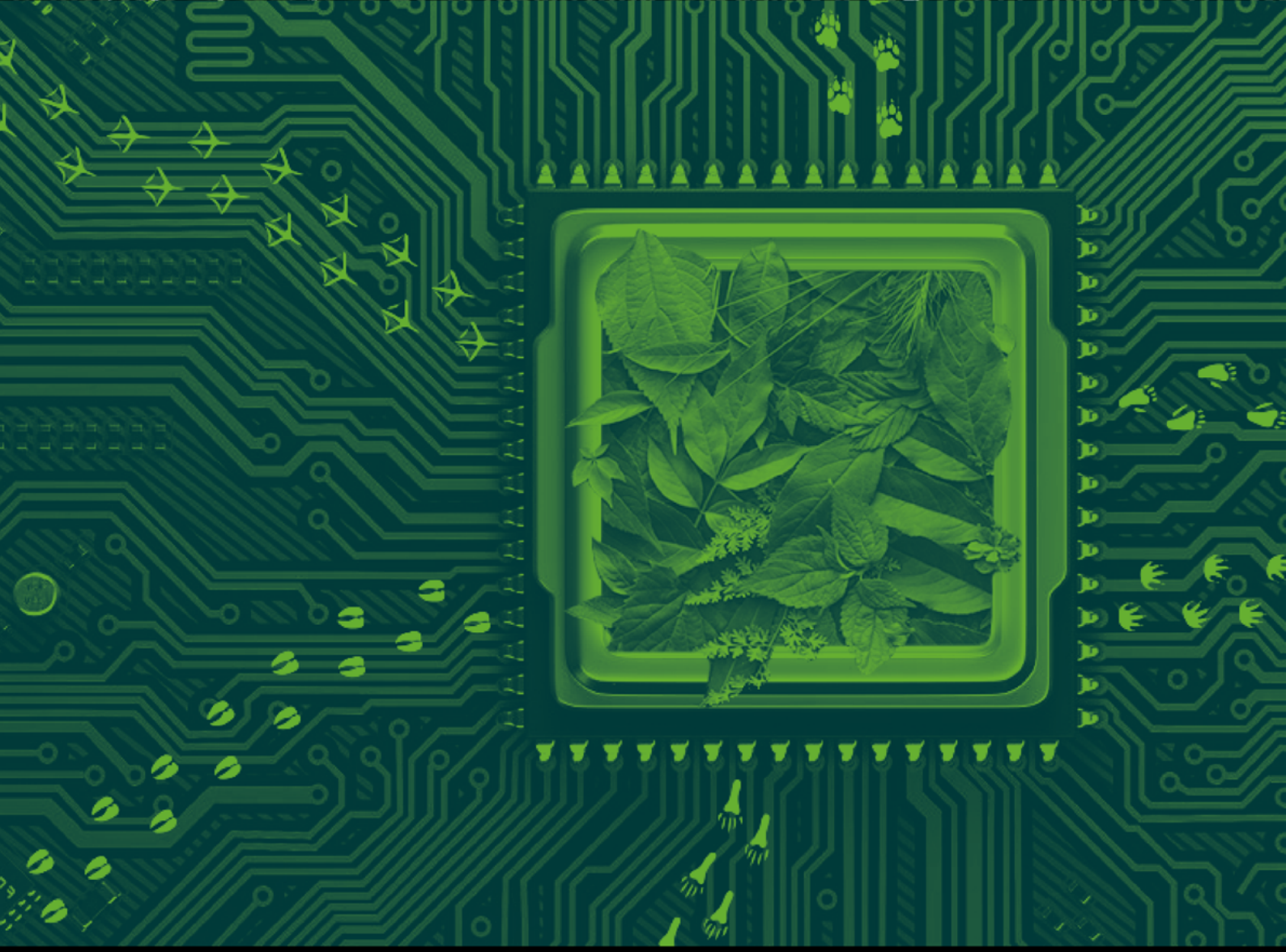

Digital Tokens for Climate Action and Nature-Based Solutions

EXPLORATION OF OPPORTUNITIES AND CONSIDERATIONS

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IDB | LAB

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FOREWORD

Latin America and the Caribbean is the principal region of biodiversity of the world, holding 40% of the world's biodiversity, 30% of the freshwater, and almost 50% of the world's tropical forests. Apart from the intrinsic value and services natural capital provides, it is critical in post-COVID-19 recovery for the region as it creates jobs, generates income, leverages private-sector investment, and acts as vital climate mitigation and resilience infrastructure.

Under the framework of the Paris Agreement, an increasing number of companies, financial institutions, and countries are claiming alignment with global climate goals, aiming for carbon neutrality by 2050. In addition, the causes of deforestation and unsustainable land use management are a complex interrelation of technical, technological, financial, institutional, and socioeconomic challenges. In this sense, there is a need for integral approaches that, among others, consider sustainable and responsible land use and management that can support the conservation and regeneration of biodiversity and help stabilize the climate. Despite these efforts to reverse the destruction of forests and other habitats, we are witnessing the fastest decline in biodiversity ever recorded.

There is no doubt that **nature is central to our response to climate change and the well-being of all ecosystems.** Nature-based Solutions are key in mitigation and adaptation to climate change while also contributing to other priorities such as economic recovery, biodiversity, and clean water. The political momentum created by the Paris agreement and the Global Biodiversity Framework, the Taskforce on Nature-Related Disclosure, and the numerous recent pledges of corporations shows that there is momentum for action. However, if we want to turn the current tipping points around, the world will need to increase manifold global biodiversity conservation and restoration financing and action over the next ten years. There is a need for integral approaches that, among others, consider sustainable and responsible land use and management that can support the conservation and regeneration of biodiversity and help stabilize the climate.

In the face of such environmental, social, and climate urgency, IDB Lab reinforces its commitment to support, finance, and design innovative and scalable solutions in Latin America and the Caribbean that address this unparalleled challenge. From this work, we create knowledge that, connected with down-to-earth experiments in Latin America and the Caribbean, generates awareness and tools for others to act and move the needle forward. We strive to improve people's lives, with a special focus on people in vulnerable situations, by valuing the region's biodiversity and ecosystem services, while providing innovative solutions to climate change impacts and natural capital degradation.

Using technology to lower costs and barriers to access, as well as a tool to generate social inclusion and democratize opportunities, is at the core of the intersection that we will be presenting in this document. Latin America and the Caribbean need to combine the opportunity that natural capital and biodiversity bring, with the acceleration of ecosystems of innovation and entrepreneurship aiming at inclusion and diversity. Focusing on developing local solutions will be critical to ensure that communities and local entrepreneurs are at the core of the green revolution in the region.

This report on digital tokens for climate action and nature-based solutions forms a valuable addition to the emerging body of knowledge and is specially intended to inform, inspire, and spur action for new, innovative, and potentially effective ways of providing financial resources and effective action for climate action and the conservation and regeneration of our natural capital. We want to thank all the organizations, communities, and startups in Latin America and the Caribbean that are entering the fascinating journey to use digital tokens to accelerate climate action and nature-based solutions.

César Buenadicha
Chief Discovery Officer, IDB Lab

Svante Persson
Senior Specialist, IDB Lab

FOREWORD

There is not a day that passes without hearing about the devastating effects of climate change and biodiversity loss, and their impact on the lives of all species, including us humans. Even though blockchain based technologies (or any technology in particular for the matter) are not the single solution to the climate and environmental crises, we owe it to ourselves and our unique planet to discover and pursue all the value that these new web3[1] tools can bring to innovate, accelerate, scale, and deepen responsible action in this field.

This report aims to add value in the understanding of how the harnessing of these digital tools can help untap opportunities in Latin America for climate action and the protection of its rich natural ecosystems. Moreover, it helps highlight the power and role of land management communities in this field, including indigenous peoples, who are key to conservation efforts. This work builds upon a broader effort of the IDB Lab, the Natural Capital Lab, C Minds´ Future of Earth Lab, the United Nations Environment Programme (UNEP), among a long list of other key institutions who are leading the intersection of frontier technologies and climate and biodiversity action in the region.

I wish this report becomes a catalyst of needed conversations on needed multi-sector collaborations, nature-tech and the tools that can facilitate having nature as an asset class. I hope it inspires more people to explore the opportunities web3 era can bring to enabling new social, environmental and conscious economic paradigms. There is a saying from Sawhill that my father told me constantly when I was little and has always inspired my work in sustainability: "In the end, our society will be defined not only by what we create but by what we refuse to destroy." In this sense, I hope that bringing more knowledge on new tools, the emerging cultural changes towards decentralization, and new forms of understanding, assigning and creating value to nature can help shift paradigms towards protecting what is most meaningful: our[2] home.

In the end, what is the development of better and more innovative tech-tools for if not to enable a more generalized well-being of all living systems, a more conscious and inclusive entrepreneurship, a more sustainable way of living, a more innovative way to account for nature in decision making and economics, and a greater respect and consideration of all cultures and forms of life?

Constanza Gómez Mont
Founder of C Minds and the AI for Climate Global Initiative; chair of the GFC AI for Humanity of the World Economic Forum 2021-2022.

1 Web3 is a concept that represents an evolution of the internet web layer which includes principles and technologies such as decentralization, blockchain, and token-based economics, among others.

2 Including all inanimate and animate matter.

EXECUTIVE SUMMARY

The climate and biodiversity loss crisis are no doubt two of the most pressing challenges of our times. They require collective action from all regions and disciplines. They require that communities from all latitudes and scales learn how to make use of the best technologies to help accelerate and scale response. The challenge is unprecedented and thus so is the call for creative, integral, and innovative answers. In this search for public and private sector solutions lies the exploration of digital tokens as tools for more transparent, agile, and decentralized processes. In the context of blockchain, digital tokens are assets that live in these blockchain networks. Smart contracts, which are programs that run in these networks, are used to establish the logic of the token, as well as the history of transactions and balances. Tokens are classified as fungible when they are not unique and can be divided into subunits, as it happens with cryptocurrencies. Tokens can also be classified as non-fungible (NFTs) when each one has specific features and cannot be divided into parts.

