wasted in supply chains.^[14] In order to combat this inefficiency, FishCoin uses blockchain technology to enable fishermen to record data about the fish they have caught on blockchain in exchange for tokens.^[15] Each person in the supply chain adds to this data in the blockchain until the fish are at the end consumer, being hotels and restaurants. The increased information allows wastages and inefficiencies in the supply chain to be discovered and mitigated. FishCoin, therefore, plays a pivotal role in reducing overfishing and promoting sustainable fishing practices;
- the HARA Agri tokens issued by HARA, a blockchain based technology company. The project aims to address a similar wastage problem which is present in the farming industry, with 30% of global food produce being wasted or lost.^[16] The project encourages farmers to record information on the blockchain regarding their operations in exchange for HARA Agri tokens, which can be exchanged for rewards such as discounts on agricultural supplies.^[17] Farmers can use the information, such as the supply and demand for a specific crop and more effectively manage stock and inventory to mitigate food wastage;^[18]
- the Plastic Bank Tokens developed by the social enterprise Plastic Bank. The project aims to reduce plastic waste and provide economic benefits to communities.^[19] The token is funded by donations in the form of a membership fees.^[20] It provides communities collecting plastic waste with tokens that can be converted into either (i) money or (ii) goods and services such as tuition and social benefits.^[21] The collected plastic is then recycled by the Plastic Bank partners and reintegrated into new products. This establishes a circular economy where plastic waste is continually recycled and reused. The use of blockchain technology allows the impact of the collections and recycling to be verifiable and traceable;
- the SolarCoin cryptocurrency issued by the SolarCoin Foundation. The foundation aims to promote solar electricity production by reducing the production cost of the electricity. This initiative uses blockchain technology to verify the amount of solar electricity generated by producers registered with the SolarCoin Foundation.^[22] The producers are then rewarded with SolarCoins which can be used as a typical cryptocurrency that can be exchanged for other cryptocurrencies or fiat, or spent at a growing network of businesses.^[23] This aims to incentivise the production of renewable energy; and
- the carbon credits issued by CarbonX, an organisation which has combined with the Zerofootprint program to use blockchain technology to lower carbon emissions. The Zerofootprint program measures and verifies the carbon impact of an organisation.^[24] The organisation can then purchase carbon credits, which are generated through sustainable initiatives, like reforestation, to offset carbon emissions.^[25] CarbonX uses blockchain technology to store the recorded information and to provide the platform to trade carbon credits. The

blockchain technology eliminates historical problems associated with carbon credits by increasing transparency, reliability and eliminating double counting.

The strides that blockchain technology has made in sustainability may also find application in the Republic of South Africa ("**South Africa**"), a country which has committed to reducing its greenhouse gas emissions as a signatory of the Paris Agreement in terms of which it aims to reach net zero emissions by 2050.[26] As part of this commitment, in July 2024, the Climate Change Act 22 of 2024 ("**Act**") was assented to by the President of South Africa. Although the Act is not yet in force, it plans to impose a limit on the amount of greenhouse gases, *inter alia*, a company may emit by assigning a carbon budget to such company.[27] Blockchain has the potential to be a useful tool in facilitating the implementation of the Act, by incorporating the reliability and transparency of the technology into the reporting process. It can also be used to facilitate the purchase of carbon credits by companies seeking to minimise the amount of carbon tax payable in terms of the Carbon Tax Act 15 of 2019.[28]

In the meantime, companies should in any event consider how they can use blockchain technology in their sustainability efforts. Inspiration can be taken from renewable energy initiatives such as the SolarCoin project. These initiatives are especially important in the South African context where the energy supply is unstable and heavily dependant on fossil fuels and where many South Africans are seeking to become self sustainable.[29] The instability of the power supply should also warrant the selection of an energy efficient consensus mechanism, in the use of blockchain technology in any sustainability project.

Conclusion

At its inception, blockchain technology was energy intensive and relied on fossil fuels to generate the requisite electricity. As the technology developed, so did its capacity to contribute meaningfully to global sustainability initiatives. The decentralised nature of the technology promotes transparency and efficiency that supports sustainability initiatives and reporting. The integration of sustainability in blockchain technology represents an important step toward a more environmentally responsible digital future and its ever developing nature presents unlimited possibilities for future deployment for sustainability initiatives.

