



► Project Genesis – Report 1

A vision for technology-driven green finance

November 2021







Contents

Abstract	2
Executive Summary	4
Foreword	7
Section 1: Catching the Green Wave	9
1.1. Swell of the Green Bond Wave	9
1.2. Dive into the Opportunities	13
Section 2: Spotlight on Tokenisation	16
2.1. Securities Market Perspective	16
2.2. Primary Placement	19
2.3. Secondary Trading	22
Section 3: Strengthening the Foundations	28
3.1. Need for Transparency	28
3.2. Mitigating Greenwashing	31
3.3. Green Auditing Challenges	36
Section 4: Goal in Sight	41
4.1. Blockchain as Base Infrastructure	41
4.2. Connecting IoT and Blockchain	43
4.3. Alliance Blockchain Idea	46
Section 5: Thinking Further Outside the Box	49
5.1. Mitigation Outcome Securities	49
5.2. Asset Backed Tokens	53
5.3. Learnings from the Crypto Sandbox	57
Section 6: Climate Action, Accounting and Yields	62
6.1. Target Greater Impact	62
6.2. Climate Accounting	67
6.3. Climate Action and Sovereign Yield	72
Section 7: Back to the Book of Genesis	77
7.1. The Make-or-Break Decade	77
7.2. What Ifs?	79
7.3. Future Scenarios	80



Abstract

In many countries, issuing and investing in bonds can be cumbersome and complex, involving numerous steps and parties, and typically requiring a considerable financial commitment from the investor. For those investing in environmentally friendly projects, there is uncertainty about whether the bond issuer is delivering the positive green impact it committed to at issuance. Also, there are typically no liquid and transparent secondary markets for retail investors. Genesis, the BIS Innovation Hub's first green finance project, explores the green art of the possible through combining blockchain, smart contracts, internet-of-things, and digital assets. Together with six partners, the project achieved two prototypes that bring to life the vision that an investor can download an app and invest any amount into safe government bonds, which will develop a green project; over the bond's lifetime, the investor can not only see accrued interest, but also track in real time how much clean energy is being generated, and the consequent reduction in CO₂ emissions linked to the investment; further, the investor can sell the bonds in a transparent market. In consonance with the take-away from the BIS Green Swan research report¹ that climate change involves complex collective action problems that require increased coordination among governments, the private sector, civil society and the international community, project Genesis was guided by a multi-disciplinary panel of experts in environmental, social and governance (ESG), green finance, bond markets, law and regulation, each of whom contributed an article giving their views on key aspects of their areas of expertise. This report is a compilation of such articles. Each article is produced as a standalone contribution by the author(s) listed and as such can be read individually or in conjunction with the rest of the report. The views given in this report are those of the authors only and may or may not be those of the BIS. The present report is a sister report to Project Genesis - Report 2 "A prototype for green bond tokenisation by the Liberty Consortium" and Project Genesis - Report 3 "A prototype for green bond tokenisation by Digital Asset and GFT".



Green and digital are not only interconnected but interdependent. The rails of tomorrow's green transformation will be digital. Central banks need to think hard about what capital market structures will channel savings into sustainable projects. Genesis is the BIS Innovation Hub's initial project showing how innovation can support the green and sustainable finance agenda.

Benoît Coeuré

Head of the BIS Innovation Hub

Special Thanks: Bénédicte Nolens, Marcel Bluhm, Anna Cheung, Frank Packer, Corinne Ho, and Gong Cheng.

¹ See Bolton, Despres, Periera da Silva, Samama, and Svartzman, BIS and Banque de France, The Green Swan: Central Banking and Financial Stability in the Age of Climate Change, January 2020, <https://www.bis.org/publ/othp31.pdf>.

Executive Summary

This report, taken as a whole, offers a broad perspective from global experts on how finance can drive the transition to a green and sustainable future. Sustainability, the contributors argue, can be better achieved by integrating blockchain and other technology into the processes that bring financial products to market. Opportunities for greenwashing products will be greatly reduced and, at the same time, the technology can be utilised to control risk for both issuers and investors, thereby helping to make truly green investment the norm rather than merely novel.