Both fungible tokens and NFTs can be used for financial and non-financial applications. Even though there is no global definition or universally accepted categorization for digital tokens, the types are generally divided into security tokens, cryptocurrencies, utility tokens, and non-fungible tokens (NFTs). Their qualities of traceability and fractionality (that can enable greater liquidity and financing opportunities), among other aspects, make these tools unique in the development of new forms of the sharing of information, the distribution of benefits, and the trading of value. Digital tokens have created the foundation of a global movement named Regenerative Finance (ReFi) which has the promotion of Sustainable Development Goals (SDGs), with a current strong focus on climate change, in a transparent and accessible manner at its core. Experts claim that ReFi allows users to redefine their relationship with the actual financial system and their relationship with finances and wealth.

Even if applications are nascent, the climate and biodiversity conservation and regeneration fields are taking advantage of these tools already. For example, digital tokens are being explored currently as mechanisms to fundraise for nature-based projects; participate in the carbon market - decarbonization projects; share data between various organizations and information points; create supply chain transparency; among others.

The list of case studies with different applications of digital tokens in the environmental realm is growing globally at a fast pace. **However, there is still a great opportunity to untap in the use of these tools in rich biodiversity areas** such as Latin America and the Caribbean; a region that hosts more than 40% of the world's biodiversity, 30% of fresh water available on earth and almost 50% of the global tropical rainforests; serving as lungs to the entire planet as well. There is no possibility of responding effectively to climate change and the well-being of all ecosystems on a global scale without innovating and scaling action in this region.

There is no doubt that digital tokens present various opportunities; however, these innovative tools raise questions that need to be addressed related to their understanding, their governance (including transparency and accountability), and the inclusion and distribution of benefits to communities that live in or around biodiversity-rich areas, especially indigenous peoples. An ethical and human rights-based approach; the development of inclusive governance structures; the creation of fair and conscious business models; the access to educational opportunities; and the respect of different epistemological concepts of **nature´s value beyond economic terms need to be taken into accoun**t in the development and adoption of these technologies.

In the quest to achieve climate justice, reach the goal of Net Zero by 2050, the ambitious targets of the 2022 Kunming-Montreal Global Biodiversity Framework, and accomplish other environmental and social 2030 Sustainability Goals, the exploration of digital tokens as tools for more inclusive and fair economic paradigms and social constructs that are embedded within nature, not external to it, is key.

INTRODUCTION

There is no doubt about the intrinsic and tangible value of biodiversity, as home and support to all animate matter and in the services it supplies to humans and all forms of life. It provides essential services such as clean air and fresh water, it has regulating benefits over pests and diseases. Moreover, biodiversity can combat the climate crisis, absorbing greenhouse gasses naturally. The United Nations estimates that global oceans and terrestrial ecosystems each absorb 25 percent of all CO_2[3] emissions, and nature-based solutions could account for roughly 40 percent of the carbon emission reduction needed to limit global warming to remain below two degrees Celsius by 2030[4]. Also, more than half of the world's Gross Domestic Product (GDP)[5] is dependent on nature[6] and 80 percent of the needs of the people living in poverty are derived from biological resources[7]. Furthermore, the livelihoods and cultures of indigenous peoples and other land management communities are immersed in nature on land which accounts for 32 percent of the land globally[8].

The list of biodiversity's environmental, social, cultural, and economic benefits is too long to enumerate. However, the level of its loss and degradation is at critical levels and approaching a tipping point. The latter is mostly due to human activities such as pollution, exploitation, deforestation, improper land use, and the effects of climate change. A recent UN report states that one in four species is in danger of extinction[9]. This means that around one million species already face extinction, many within decades. Also, without any meaningful action, **continued regional deforestation, climate change, and wildfires can result in a loss of up to 60 percent of the Amazon basin's forest by 2050[10].**

Overall, experts state that the collapse of ecosystem services provided by nature – such as wild pollination, provision of food from marine fisheries, and timber from native forests – could result in a decline in global GDP of $2.7 trillion annually by 2030[11]. As the Dasgupta Review (2021) states, there is an existing 'Impact Inequality' meaning that *there is an imbalance between the demands of humans and Nature´s capacity to supply us with the goods and services humans all rely on. In this sense, between 1992 and 2014, produced capital per person doubled, and human capital per person increased by about 13% globally; but the stock of natural capital per person declined by nearly 40%*[12].

This continuous environmental crisis requires the most effective solutions for its regeneration, protection, and resiliency. There is a need for the public and private sectors to increase the exploration of

3 UN. Climate Action Fast Facts. https://www.un.org/sites/un2.un.org/files/fasct_fact_-_ocean_oct_2022.pdf

4 Griscom, B. W., Adams, J., Ellis, P. W., Houghton, R. A., Lomax, G., Miteva, D. A., Schlesinger, W. H., Shoch, D., Siikamäki, J. V., Smith, P., Woodbury, P., Zganjar, C., Blackman, A., Campari, J., Conant, R. T., Delgado, C., Elias, P., Gopalakrishna, T., Hamsik, M. R., Fargione, J. (2017). Natural climate solutions. Proceedings of the National Academy of Sciences, 114(44), 11645-11650. https://doi.org/10.1073/pnas.1710465114

5 Gross domestic Product: Standard measure of the value added created through the production of goods and services in a country during a certain period. It also measures the income earned from that production, or the total amount spent on final goods and services (less imports) OECD. Gross Domestic Product (GDP). https://data.oecd.org/gdp/gross-domestic-product-gdp.htm

6 WEF.Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy. https://www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf

7 UN International Day for Biological Diversity. https://www.un.org/en/observances/biological-diversity-day

8 ICCA Consortium. Territories of Life: https://report.territoriesoflife.org/

9 UN Worlds is 'on notice' as major UN report shows one million species face extinction. https://news.un.org/en/story/2019/05/1037941

10 Nobre, C. A., Sampaio, G., Borma, L. S., Castilla-Rubio, J. C., Silva, J. S. & Cardoso, M. (2016). Land-use and climate change risks in the Amazon and the need for a novel sustainable development paradigm. Proceedings of the National Academy of Sciences, 113(39), 10759-10768. https://doi.org/10.1073/pnas.1605516113.

11 CBD World Bank Report: The Economic Case for Nature. https://www.cbd.int/article/world-bank-economic-case-for-nature

12 Gov.UK: The Economics of Biodiversity: The Dasgupta Review – Headline Messages. https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review

innovative, effective, and market-based solutions that take into account the previously mentioned Impact Inequality. The pressing needs to simplify the certification and value assignment of natural assets; lower the barrier of access to financial resources that can be quickly connected to local and global markets, adapted and localized to the needs of biodiversity conservation; the creation of more transparent and traceable models and operations; and the lowering of barriers for the development of schemes and business models that allow for distributed processes, governance, and benefits, among other challenges for this field become key challenges of our times. Most importantly, addressing the challenges low income countries face to access funding and resources has to be central to discussions and action if climate justice[13] is to be the norm.

In this unprecedented quest for new and better answers, new digital technologies become valuable tools to untap possibilities of biodiversity conservation and nature-based climate action. Specifically, the rise of digital tokens has become a key aspect of digital transformation as they are allowing new ways of trading value and sharing information, among other factors that are explored in this report. According to the International Data Corporation (IDC), the global tokenized asset market would reach a valuation of 500 billion USD by 2025[14]. And, even if their exploration and use are nascent for the field of biodiversity conservation, their opportunities and challenges are worth exploring as they can become key tools for the climate and biodiversity conservation agendas.

In this sense, this report aims to make accessible, in a summarized way, the basic knowledge about digital tokens, present examples of applications, and analyze the opportunities and considerations for their adoption in the biodiversity conservation and climate field. It is written for non-technical researchers, practitioners, and decision-makers working in any sector related to this area and has a special focus on local communities that are being impacted directly and indirectly by the adoption of these technologies.

This publication is an effort led by the **Inter-American Development Bank Lab (IDB Lab)** with the support of the Latin-American-born initiative **AI for Climate** by **C Minds** and the contribution of a group of experts[15]. Moreover, it is part of a larger vision of IDB Lab to enable opportunities in this field in Latin America and the Caribbean. Part of these efforts includes the financial support of solutions in the region through a Challenge launched in 2022 (Box A), and other actions aimed at creating more awareness and promoting collaborations between local communities, the technological ecosystem, and other actors that are based on ethical and human rights approaches. Moreover, it goes hand in hand with the efforts of LACChain, a global alliance led by IDB Lab to develop the blockchain ecosystem in Latin America; as well as the work of the Natural Capital Lab and fAIr LAC of the IDB.