[1] Sedlmeir J *et al* "The energy consumption of blockchain technology: beyond myth" (2020) <https://link.springer.com/article/10.1007/s12599-020-00656-x> [accessed 4 March 2025] page 599 ("**The energy consumption of blockchain technology**")

[2] The energy consumption of blockchain technology page 599

[3] <https://www.techinasia.com/inner-mongolia-bitcoin-mine> [accessed 4 March 2025]

[4] According to 'Declaration of a Crypto Asset as a Financial Product Under the Financial Advisory and Intermediary Services Act, 2022' published under General Notice 1350 in *Government Gazette* 47334 of 19 October 2022, a crypto asset is defined as a digital representation of value that –

(a) is not issued by a central bank, but is capable of being traded, transferred or stored electronically by natural and legal persons for the purpose of payment, investment and other forms of utility;

(b) applies cryptographic techniques; and

(c) uses distributed ledger technology

[5] Stoll C *et al* "The carbon footprint of Bitcoin" (2019) <http://sciencedirect.com/science/article/pii/S2542435119302557#bib5> [accessed 4 March 2025]

[6] The UNCTDAD secretariat "Harnessing blockchain technologies for sustainable development" (2024) https://unctad.org/system/files/official-document/ciid52_en.pdf [accessed 4 March 2025].

[7] Investopedia – Blockchain

[8] Investopedia – Blockchain

[9] Investopedia – Blockchain

[10] Akgiray V "The potential for blockchain technology in corporate governance" (2019) https://www.oecd.org/content/dam/oecd/en/publications/reports/2019/06/the-potential-for-blockchain-technology-in-corporate-governance_3f26824e/ef4eba4c-en.pdf#page=20&zoom=100,82,186 [accessed 5 March 2025] page 20

[11] Hoskin O *et al* "Tokenized carbon credits: how blockchain is revolutionizing carbon markets" (2025) <https://www.lexology.com/library/detail.aspx?g=2704d8a7-fa26-40ac-8366-9dea0dc4433e> [accessed 5 March 2025]

[12] Alvarez IA *et al* "Unsealing the secrets of blockchain consensus: A systematic comparison of the formal security of proof-of-work and proof-of-stake" (2024) <https://dl.acm.org/doi/pdf/10.1145/3605098.3635970> [accessed 3 March 2025] page 280

[13] Cambridge Blockchain Network Sustainability Index: CBECI [Accessed 26 February 2025]. Bitcoin used 121.13 TWh of electricity in 2023, while Ethereum used only 0.00585 TWh.

[14] <https://fishcoin.co/> [Accessed 26 February 2025]

[15] <https://fishcoin.co/> [Accessed 26 February 2025]

[16] D Uzsoki *et al* "Impact tokens: a blockchain-based solution for impact investing" (2019) <https://www.iisd.org/system/files/publications/impact-tokens.pdf> [Accessed 26 February 2025] ("**Impact tokens**") page 20

[17] Impact tokens page 21

[18] Impact tokens page 21

[19] <https://plasticbank.com/about/> [Accessed 26 February 2025]

[20] <https://plasticbank.com/about/> [Accessed 26 February 2025]

[21] <https://plasticbank.com/about/> [Accessed 26 February 2025]

[22] <https://solarcoin.org/> [accessed 5 March 2025]

[23] <https://solarcoin.org/> [accessed 5 March 2025]

[24] <https://www.carbonx.ca/projects> [accessed 5 March 2025]

[25] <https://www.carbonx.ca/projects> [accessed 5 March 2025]

[26] <https://www.wri.org/news/statement-south-africas-climate-commitment-much-more-ambitious> [access 6 March 2025]

[27] The Act, section 27

[28] Section 13.

[29] <https://ember-energy.org/countries-and-regions/south-africa/#:~:text=South%20Africa%20generated%2017%25%20of,the%20highest%20in%20the%20G20> [accessed 6 March 2025]



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