The report starts with a foreword by Christine Loh of The Hong Kong University of Science and Technology, setting the backdrop of humanity's date with destiny. In Section 1 Ivy Lau of the Climate Bonds Initiative spells out the considerable support for the green transition provided by the Government of The Hong Kong SAR. She notes that Mainland China entities account for 60% of Hong Kong's green debt issuance. Grace Hui of the Hong Kong Stock Exchange then explains the importance of Hong Kong's integration into the Greater Bay Area (GBA) and how this positions Hong Kong (the GBA's designated green finance centre) to channel the flow of green funds between the Mainland and the rest of the world.

Section 2 begins with Laurence Van der Loo of ASIFMA and Laurence Kehoe and Johnny Wijaya of BNY Mellon, who discuss the benefits of tokenised securities: improved speed, reach, custody and clearing cycles, and recording of transactions. They also note that these properties have created a new digital ecosystem that has significant potential for green growth. However, Connie Heng, Mark Chan and Rocky Mui from law firm Clifford Chance, point out that some jurisdictions, of which Hong Kong is an example, exercise additional regulatory caution when dealing with tokenised bond issuance. Finally, Urszula McCormack from law firm King & Wood Mallesons summarises the key considerations from a secondary trading perspective.

Pratima Divgi of the Carbon Disclosure Project begins Section 3 with a reminder that the rise in green financing has not been matched by a decline in global emissions. To meet global emission targets, green financing requires greater transparency and mandatory disclosure across asset classes and individual portfolios. Frank Packer of the Bank for International Settlements then deals in-depth with the issue of greenwashing and how it might be better detected and dealt with. Cindy Ngan of PwC closes the section by taking the reader through the steps in setting global standards for the auditing of green financial products. She explains how tokenising would help to determine that such products are truly green. And she closes by posing the question: who will audit the auditors?

Dave Sandor's article, co-founder of AllInfra, opens Section 4 and reinforces the idea that blockchain technology is key to ensuring that the environmental impact of a product is known and verifiable. Ben El-Baz of HashKey then discusses the roles of IoT and blockchain technology in generating and storing impact data. He notes that the technologies mitigate the risk of fraudulent impact reporting, allowing regulators and investors to have confidence in the quality of the reported data, Shi Piao and Yaling Wu of Ant Financial close the section by explaining how blockchain can give regulators macro-oversight of green bond management.

Section 5 begins with the description by Massamba Thioye, project executive of the UNFCCC's Global Innovation Hub, of the UN's Mitigation Outcome Securities (MOS), which link green bonds securely and comprehensively to the carbon market. Ben McQuhae of the Green Finance Association of Hong Kong then describes tokenisation use cases in Hong Kong in the renewable energy (RE) and shipping sectors. Henri Arslanian, Duncan Fitzgerald, Alexandre Tabbakh, Oscar Fung, and Galen Law-kun of PwC round off the section by providing an overview, based on empirical data, of the user experience and community-building aspects of crypto exchanges.



Katherine Foster of the Open Earth Foundation launches Section 6 by highlighting the disproportionate need for investment in developing economies. She shows that an automatic settlement system coupled with digitised green bonds would encourage investment in both smaller individual projects and community-driven projects. Martin E. Wainstein's article, also from the Open Earth Foundation, focuses on how green bonds, to truly prove their worth in terms of verifiable mitigation, need to map with national inventories which, in turn, meet the Nationally Determined Contributions (NDCs) set by the Paris Agreement. Entela Benz of the Hong Kong University of Science and Technology then reports the findings of research into how vulnerability and resilience to climate hazards affect a country's borrowing costs, with less attentive governments being punished by low bond yields. Some Asian countries may find this a constraining factor as they enter the green bond market.

Section 7 consists of a single article by Jean-Marc Champagne and Jochen Krimphoff of the WWF, who argue for universal agreement of what it means to be 'green'. They go on to present a number of challenging scenarios for 2025, and argue persuasively for greatly increased public participation in driving green finance forward.





“

Humanity is connected to the health of our earth. The clock of nature is ticking. This report shows both the importance, yet also the complexity, of achieving and verifying the green component in finance. Novel technologies can be deployed to supplement manual verification and to increase transparency.