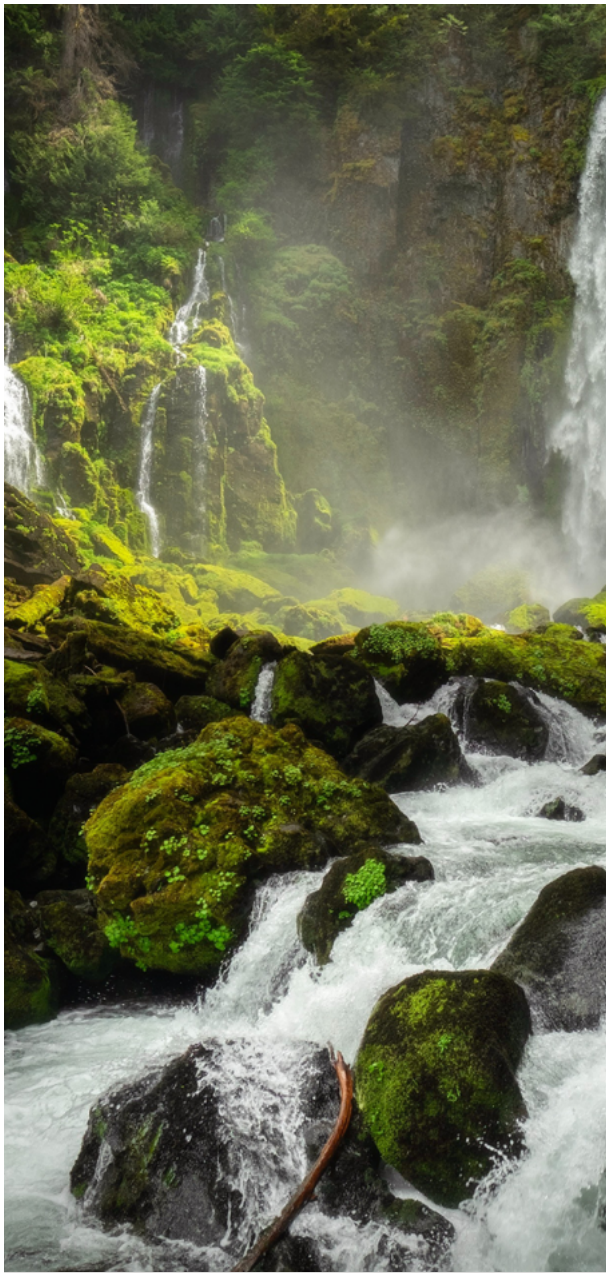
13 See more: The conversation. https://theconversation.com/global-climate-finance-is-still-not-reaching-those-who-need-it-most-115268

14 IBM Blockchain tokenization in enterprises and beyond. https://www.ibm.com/blogs/blockchain/2021/02/blockchain-tokenization-in-enterprises-and-beyond/

15 Found in the appreciation section of this Report.

This report is by no means meant to be exhaustive and is limited by its length and scope of research that ended in September 2022. It builds upon existing knowledge of key institutions[16] and gathers examples of ongoing initiatives. And, as with any other conversations involving the understanding of new technologies and their application, it is recommended that the reader is updated with complementary emerging publications on the technology´s evolution and its impact.

IDB Lab and its partners wish that this knowledge can promote a general understanding of the practical use of these technologies for the sector to catalyze new and better ways to accelerate multisector action, and design innovative regulations with the decentralized community that can pave the way towards a secure and cross-jurisdiction responsible adoption. It wishes that this exploration can help analyze the use of these tools in nature as an asset class, and the redirection of Decentralized Finance (DeFi) towards regenerative assets (increasing Regenerative Finance (ReFi)[17]). Moreover, the report can hopefully shed a light on how value is understood and obtained from nature, one that is based on conservation and regeneration and not only extraction.



16 Such as the Social Alpha Foundation (SAF) and the United Nations Environment Programme´s (UNEP) report "Blockchain for sustainable energy and climate in the Global South" (2021); and the Report "Navigating Blockchain and Climate Action" of the Climate Ledger Initiative.

17 "Regenerative Finance is a new, noteworthy trend in the blockchain space and describes a subset of Decentralised Finance (DeFi) projects. ReFi projects aim to promote the Sustainable Development Goals (SDGs) and use their services to increase the transparency, accessibility and profitability of social and environmental projects." Innovation Forum (2022) https://innovation-forum.org/regenerative-finance-refi/

Box A: Digital Tokens for Biodiversity Challenge by IDB Lab. The Digital Tokens for Biodiversity Challenge was an effort led by IDB Lab with the support of LACChain and the Natural Capital Lab launched in 2022. Its objective was to support solutions that harness digital tokens, when appropriate, for biodiversity value creation and climate action in Latin America and the Caribbean. This included, but was not limited to, the establishment of market mechanisms to value nature, the transfer of financial value to community-led climate and sustainability actions, or simply to improve the efficiency, traceability, and transparency of its own and others' operations.

LET'S START WITH THE BASICS

To simplify the understanding of the basics of digital tokens, this section addresses main questions in a nontechnical and layperson way.

What is blockchain?

As per a report of IDB[18], in general terms, blockchain is a decentralized and immutable digital registry. It is decentralized because every participant can have a node, which is a device (typically a computer) having a full copy of the entire history of registrations. Participants can also use their nodes or applications connected to the nodes to interact with the network directly. Blockchain networks can be used to create crypto assets, to register data, and to automate processes using smart contracts, among other things. As of the end of the year 2022, there are thousands of blockchain networks that are based on different protocols that determine the throughput and the rules and mechanisms to package transactions into blocks through a process denominated consensus protocol.

So, what are digital tokens?

In the context of blockchain, tokens are assets that live in these blockchain networks. Smart contracts, which are programs that run in these networks, are used to establish the logic of the token, as well as the history of transactions and balances[19]. Tokens are classified as fungible when they are not unique and can be divided into subunits, as it happens with cryptocurrencies. Tokens can also be classified as non-fungible (NFTs) when each one has specific features and cannot be divided into parts. Both fungible tokens and NFTs can be used for financial and non-financial applications. In the case of NFTs, there are use cases when they represent purely digital assets such as crypto art, and use cases when they represent physical assets such as a land registry. Because they are created, issued, and managed on a blockchain network, they are meant to store or trade value on the internet.

Examples of NFTs tokens include digital representations of financial assets such as stocks and bonds, non-financial assets such as art, real estate, land, among a growing list. They are designed to be instantly transferable and can be programmed with various built-in functionalities in the form of smart contracts. These smart contracts give predefined qualities to the digital token, and the fact that they are deployed on a blockchain

18 IDB Blockchain: How to Develop Trust in Complex Surroundings to Generate Social Impact Value (2018) https://publications.iadb.org/en/blockchain-how-develop-trust-complex-surroundings-generate-social-impact-value

19 ConsenSys Tokenization: What is it and How Can it Help Business? (2019) https://www.youtube.com/watch?v=tRIJA4KAJi4

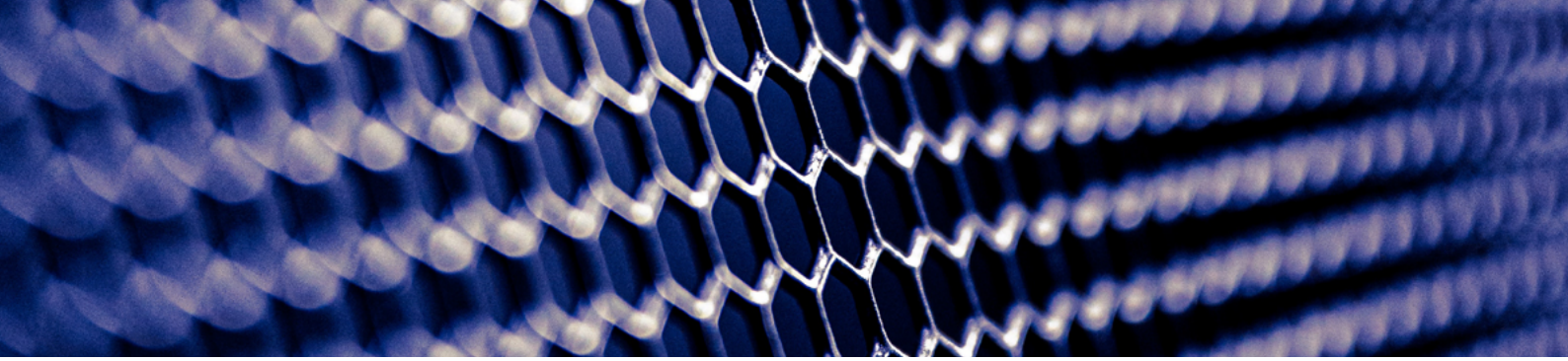


Foto de Art Rachen en Unsplash

network enables the development of automated and decentralized processes[20].

What types of digital tokens exist?

Even though there is no global definition or universally accepted categorization for digital tokens, the types are generally divided in[21]:

• **Security token.** This is a digital asset that represents ownership of a project or company. In other words, these types of tokens offer ownership rights of the asset that has been tokenized. Since there is a promise of profit in the form of interest or shares on the company's profit in any form, these tokens are subjected to regulations and securities that protect the investor and make sure the market is fair and efficient.

On the positive side, security tokens enable innovative methods to trade securities in real time avoiding counterparty risks and post-trade processes. They lower the barrier of access for investors, and provide traceability of ownership. Regulations to provide the required assurances are still under development (more in the Annex B).

Examples of security tokens include tokenized shares, bonds, notes, and Initial Coin Offerings (ICOs), among others. Some examples include the tokenized stocks of Tesla[22] and Amazon[23]. Moreover, they have been found useful for the raising of capital for pre-Initial Public Offering (IPO) companies.

• **Cryptocurrencies:** these are commonly referred to as crypto in short and belong to a specific blockchain network. They are a type of digital asset that works as a tool for digital transactions without a promise of profit. Examples of recognized crypto are Bitcoin[24], Ether[25], and Tether[26], among others. The global cryptocurrency exchange platform market size was valued at $30.18 billion in 2021 and is expected to grow at a compound annual growth rate (CAGR) of 27.8% from 2022 to 2030[27].

- **Stablecoin.** a type of cryptocurrency designed for price stability. They are linked to fiat currencies (such as pesos, dollars, euros or any recognized country currency), commodities, or other crypto assets[28].

• **Utility tokens:** they are designed to be used for a specific purpose. They offer holders certain predefined benefits such as access to services and products. They work similarly to a coupon and are not considered cash-type digital assets[29]. Their benefits include the improvement of accessibility of a product or service.

Examples include user tokens for a specific project or company that work as digital coupons that can be redeemed; virtual game tokens; rewards; and crowd-sales of projects (this works

20 Diego Geroni. Top 12 Smart Contract Use Cases. 101 Blockchains. https://101blockchains.com/smart-contract-use-cases/

21 Another way to categorize digital tokens can be found at https://medium.com/amazix/a-taxonomy-of-token-models-and-valuation-methodologies-7b6c0a1d02a9 ; and in the Coursera course "Criptoeconomía y Modelos de Tokens" (spanish) which can be viewed at https://kr.coursera.org/lecture/inversiones-en-cripto/criptoeconomia-y-modelos-de-tokens-rAY1B

22 See more: Tesla https://www.tesla.com/

23 See more: Amazon https://www.amazon.com/

24 See more: Bitcoin https://bitcoin.org/en/

25 See more: Ethereum https://ethereum.org/en/

26 See more: Tether https://tether.to/en/

27 Grand View Research. Cryptocurrency Exchange Platform Market Size, Share & Trends Analysis Report by Enduse, by Cryptocurrency Type, Region and Segment Forecasts, 2022-2030 (2021). https://www.grandviewresearch.com/industry-analysis/cryptocurrency-exchange-platform-market-report?fbclid=IwAR1pjUFWoyy_PHiyjFDDwhA0DBqEG8G6sHKP8fcfUB4mKsBhCfMVueWo00I

28 See more: PricewaterhouseCoopers (PwC) https://www.pwc.co.uk/industries/financial-services/insights/global-cbdc-index-and-stablecoin-overview-2022.html

29 Utility Tokens vs. Security Tokens: What's the Difference?by Crypto.com. https://crypto.com/

like ICOs but without voting rights), among others[30].

• **Nonfungible tokens (NFTs):** This is a token that can not be broken down into smaller pieces and has unique features. The main function of the NFT is to represent ownership of a unique item or asset, which can be digital or not.

What makes digital tokens different from the asset they represent? Why is this unique?

To start, digital tokens such as NFTs allow to represent both entire assets or fractions of an asset. This fractionality principle of digital tokens allows people to be able to own a piece of the total asset that becomes useful when fixed, non-liquid assets (such as art, music video, or a house) can not be broken down into fractions.

For example, you can not cut a Warhol painting into 5,000 pieces and sell each one separately. However, you can tokenize the painting, breaking it down into 5,000 components (referred to as tokens), and then sell each token independently.

This process potentially untaps new investment opportunities by lowering the barriers to access that can be both financial and geographical. It also helps create liquidity[31]. Liquidity shows how quickly and easily an asset can be bought, sold, or transferred. In the case of Warhol's painting, it could be easier to find multiple investors in many countries to pay a fraction of the price than one single investor to pay for the totality. In other words, by tokenizing the painting, it increased its liquidity.

This fractionalization principle allows various parties to own a component of the asset. This means that they enable a mechanism to distribute ownership in an agile way. This becomes useful, especially for assets that are fixed and not liquid. Moreover, digital tokens can open the door to financial derivatives.

What is the value of a digital token? Who establishes this value?

Tokens represent a digital unit of value. This unit of value is assigned and recognized by the community that issues the token. When a digital token is purchased, the buyer stays with the ownership of the token which is stored in their digital wallet and in some cases, can be traded. For this, there are marketplaces or exchanges where individuals and institutions can trade crypto assets against other crypto assets and against fiat currencies. When a trading mechanism is used, the value is determined by a demand-supply relation. In other cases, the value of the digital token is determined by the issuing party and can appreciate or depreciate depending on the change in the value of the asset it represents.

30 See more: Blockchain Council Reorient, Rethink, Revolutionize https://www.blockchain-council.org/

31 Liquidity: "In financial markets, liquidity refers to how quickly an investment can be sold without negatively impacting its price. The more liquid an investment is, the more quickly it can be sold (and vice versa), and the easier it is to sell it for fair value or current market value. All else being equal, more liquid assets trade at a premium and illiquid assets trade at a discount" (Corporate Finance Institute, 2020). See more: https://corporatefinanceinstitute.com/resources/knowledge/finance/liquidity/

Why so much fuzz? What are some of the main opportunities for the use of digital tokens?

- They allow **operational efficiency:** there is no central third party and automation processes help reduce the costs (including the reduction of overhead, the elimination of post-trade processes as settlement and clearing happen instantly, the elimination of counterparty risks, and other administrative costs) and the time to complete the transactions. This can help **scale** operations across borders with agility.

- They allow for the **fractionalization** of assets that enables greater **liquidity** and, generally, the decentralization of funding because of smaller transaction amounts that diversify profiles that can purchase them. This provides a more accessible, transparent, democratized, and standardized approach to funding.

- Since digital tokens and the operations related to them are on blockchain networks, there is **traceability** of the token state and its transactions, increasing **openness of the information that can translate into explainability** and streamlining of the processes.

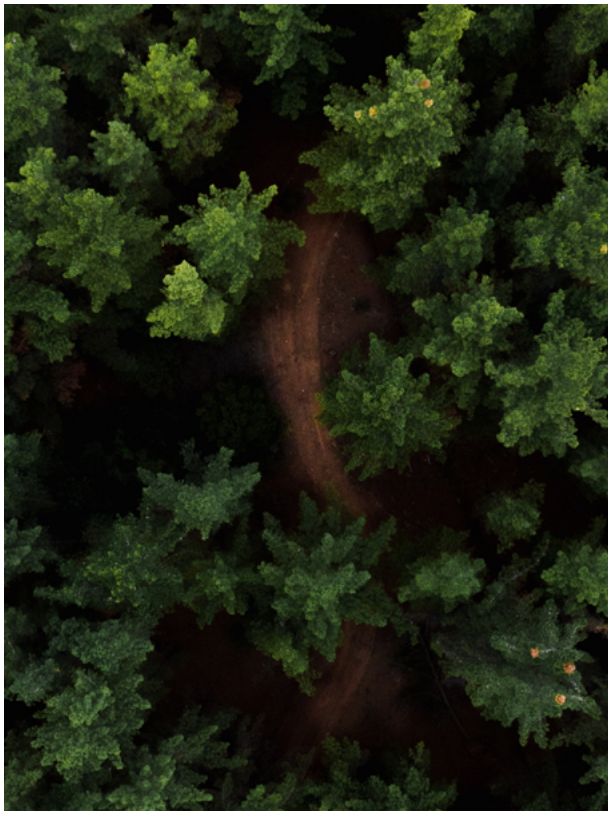
- It improves the **trustability and auditability** of processes which becomes key in environments where there is a presence of corruption or where distrust among parties prevails. Also, there is verifiable digital ownership and traceability as the assets evolve or change owners.

- Digital tokens may become **verifiable single sources of truth**, which promotes information symmetry, allowing new approaches to collaboration such as traceable and agile sharing of data.

- Because of all the attributes above, digital tokens can acquire value; thus they can be **monetized**, meaning they can embed intrinsic value that can be converted into fiat money later on.

Which are the types of Tokens in terms of fungibility?

There are Fungible or Non-Fungible tokens. Fungible means that all parts have precisely the same value and financial properties and thus can be interchangeable, added up, and subdivided into pieces. An example is cash or crypto. Non-fungible means that the token is unique and cannot be broken down into pieces.



How do you tokenize an asset?

Oversimplifying, the first step is to select an asset that you wish to tokenize. Technically, depending on the type of asset to tokenize, the next step is deciding which token standard to use and on which blockchain network configure and deploy the desired tokenized asset. To tokenize the asset, smart contracts are written with the selected token standard and deployed on the selected blockchain network. For some token design companies[32], the process includes analyzing market design (understanding how the digital token and business model improves markets or creates new ones), customer development (based on enough demand opportunity), protocol architecture (how it is built), and distribution (making sure the right people get the tokens).

Where are digital tokens stored once purchased?

They are stored in digital wallets (such as crypto and NFTs).

What are Decentralized Autonomous Organizations (DAOs)?

DAOs are new kinds of entities that are considered collections of individuals organized around decentralization, autonomous functioning, transparency, and bottom-up principles. Most of them are centered on cyber-related projects[33].

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Now that the basic information of digital tokens has been covered, let us explore how these tools are being harnessed in the field of climate change and biodiversity conservation.