Bénédicte N. Nolens

Head of the BIS Innovation Hub Hong Kong Centre

Foreword



Christine Loh is the chief development strategist, Institute for the Environment, The Hong Kong University of Science and Technology. Prior to her present role, she was the undersecretary for the environment in the HKSAR government (2012-17). She also teaches a course at the Anderson School of Management, UCLA, on nonmarket risks. Professor Loh is a lawyer by training and a commodities trader by profession. She served as a legislator for almost a decade, and was also the founder-CEO of a policy think tank. She currently serves on numerous for profit and non-profit boards in Hong Kong and overseas.

We have a Date with Destiny. The aim is for the world to achieve climate neutrality by 2050 to 2060. This is ambitious. To get there, it requires consistent policies from governments, on-going engagements between the public and private sectors, and sustained support from citizens to flight climate change. Moreover, it requires capital to be diverted away from high carbon investments to zero carbon and environmentally sustainable projects. Many types of innovations will be required, including in financial products.

We are forced to face up to problems we have ignored for too long. As the Covid-19 pandemic continues to challenge the world in 2021, there are also extreme climate events that have brought fatalities and massive damage in many places. The extensive wildfires and relentless heat wave in the Northwest Pacific affected the rich economies of Canada and the US, and the severe floods in Central Europe that affected Belgium, Germany, the Netherlands, and Switzerland have woken people up in developed economies to the existential threats arising from climate change. China too has had to deal with a flood arising from extreme downpours in Zhengzhou and Henan province in July 2021.

Amidst these challenges, more and more governments from around the world are committing to achieve carbon neutrality by 2050 to 2060. One could say the world has set a Date with Destiny to avert the climate crisis by aiming to decarbonize within three to four decades. While that is a demonstration of the right ambition by governments, it is easier said than done. Currently, about 84% of the world's energy still comes from fossil fuels, which are the dominant sources of carbon emissions that cause global warming. Thus, to succeed at massive decarbonization at speed and scale, there must be an industrial, technological and governance revolution.

To have a chance to meet our collective Date with Destiny, we must have "all-hands-on deck". We must co-learn, cooperate and co-fund the many projects that are needed to get us to carbon neutrality. Moreover, it isn't all about climate mitigation because the world needs to also defend people and assets from extreme weather events and adapt their infrastructure and systems to storms, floods, sea level rise, landslides, heat, drought, and even cold spells.

The greening of finance is absolutely necessary. Governments are designing policies and regulations to internalize externalities, so that investments could be diverted away from high-carbon projects to low-and-zero carbon ones. Enormous capital is also needed for climate adaptation. Governments and the finance sector need to work together, as is happening with the BIS project to explore tokenization of green projects. There must be the sort of innovation in finance that can involve everyone because we all have a direct stake in dealing with climate change.

Missing our Date with Destiny means climate risks become higher still that could lead to greater devastation. It is much better to invest time and effort to do as much as possible within this decade to get the ball rolling, as the longer we delay in decarbonization and climate adaptation, the harder and costlier it gets. Adopting a cooperation attitude is vital, as the world needs to learn how to decarbonize at speed and scale across developed and developing economies, and to ensure a just transition that benefits the community of nations.



“

Hong Kong, as Asia's leading international financial centre, plays an important role in the transition of the world's economy towards a low carbon and sustainable economy. The Government will continue to work closely with the industry and stakeholders to develop innovative solutions for the development of green and sustainable finance.

Joseph Chan

Undersecretary for Financial Services and the Treasury
Hong Kong SAR

Section 1: Catching the Green Wave

1.1. Swell of the Green Bond Wave

By the Climate Bonds Initiative



Ivy Lau is General Manager East Asia, Client Services, Climate Bonds Initiative. She leads business development and stakeholder engagement in East Asia at the Climate Bonds Initiative (CBI), an international and investor-focused not-for-profit that works solely on mobilising the \$100 trillion bond market for climate change solutions. Based in Hong Kong, she manages business opportunities in Greater China, Japan and South Korea, and forges strategic partnerships with key stakeholders in green and sustainable finance, including government authorities, regulators, financial institutions, investors and corporates.*

*Contribution written in August 2021 as representative of the Climate Bonds Initiative.