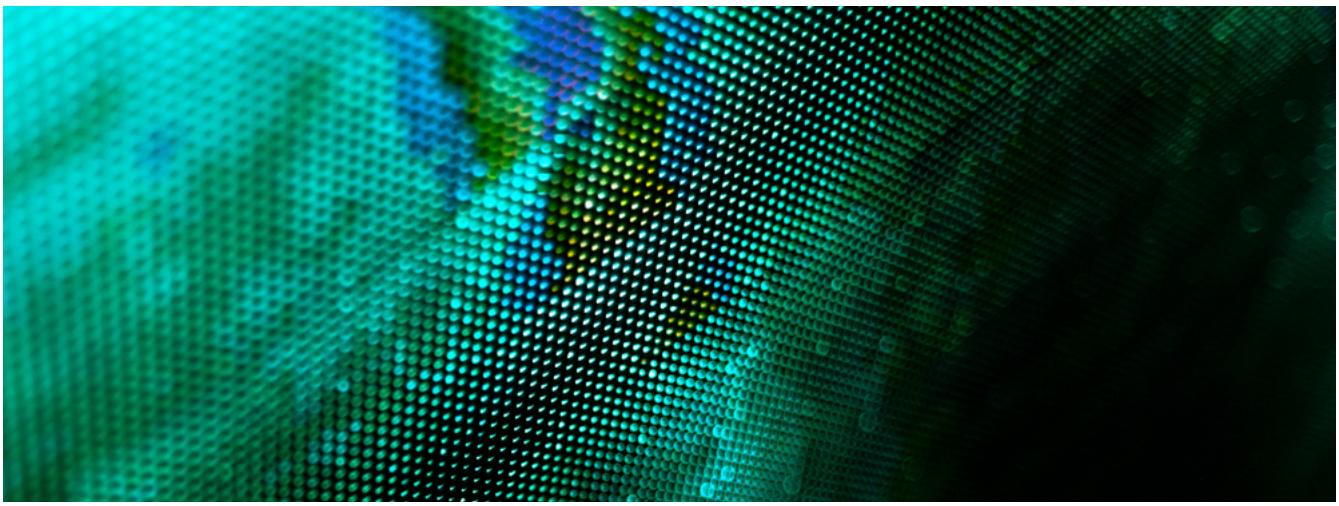
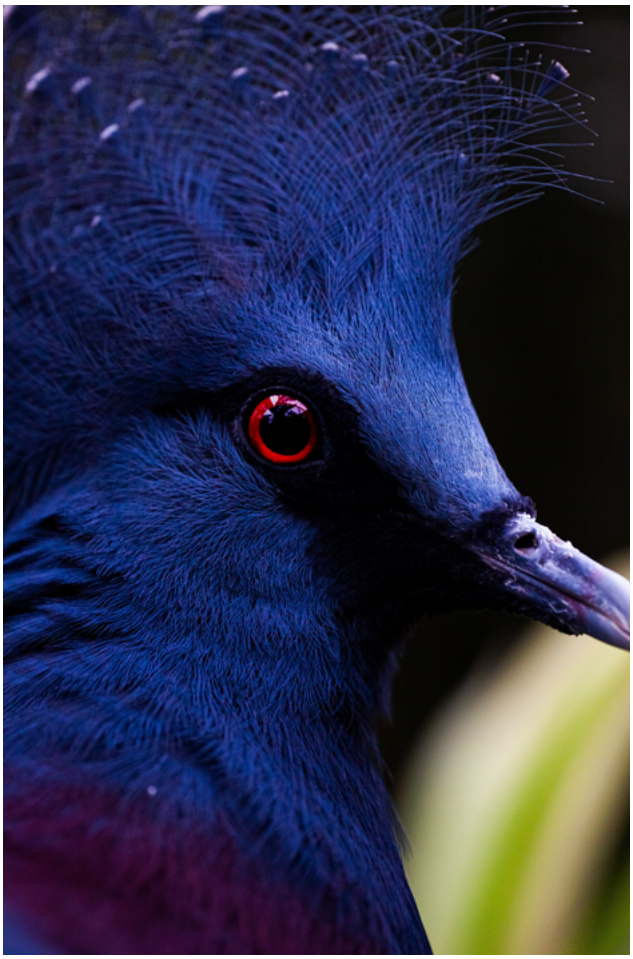


Foto de Nicholas Arnold en Unsplash

32 Such as ConsensSy, see more: ConsenSys Unlock web3, Build on Ethereum. Collaborate worldwide https://consensys.net/

33 See more: Harvard Law School. A Primer on DAOs. https://corpgov.law.harvard.edu/2022/09/17/a-primer-on-daos/

TYPE OF APPLICATIONS OF DIGITAL TOKENS FOR CLIMATE ACTION AND NATURE-BASED SOLUTIONS



Although lately these technologies have experienced a period of extreme hype, they are increasingly becoming mainstream and are being used by a growing number of businesses and industries to facilitate transactions, track information, democratize access to resources and introduce new assets and value propositions in their business models. Some experts claim that they make up the foundations for a complete paradigm shift in the digital economy[34].

Even though the adoption of these technologies is emerging, the climate and biodiversity field is no exception to its exploration. For example, digital tokens have created the foundation of a whole global movement named Regenerative Finance (ReFi) which has the promotion of Sustainable Development Goals (SDGs), with a current strong focus on climate change, in a transparent and accessible manner at its core[35]. Experts claim that ReFi allows users to redefine their relationship with the actual financial system and their relation with finances and wealth[36].

With the continuous growing demand for solutions to the climate and environmental crises, digital tokens present unique opportunities to address some of their challenges.

34 See more: https://www.mckinsey.com/industries/financial-services/our-insights/web3-beyond-the-hype

35 European Innovation Forum. Regenerative Finance (ReFi). https://innovation-forum.org/regenerative-finance-refi/

36 Mashiat Mutmainnah. CoinTelegraph. "What is regenerative finance (ReFi) and how can it impact NFTs and Web3?". https://cointelegraph.com/news/what-is-regenerative-finance-refi-and-how-can-it-impact-nfts-and-web3

Foto de Rui Silvestre en Unsplash

For example, digital tokens are being explored currently as mechanisms to:

a) Fundraise for nature-based projects including a mechanism for the ownership of rights of a digital or material asset tied to the financing of nature-based solutions;

b) Participate in the carbon market - decarbonization projects;

c) Share data between various organizations and information points;

d) Create supply chain transparency; among others.

The following section includes a more detailed explanation of each example of the type of application.

a) Fundraising for nature-based projects; including mechanisms for ownership of digital or material asset rights linked to financing solutions: NFTs that represent proof of participation in financing nature-based projects are being issued and sold. This allows for an agile transaction process between the purchaser and the implementing organization. It also normally enables a mechanism for the metadata of the funded project to be followed in real-time, bringing greater transparency for the purchaser. Typically, in this type of application, the purchaser does not receive ownership of a tradable asset. In other words, this type of digital token application allows for donation-type funding that translates into real-life conservation actions led by the issuing party.

It also allows the creation of a system of awards that incentivize behavior change at the consumer level.

Also, digital tokens work as a mechanism to own rights of a digital or material asset tied to the financing of climate and nature-based solutions. In this sense, digital tokens can assist in creating more effective and inclusive funding mechanisms for biodiversity protection, regeneration, and or nature-based climate action. Other application examples include the gaming world where the trading of tokens that represent biodiversity (in the form of species, for example) are being included to support real-life nature-based solutions.

Why is this relevant? It is estimated that to meet the climate change, biodiversity and land degradation targets, a financing gap of USD 4.1 trillion in nature by 2050 would need to be closed. Currently, USD 133 billion is available for investments in nature-based solutions. Of which 86% (USD 115 billion/year) comes from the public sector and only 14% (USD 18 billion/year) comes from private investment[37]. This calls for innovative financing mechanisms which are decentralized, agile, and transparent. The business as usual for citizens to finance biodiversity is through donations which are sometimes complicated to follow-up on their impact. Digital tokens are bringing new accessible and transparent ways of allowing more people to finance nature-based solutions. This greater global access to nature-based solutions can translate into an increased capital allocation that addresses the funding gap.

Examples of companies that are already doing this include Alipay's 500 million users **Ant Forest**[38] project; the **TreeCycle**[39] company; and **IDB Lab's tokenization project in the Amazon**

37 UN environment programme. State of finance for nature, tripling investments in nature-based solutions by 2030 (2021). https://www.unep.org/resources/state-finance-nature

38 See more: https://unfccc.int/climate-action/momentum-for-change/planetary-health/alipay-ant-forest?gclid=Cj0KCQjwhY-aBhCUARIsALNlC07H1h65sM0SFlPj2flq4XBJJUcCiHQBy4M8EWs0qGbrMkmc1DilBC0aAvJzEALw_wcB

39 See more: https://treecycle.ch/en/tokens-and-blockchain/

with OPIAC, a collective of indigenous groups[40]. Also, **PO8 Museum Foundation**[41] which uses NFTs to convert ownership rights of recovered artifacts in the sea with economic value into digital titles or smart contracts, while the physical artifact stays in their custody to be preserved and exhibited. This has become a creative fundraising mechanism for their work. Other examples of material nature assets that are being tokenized include oxygen, conservation bonds, data, oceanic plastic, trees, and specific species. WWF, through their **Non-Fungible Animals**[42] initiative, and other projects such as **Wildcards**[43], are selling NFTs of art or collectibles that represent endangered species to fund conservation strategies. The Commonwealth Bank of Australia is also piloting an innovative mechanism to create a marketplace for biodiversity credits using a tradeable '**BioToken**[44]'; **Fund The Planet**[45]; **Nemus**[46]; **Invert**[47].

b) A mechanism to participate in the carbon market - energy and decarbonization projects: there is a growing trend of organizations who are selling NFTs that represent nature-based projects tied to carbon credits. Some models are selling tokenized carbon credits directly which represent specific amounts of CO2 reduction (for example, a one-year ton of carbon emissions). The NFTs holders receive the yield made from the selling of the carbon credit in carbon voluntary markets (which is normally coordinated by the NFT-producing organization). Because of the characteristics of digital tokens, this mechanism lowers the barriers of entry for people to invest in the carbon market, provides more transparency, and lowers operational costs. This potentially would bring a greater number of interested parties to joining the voluntary carbon market including citizens that could use these assets as frictionless investment vehicles. Moreover, digital currencies (cryptocurrencies) that are backed by real carbon assets are being created to purchase tokenized carbon credits through carbon trading platforms[48].

Why is this relevant? The world is moving towards net zero and carbon credits are a key component to achieving this goal as they allow institutions to compensate for their produced emissions. Carbon credits also are a fundamental source of funding for nature-based projects which support the 1.5 degrees trajectory and the biodiversity conservation and regenerations targets as well as other Sustainable Development Goals (SDGs). In this sense, the carbon market is growing at unprecedented rates and the nature-based carbon credit market is increasing in demand as well. In 2021, the carbon credit market increased by almost 60% from 2020 levels, to around $84 billion[49]. More than two-thirds of the carbon credits sold in 2021 were nature-based solutions, doubling since 2016[50].

40 See more: https://www.iadb.org/en/project/CO-T1673

41 See more: https://markets.businessinsider.com/news/stocks/bahamian-company-po8-tokenizing-underwater-artifacts-says-blue-economy-is-ripe-for-blockchain-1027905490

42 See more: https://www.wwf-nfa.com/en

43 See more: https://wildcards.world/

44 See more: https://www.commbank.com.au/guidance/newsroom/blockchain-biotokens-biodiversity-marketplace-201908.html

45 See more: https://fundtheplanet.net/

46 See more: https://nemus.earth/

47 See more: https://twitter.com/letsinvert?lang=en

48 The use of Stable Coins are being explored in these schemes to reduce risks of extreme volatility. The case studies emerging in this type of application could enhance more liquidity for the carbon market and allow more institutions and people to see carbon credits as investable assets.

49 The World Bank. Global carbon pricing generates a record $84 billion in revenue (2022). https://www.worldbank.org/en/news/press-release/2022/05/24/global-carbon-pricing-generates-record-84-billion-in-revenue

50 Verra. Standards for a Sustainable Future. https://verra.org/

Examples include Carbonable[51], Moss[52], Single.Earth[53]. Victoria.land[54]; Universal Carbon[55], AirCarbon Exchange[56], Tucán[57], Blockchain for Climate Foundation[58], Flow Carbon[59]; World Bank's International Finance Corporation (IFC)[60]; IBM y Energy Blockchain Lab[61]; Zerocap[62]; KlimaDao[63]; Regen.network[64]; and ClimateCoin[65].

c) An effective way to share data between various organizations and information points:

this can provide a basis for better interoperability and increase the opportunities for advanced data analysis and Machine Learning applications to guide decision-making in the field, advance science-based research and identify green business opportunities. Digital tokens can provide a better flow of data among parties that is more transparent, traceable, secure, and agile to all, creating incentive mechanisms for data sharing within and across borders.

Why is this relevant? The digitalization of the world is offering growing datasets and the biodiversity and climate field are no exceptions to this. The growing availability of data however is not translating automatically into more sharing of data among institutions. There are challenges regarding privacy, credit, inclusive profit or benefits, clear governance protocols, and other lack of incentives that hinder efforts. This leads to a lack of data for better analysis and the use of AI tools that base their effectiveness on vast amounts of available data. Digital tokens can represent a mechanism to address these challenges.

Examples of projects implementing this model include a project by Earth Bank of Codes[66] which is registering genetic codes of the biodiversity of the Amazon rainforest on digital tokens and allowing for third parties (such as Pharmaceutical companies) to purchase access through crypto that automatically distributes benefits to the communities. Other examples include Climate Ledger[67].

d) Create supply chain transparency; among others;

Blockchain technologies are allowing different parties from the value chain to register data at every step of the supply chain lifecycle which is bringing more accountability and transparency. This is also enabling value to environmental data (in some cases data producers are being paid for the data they register), incentivizing behavioral change and reinforcement towards more sustainable practices, including better sharing policies, and a mechanism to enable micro-payments in a cost-effective and automated way.

51 See more: https://carbonable.io/
52 See more: https://moss.earth/
53 See more: https://www.single.earth/
54 See more: http://www.victoria.land
55 See more: https://universalcarbon.com/
56 See more: https://www.aircarbon.co/
57 See more: https://toucan.earth/
58 See more: https://www.blockchainforclimate.org/
59 See more: https://www.flowcarbon.com/
60 See more: https://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/home
61 See more: https://www.ibm.com/blockchain
62 See more: http://zerocap.com/
63 See more: https://www.klimadao.finance/
64 See more: https://www.regen.network/
65 See more: https://www.climatecoin.io/
66 See more: Earth Bank of Codes. Engineering an Inclusive Bioeconomy and Preventing the Next Pandemic. https://www.earthbankofcodes.org/
67 See more: https://www.climateledger.org/en/Use-Cases/Climate-Risk-Insurance.68.html

Why is this relevant? Companies that have trackable environmental impact data through their supply chain can give more transparency, credibility, and loyalty of consumers. According to an IBM study, 79% of customers indicated the importance of brands guaranteeing their authenticity through, for example, certifications. 71% of this customer group are willing to pay a premium for brands that provide it[68]. Bio-friendly sourcing of suppliers and products is becoming more and more important for consumer decisions that have to halt the decline and the degradation of ecosystem services which represents an annual economic loss of at least US$479 billion per year[69]. Moreover, the sales of more certified sustainable commodities are expected to increase contribution to biodiversity by at least 12-19 billion annually by 2030[70]. These types of mechanisms can help the traceability of forest based products, for example. This can enable better transparency, increase producer and consumer confidence and strengthen sustainable forest certification schemes, which brings economic benefits for producers, as well as environmental benefits by promoting the sustainable use of resources.

Examples include Fishcoin[71]; Norwegian Seafood Trust[72]; Open Wine[73]; and WTP[74].

* * *

In summary, the opportunities that are being enabled through these applications include:

- **Increasing financing opportunities:** lowering the investment barrier on natural assets through the creation of digital tokens that can be sold in a global market can increase funding opportunities for conservation activities.

- **Transparency and auditability:** understanding that natural assets' value can change over time, registering identifiers of their quality (for example, environmental health indicators) over time can provide transparency and auditable mechanisms for third parties that create accountability and trust.

- **Tradability and greater liquidity:** assigning value to natural assets and trading on this value.

- **More trustworthy and effective carbon credit systems:** avoiding double counting when forestry-based carbon credits are sold.

- **More effective mechanisms for sharing data and distributing benefits:** transparent, secure, privacy-driven, credited, and traceable data sharing with specific built-in governance protocols that can lead to more cooperation between institutions to share data, interoperability, and increased regional and global cooperation.

68 Leslie Park. IBM Study; Purpose and provenance drive bigger profits for consumer goods in 2020. IBM Newsroom (2020) https://newsroom.ibm.com/2020-01-10-IBM-Study-Purpose-and-Provenance-Drive-Bigger-Profits-for-Consumer-Goods-In-2020

69 UN Environment Programme, UNEP Finance Initiative and Global Canopy (2020). Beyond 'Business as Usual': Biodiversity Targets and Finance Managing biodiversity risks across business sectors.

70 Tobin-de la Puente, J. and Mitchell, A.W. (eds.) Global Canopy (2021).

71 See more: https://fishcoin.co/

72 See more: https://norwegianseafoodtrust.no/vart-arbeid/?lang=es

73 See more: https://openvino.org/

74 See more: https://www.climatecoin.io

What kind of possibilities could be explored?

Even though there are various types of digital token applications emerging in this field, there is a long and exciting road ahead in the search for new possibilities that bring tangible value, greater capital access, transparency, and agility. Apart from the type of applications that are already being implemented (previous section), there are other application avenues that could be further explored to create opportunities for communities that depend on and/or live in dense biodiversity areas; more innovative entrepreneurship; for and for more transparent and agile environmental policies.

a) More access to capital for impacted peoples while innovating climate action and nature solutions.

- Tokenizing assets could be able to serve as **collaterals** for loan applications serving as guarantees.

- **Developing schemes for the payments of environmental services (PES)** could harness the use of digital tokens by lowering the costs of transactions, easily identifying data providers, and asset owners, and enabling micro-payments tied to specific conservation targets registered and automated in smart contracts.

- **Creating a mechanism for the payment of results**, through proof-of-impact documentation, combined with smart contracts, implementing transparent payments to organizations in a seamless way.

- Enabling incentives for better **on-the-ground data production** and citizen science by having a digital token system for data governance, IP biological data registration, and data production micro-payments. This can bring a new biodiversity **data-knowledge economy** and create methods for reliable, rapidly actionable information about projects and their impact. Moreover, it can help transform data into tradable assets.

b) Entrepreneurships and/or new entrepreneurships to innovate climate and biodiversity protection action

- One of the biggest barriers to the conservation and restoration of ecosystems has been the lack of valuation of their ecological functionalities. The tokenization of natural assets could be an efficient way to introduce their **economic value** in a global market, expose their correlation to industries and enable transparent, decentralized financial transactions to fund restorative and conservatory activities on the ground.

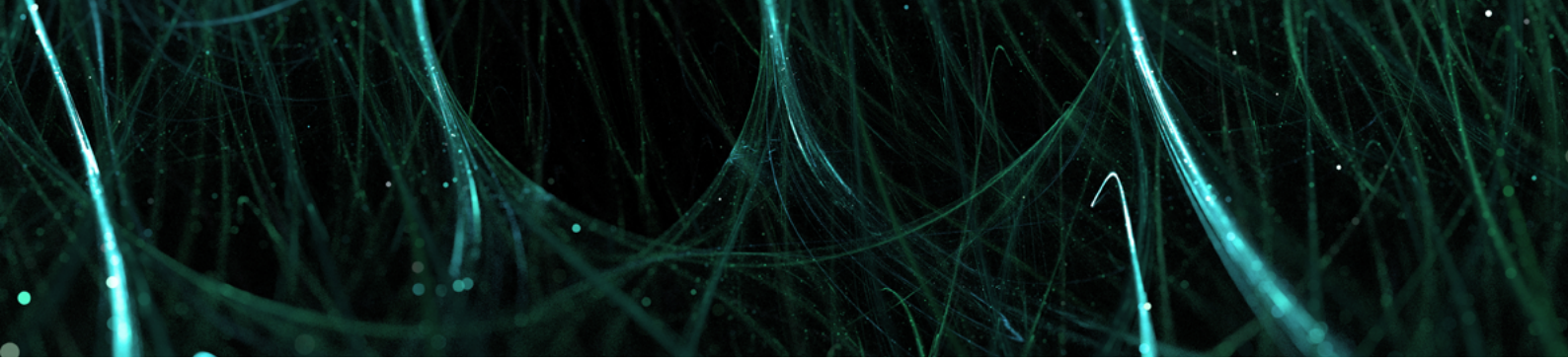
- Creation of new and innovative biodiversity **capital market instruments**[75]. Likewise, digital tokens can open the doors to financial derivatives around nature-based solutions; as well as mechanisms to support the processes of nature as a new class of assets.

- Exploration of new forms of digital value for ecosystem services. For example, in marketplaces emerging in **virtual worlds** (Metaverse applications).

- Development of reward systems that incentivize **behavioral changes.** Harnessing gamification and social media network principles to accelerate action.