1.1.1. Growing the Global Green Bond Market

The green bond market has seen exponential growth since its inception in 2007, passing the significant USD1tn in cumulative issuance. The milestone was passed in early December 2020.² As one of the leading international financial centres, Hong Kong plays an instrumental role in channelling capital into the low carbon transition of Asian economies and beyond.

In the 13 years since market inception, the global green bond market has recorded an average annual growth rate at approximately 95%. The very first green bond was issued in 2007 with AAA ratings from multilateral institutions such as the European Investment Bank (EIB) and World Bank. The wider bond market started to react after the first USD1bn green bond sold out within an hour of issue at the IFC in March 2013.

November 2013 witnessed a turning point in the market as the first corporate green bond was issued by Vasakronan, a Swedish property company. The market gathered momentum in 2014 and since then each year has closed at record all-time highs. Large corporate issuers include SNCF, Berlin Hyp AG, Apple, Engie, ICBC, and Credit Agricole.

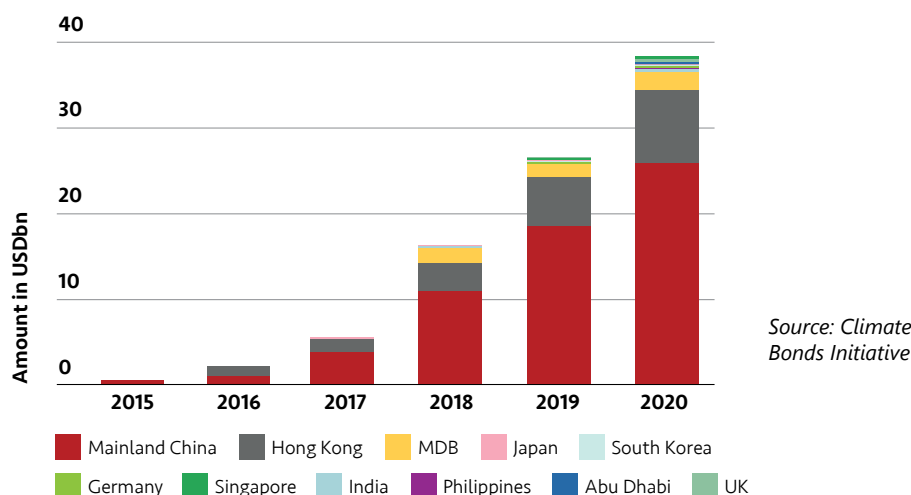
An encouraging characteristic of the green finance market has been the remarkable growth of green debt instruments. On top of green bonds, a diversity of products has come to market, including green asset-backed securities (ABS), green loans and green sukuk. By the end of 2020, green instruments had originated from a record 67 nations and multiple supranational institutions.

Despite the impact of COVID-19, during the course of 2020 global green bond issuance reached USD290bn, which represents a 9% year-on-year growth.³ In terms of use of proceeds (UoP) of green bonds globally, Energy, Buildings, and Transport were respectively the three largest categories, contributing 85% of the total in 2020.

² For further information on the Climate Bonds Initiative see <https://www.climatebonds.net/market/explaining-green-bonds>.

³ See Climate Bonds Initiative, Sustainable debt - Global State of the Market 2020, April 2021, https://www.climatebonds.net/files/reports/cbi_sd_sotm_2020_04d.pdf.

Cumulative green debt arranged and issued in Hong Kong amounts to over USD38bn



1.1.2. Hong Kong as a Regional Green Finance Hub

2016 marked the beginning of the Hong Kong green bond market, when real estate investment trust Link REIT issued the first green bond from Hong Kong-domiciled issuer. However, the market really began to pick up speed in 2018 with private sector companies issuing debut green bonds.⁴

The turning point came when a series of policy signals and measures were announced by the Government of the Hong Kong SAR in late 2017, aimed at promoting green finance development by creating liquidity, supporting integrity and providing incentives for green bonds. In October 2017, the Chief Executive of the Government of the Hong Kong SAR included a green finance agenda in the Policy Address, which was followed by the government's announcement in early 2018 of its intention to issue sovereign green bonds.