- Digitizing the governance of emerging **biodiversity impact bonds** using digital tokens could be explored. This could lead to lowering the access of entry to diverse buyers, automating processes, having verifiable impact metrics, accountability processes, proof of impact methods, and opening to secondary markets

75 Green Digital Finance Alliance. Fintech for Blodiversity A global landscape (2020). https://www.sustainablefinance.ch/upload/rm/fintech-for-biodiversity-final-30-32020-1.pdf?_=1586152773749



trading. This could also create instruments that merge philanthropic funds and social impact capital seamlessly[76].

c) More transparent and agile environmental policies:

- Exploring digital tokens for **result-based financing** to help the advancement of biodiversity conservation and climate action targets such as the 2022 Kunming-Montreal Global Framework of Biodiversity. Moreover, digital tokens are harnessed by countries to implement, monitor, and report in a transparent and traceable way on their nature-based solutions (NbS), across their relevant plans and targets[77]. Public policy on biodiversity sometimes lacks transparency and access to greater funding for implementation and digital tokens can be explored to address this.

- New regulations and frameworks such as the ones created by the Task Force on Climate-related Financial Disclosures (TCFD)[78] and the Taskforce on Nature-related Financial Disclosures (TFND)[79] include provisions related to the value of nature and the risks that the loss of biodiversity represents to industries and financial institutions. These frameworks require the development of effective and transparent means to register nature-based data, trace results and offer high standards of trustability and transparency to ensure the achievement of corporate sustainability targets. Digital tokens could add value to the **operationalization of these new frameworks.**
- Developing digital, automated, and transparent carbon and biodiversity offset mechanisms powered by digital token-led platforms that could lead to greater transparency, traceability, and governance efficiencies. Tradable credits can exist in secondary markets. Also, the data driven tokenized carbon credits could serve to avoid double counting, bringing more transparency and accountability to the entire carbon market.

- Enabling new forms of including biodiversity risks in the Environmental, Social, and Governance ESG targets (and ESG risk management data tools) to drive prioritization of action, investment, and credits that take into consideration biodiversity scores and nature externalities.

- Allowing for traceable and transparent mechanisms around the UN statistical framework to account for biodiversity and ecosystems in national economic planning and policy decision-making as well as the European Union´s proposed international natural capital accounting initiative[80].

- Creating Conservation Security Token Offerings (STOs) that could lower transaction costs and provide a mechanism for biodiversity assets to access capital markets. This would need regulatory clarity which is currently nonexistent[81].

Even though there is a growing list of opportunities to be explored in this field (Box B), it is important to note that, as with all other technologies, there are multi-level challenges and considerations that have to be identified, mitigated and/or managed in a timely manner if the promise of these technologies is to be

76 Green Digital Finance Alliance. Fintech for Blodiversity A global landscape (2020). https://www.sustainablefinance.ch/upload/rm/fintech-for-biodiversity-final-30-32020-1.pdf?_=1586152773749

77 Including: Long-term Strategies (LTS); Nationally Determined Contributions (NDCs); National Adaptation Plans (NAPs); NBSAPs; and Land Degradation Neutrality (LDN) targets.

78 See more: https://www.fsb-tcfd.org/

79 See more: https://tnfd.global/

80 European Commission. Natural Capital Accounting (2021). https://ec.europa.eu/environment/nature/capital_accounting/index_en.htm

81 Switzerland is currently developing a Green Bond Market which is pioneering this field. See more: Green Digital Finance Alliance. Fintech for biodiversity, a global landscape (2020). https://www.sustainablefinance.ch/upload/rm/fintech-for-biodiversity-final-30-32020-1.pdf?_=1586152773749

Box B: Digital Tokens for Climate Action and Biodiversity Conservation Idea Bank

IDB Lab and the **Future of Earth Lab** of the organization **C Minds** have transformed the previous list of potential applications into a Collective Idea Box that is open for anyone with a creative application to add it.
The objective of this idea bank is to use the power of collective intelligence to inspire actors in the tech and climate-biodiversity ecosystem to explore these technologies taking into consideration appropriateness, context, and with the application of ethical and human rights risks analysis.

You can check the updated list of ideas and contribute at:

www.cminds.co/tokens

materialized. The following section covers some of the key concerns.

CONSIDERATIONS

Even though digital tokens present various opportunities, these innovative mechanisms raise questions that have to be considered related to their understanding, their governance (including transparency and accountability), their effectiveness, and the inclusion and distribution of benefits of communities that live in or around biodiversity-rich areas, especially indigenous peoples.

The following bullets present some of the key challenges and considerations in the realm of ethics and Human Rights, governance, business models and education that need to be taken into account in the development and adoption of these technologies.

Ethical and Human Rights approaches together with environmental and social impact considerations

Ethics and Human Rights. Ethics and Human Rights. ethics and Human Rights-centered approaches to the design and implementation of these technologies is fundamental. The perspective, needs, benefits, and land management practices of people living from or in nature, including agricultural and indigenous communities, have to be prioritized in the lifecycle of projects and business models. The risk of not doing so is the continuous development of imported technological solutions and business models that are not inclusive or respectful of the Rights of impacted communities. This includes topics such as bio-IP ownership in high-value ecological territories.

Narrative and epistemological gaps. Avoid digital tokens becoming part of the creation of any new form of power dynamics and narratives. The agency of impacted communities and respect for various perspectives of value and knowledge from indigenous peoples must be core to the development of this technology for the climate and biodiversity conservation field. Furthermore, there is a risk of detachment between high-level technical expertise in frontier technologies applied to climate action and biodiversity conservation with indigenous peoples that operate under different epistemological constructs. This merge is sensitive and has to be approached respecting their Rights, values, belief systems and epistemic constructions[82].

Energy use. Blockchain-based technologies are very compute intensive thus their energy consumption is one of its main concerns. For

82 There is a need to count with frameworks that help navigate unexpected outcomes in this realm.

example, It's estimated that Bitcoin consumes electricity at an annualized rate of 127 terawatt-hours (TWh), more than the entire annual electricity consumption of Norway[83]. However, many blockchain platforms are migrating to more energy-efficient processes including switching proof of work (PoW[84]) which is high energy consuming to Proof of Stake (PoS[85]) or Proof of Authority which eliminates 99% of the power consumption[86]. However, even if more efficient mechanisms are used, carbon neutrality of this sector should become a key goal in line with the 2050 carbon neutrality international goals.

Governance

New regulations and/or upgrades to existing ones

are needed to be able to guarantee predictability, efficiency, transparency of the processes, and protection for both the consumer and seller. Moreover, until regulations across geographical borders are harmonized, interoperability will be hindered[87]. Also, there are still profound challenges in the relationship and governance between the digital token and the physical asset they represent. For example, what happens if you buy a digital token that represents a fraction of a forest and the forest is depleted in a fire? How are ownership rights traduced into legal rights based on different jurisdictions? These types of questions require governance and legal clarity for each tokenized asset[88].

Privacy, security and transparency.

There is a risk of linking information registered through the smart contracts to private data or private information on public ledgers that are public to all. Smart contract breaches and hacks are possible[89] and thus privacy and security protocols have to be taken into consideration as well as private blockchains when needed to ensure that private data, sensible business information, and funds are safe. On the other hand, effective governance systems that are inclusive, fair, transparent[90] and accountable in nature should be the core component of the consolidation of this sector.

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83 John Schmidt, Courtney Reilly Larke. Why does Bitcoin use so much energy?. Forbes (2022). https://www.forbes.com/advisor/ca/investing/cryptocurrency/bitcoins-energy-usage-explained/#:~:text=It's%20estimated%20that%20Bitcoin%20consumes,annual%20electricity%20consumption%20of%20Norway

84 PoW: Mechanism used by miners to find blocks that can be added to the chain through a set of data obtained by downloading and running the full chain (trial and error) which causes a large energy expenditure.See more: Ethereum. Proof-Of-Work (2022) https://ethereum.org/en/developers/docs/consensus-mechanisms/pow/#top

85 PoS: Mechanism to create new blocks in a distributed consensus through the confirmation of transactions executed by validators in a secure database.See more: Ethereum. Proof-Of-Stake (2022) https://ethereum.org/en/developers/docs/consensus-mechanisms/pos/

86 Evin Cheikosman. Ethereum Merge: what it means for the crypto-currency industry. World Economic Forum. (2022) https://www.weforum.org/agenda/2022/09/ethereum-merge-crypto-currency-sustainability/

87 Nonetheless, the Decentralized Finance (DeFi) sector´s and in general, decentralized technologies, logic is profoundly different from traditional sectors regarding governance and other aspects. Thus, regulations would benefit from being developed through innovative approaches and in close collaboration with the Blockchain-DeFi ecosystem. This would increase the chances for balanced regulations, and the harnessing of the power of self-regulation structures in this field. Regulations could also consider dynamic frameworks as this technology is evolving at a fast pace.

88 Nature as a new asset class requires the development of clear regulations and protocols that protect sellers, buyers, and affected communities from scams, fraud, and privacy breaches, among others. New regulations and amendments to existing ones can give certainty to transactions and other aspects of crypto assets including real-world legal processes tied to digital ones, security, and auditory mechanisms, among others. Cross-jurisdiction consensus and clarity on transferring natural asset ownership are key. Algorand. Asset Tokenization: A guide for financial institutions and fintechs (2021). https://www.algorand.com/resources/blog/asset-tokenization-guide-for-financial-institutions

89 To name an example, a crypto security firm estimated that $670 million USD was lost in the second quarter of 2022 because of these breaches. Immunefi. Crypto losses in Q2 2022 (2022). https://drive.google.com/file/d/1jpS3y0isdneBuMMH0hUwzTS3WrEDxZV3/view

90 Transparency does not equal explainability. One of the greatest values of blockchain- based technologies is transparency. However, not because information can be accessed or traced means it is understandable by key communities. Digital literacy, context, and explainability have to accompany transparency efforts to make the digital token´s transparency opportunities effective. What about the need for effective monitoring and supervision (i.e. satellites, IoT etc) which can be very costly and complex sometimes?

Business models

An ecosystem that is self-sustaining and based on need and context.

Will token design bring improvements to how the process is currently done? Is this solution appropriate and based on context?[91] Evaluating these questions becomes key before a technology development. Moreover, understanding if there is a market opportunity for the solution is important[92]. In other words, there is a sometimes false premise based on the philosophy that if a digital token is created, there will automatically be buyers. Rather, there has to be clarity on the value the digital tokens will produce. Also, many of the digital token new marketplaces require a public that understands how digital tokens work and are willing to purchase them when appropriate. Furthermore, for the crypto space, speculation and volatility of the investments in nature related digital assets are factors that have to be taken into consideration for the long-run effectiveness and sustainability of the field.

Education

Cryptoassets and decentralized financing literacy.

The majority of the information of this technological field is sometimes too complex to understand for non-technical people and impacted communities. Moreover, there is no current unified definitions which presents challenges for the creation of global lexicon and frameworks[93]. The generalized understanding of how these technologies work, their applications, the opportunities as well as the challenges will lead to better decision-making for regulators and decision-makers, to the creation of more entrepreneurships and companies, and a greater social and environmental positive impact.
In this sense, greater efforts to translate the opportunities and challenges into simple terms that are understandable by diverse groups should be a priority.

These considerations, coupled with other ones such as lack of financing for the adoption of these technologies in the region (and other ones not related to the technology itself detailed in Annex C), will need to be addressed if the region is to benefit from the potential environmental, social, and inclusive economic gains these technologies could facilitate.

91 Techno-solutionism should be avoided. This refers to an approach that seeks to solve complex and global problems through single technological progress. It tends to simplify and obfuscate diverse realities, so that despite avoiding immediate effects or collapses, in the long term it could even worsen it by not taking into account the complex series of events that caused the problem in the first place. Joana Moll Against Complexity, Technological solutions often side-step the complexity of the systemic problems they face. CCCB LAB Cultural research and innovation (2021) https://lab.cccb.org/en/against-complexity/

92 Another term used is thickness evaluation regarding evaluating if there are enough sellers and buyers to ensure trading.

93 There is a global initiative called Token Taxonomy Framework (TTF) that wishes to fill this role however mainstreaming agreements in such a decentralized and self-regulated ecosystem presents its challenges.

CONCLUSION

The new socio economic paradigm based on transparent processes, decentralization, and new forms of value creation can not be ignored by any field, especially one that requires urgent and profound collective action, such as the climate and biodiversity conservation sector.

The emerging digital tools that play a key role in this transformation, including digital tokens, are innovating how public and private institutions are creating new solutions and business models for this field. The list of case studies with different applications of digital tokens in the environmental realm is growing globally at a fast pace. However there is still a great opportunity to use these tools in benefit of key biodiversity areas, such as Latin America and the Caribbean: a region that hosts more than 40% of the world's biodiversity, 30% of fresh water available on earth and almost 50% of the global tropical rainforests, serving as lungs to the entire planet as well. There is no possibility of responding effectively to climate change and the well-being of all ecosystems on a global scale without innovating and scaling actions in this region.

The different applications and case studies mentioned in this report, showcase the present and potential use of digital tokens as tools to create more operational efficiency, trust, decentralized process, liquidity, auditability, among others. Also, it highlights the **great opportunity for digital tokens to become strategic instruments for new regenerative financial mechanisms,** innovative market-based schemes for nature-based solutions, and other types of approaches that aim to balance what humans demand of nature and what humans can give back to it, in the form of regeneration, conservation, and respect of ecosystemic harmony.

Furthermore, as established in this document, the state of the world and intertwined systems require new transboundary governance models and new notions of multi-sector and large-based multi-party collaborations. In this sense, **exploring and understanding how these technologies can play a role in both local to planetary-scale governance systems becomes not only strategic but crucial.**

Last but not least, there is also an important layer that one must not forget when exploring new forms of the valuation of nature and the role technology plays in this: the **reflection on the value of nature beyond economic terms.** Being inclusive and respectful of different epistemological concepts of nature´s value is key to moving forward in this field.

In the quest to reach climate justice, the goal of Net Zero by 2050, the ambitious tarjets of the Kunming-Montreal Global Biodiversity Framework, and other environmental and social 2030 Sustainability Goals, the exploration of digital tokens as strategic tools can potentially catalyze Multilateral Development Banks (MDBs), technologists, entrepreneurs, scientists, investors, donors, governments, activists, Non-Governmental Organizations (NGOs), International Non-Governmental Organizations (INGOs), indigenous peoples and all other communities working closer together in the re-imagination of more inclusive and just economic paradigms, plus social constructs that are embedded within nature, not external to it.

ANNEX

Annex A: Some useful jargon

Asset tokenization: the process of representing assets in digital tokens.

ERC20 tokens. A token standard for blockchains based on Ethereum. These define tokens that are tradable and fungible. In the smart contracts, they report the total supply and the report balance for a specific account; they have pre-authorized transfers, and they transfer tokens to and from an address. They are considered one of the most functional utility tokens.

ERC721 tokens. A token standard for blockchains based on Ethereum. These are non-fungible and unique. They have similar functions to ERC20 for sending and receiving and they have a token ID, as well as unique properties in the smart contract which can evolve and change such as the token state.

ERC1400 tokens: (a token standard for blockchains based on Ethereum) are an extension of the ERC20 standard and allows the issuance of Security tokens with transfer restrictions to fulfill compliance requirements, such a implementing a whitelist so the issuer can selectively control who is able to buy and own the token, after running an onboarding process with KYC and AML checks[94].

Other terms can be found in the Token Taxonomy Framework (TTF), a collaborative effort that defines a common set of concepts and terms so participants of the ecosystem can potentially talk the same language[95]. For spanish speakers, the platform Cryptoconexión has a glossary that could be useful[96].

Annex B: Example of regulations

In the United States, the U.S. Securities and Exchange Commission or SEC is in charge of regulating this field.

In Europe, there is a Distributed Ledger Technology (DLT) regulation for security tokens that will come into force in March 2023. This regulation deals with crypto assets that qualify as financial instruments such as stocks, bonds, money market securities, and funds.

Parallelly, in Europe, there is another regulation called Regulation on Markets in Cryptoassets (MICA) passed in March 2022. It regulates asset reference tokens, stablecoins, and crypto assets.

Other countries and regions are developing crypto asset regulations and clear taxation standards including Australia, Canada, Germany, Japan, India, Luxemburg, Philippines, Singapore, Switzerland, and South Korea, among others. Also, the Organization for Economic Cooperation and Development (OECD) presented to the G-20 in October 2022 a proposal for a new global tax transparency framework for the reporting and exchange of crypto asset information. The new framework defines crypto assets as those that can be "held and transferred in a decentralized manner" without financial intermediaries, including stablecoins and derivatives. If approved, it would formalize the automatic transfer of crypto asset taxpayer information between the OECD's 38 member countries[97].

94 See more: https://github.com/ethereum/EIPs/issues/1411

95 See more: GitHub Token Taxonomy Framework (2022). https://github.com/InterWorkAlliance/TokenTaxonomyFramework/blob/main/token-taxonomy.md

96 See more: Cryptoconexión. https://cryptoconexion.com/glosario/#PoW

97 See more: https://www.oecd.org/tax/exchange-of-tax-information/crypto-asset-reporting-framework-and-amendments-to-the-common-reporting-standard.htm

ANNEX

Annex C: Other considerations

Other considerations not related to the technology itself but have to be taken into account:

On the tokenization of carbon credits: There are concerns by some institutions that tokenizing carbon credits is not necessarily solving one of the most pressing issues to address climate change through the carbon market: ensuring additionality. For example, if a carbon credit finances a forest that is not at risk of depletion, then the carbon credit did not reduce carbon emissions as per the terms of the protocols of the carbon market[98]. Projects have to ensure that CO2 is reduced or that its release is prevented[99] and thus the importance of including transparency, accountability, evaluations, follow ups and monitoring practices.

Moreover, tokenized projects have to be high in quality and integrity, if not there is a risk of only creating more supply of projects but not necessarily increasing the supply of high quality credits[100]. Experts state that tokenized decarbonization projects that do not take this into consideration risk "artificially inflating the market by providing a platform for credits what would have otherwise been ignored"[101]. There is a need to ensure that the registered decarbonization projects are certified by recognized registries[102] and meet all the criteria.

Carbon credits retirement vs trading: Carbon credits are effective in their mission to help neutralize carbon emissions when buyers retire them (this means, they are not resold). However, the new tokenization ecosystem is in many cases betting on the model that allows the buyer to resell their carbon credit. This could create economic value to the buyer (if the value is appreciated); however this passing of the credit to another owner does not translate into more CO2 reduction. Digital tokens are allowing for trading marketplaces, yet this process does not add value to the final cause: climate action.

Data sophistication: creating nature assets, tying payments to impact, and securing more transparent nature-based solutions powered by digital tokens will require data points sophistication. This can be tricky because nature data is considered sometimes more complex than social data due to the extension and accessibility of reserves and behavior patterns of species.

98 Carbon credits, although in the first instance do not increase the capture of CO2 emissions, are used to protect and conserve the state of the ecosystem, including its capacity to absorb CO2. In addition, the investment must contribute to the development of strategies to increase tree density in the medium and long term, increasing the capture of verifiable carbon emissions and protecting biodiversity. It is important to highlight that the added value is also reflected in employment, income, and livelihoods of the communities in the area under conservation. The World Bank. Healthy forest are fertile ground for carbon markets (2021) https://www.worldbank.org/en/news/feature/2021/11/05/healthy-forests-are-fertile-ground-for-carbon-markets

99 However, the carbon credits in healthy forests, although they do not increase CO2 sequestration levels per se, serve as a means to protect/maintain those natural areas, and thus continue with the sequestration and reduction of GHG emissions, in addition to financing, over the years, the rate of abundance and biodiversity itself can be improved, increasing verifiable carbon emissions. Also, the added value is reflected in the employment, income, and livelihoods of the protected area.

100 CarbonPlan. Zoombies on the blockchain (2022) https://carbonplan.org/research/toucan-crypto-offsets

101 iIDB.

102 Such as Verra and the Gold Standard.

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