Cumulative green bond issuance by Hong Kong domiciled issuers reached USD9.2bn by year end 2020; total issuance in 2020 decreased by 18% to USD2.1bn.⁵ Despite a raft of policies and market support efforts by the government, the growth of the city's green finance market has been largely underpinned by conglomerates and large corporates, primarily property developers, as evidenced by the allocation of green bond proceeds, where the Buildings category has been consistently the dominant investment destiny, followed by Transport, Energy and Water.

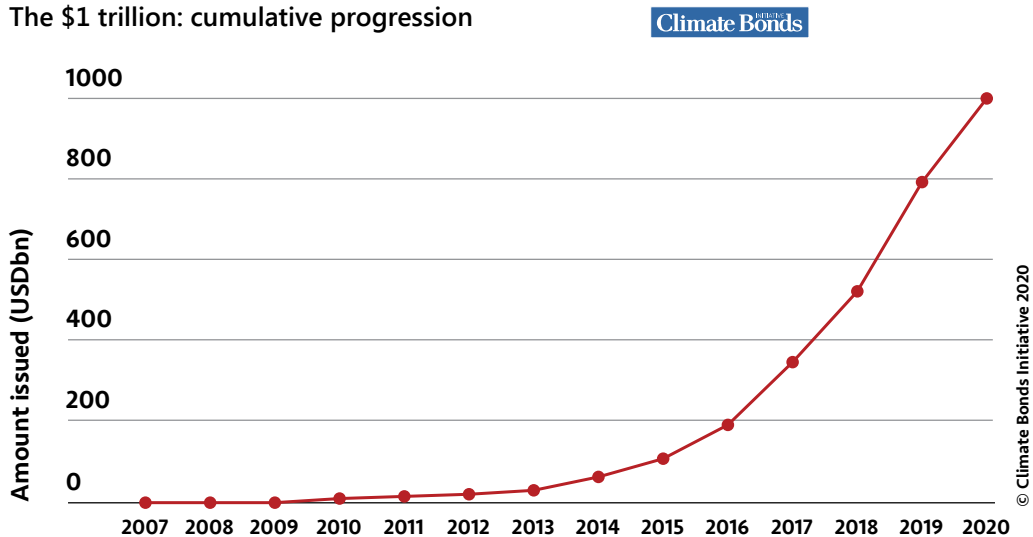
In addition to the domestic market, Hong Kong plays a pivotal role in facilitating Asia's green finance deal flows. The Hong Kong Stock Exchange remains the largest venue for China's offshore green bond listing. According to the Hong Kong Monetary Authority (HKMA), the Hong Kong green debt market, comprising all the green bonds arranged and issued in Hong Kong, continued to grow not only in size but also in diversity. Cumulative green debt issuance amounted to over USD38bn by the end of 2020.

In 2020, USD12bn of green debt was arranged and issued in Hong Kong, of which USD1.3bn was issued as green loans. Mainland China entities continued to drive the market, with green debt issuance totalling USD7bn in 2020, or 60% of the total. Local Hong Kong issuers were the second largest issuer group, making up nearly 26% of the market. The rest of the market comprised issuers from a broad range of countries in the Asia Pacific region, the Middle East and Europe.

⁴ See Climate Bonds Initiative, Green Bond Market Briefing on Hong Kong, February 2019, https://www.climatebonds.net/files/reports/hk_briefing_cbi_hkma_final_25feb2019.pdf.

⁵ See Climate Bonds Initiative, Green Bond Market Briefing 2020, May 2021, https://www.climatebonds.net/files/reports/cbi_hkg-b_2020_04c.pdf.

The \$1 trillion: cumulative progression



Source: The Hong Kong Monetary Authority

1.1.3. Upping the Ante on Financing for Low Carbon Transition

Scaling up investments for climate action and sustainability requires unwavering policy support. Below are some of the key areas where policy actions are required to bolster the development of green finance.

Closer collaboration with the Greater Bay Area (GBA)

Between 2016 and 2020, internationally aligned green bonds from GBA-domiciled issuers amounted to USD16.9bn. Prior to the global pandemic, the GBA green bond market grew at a CAGR of 69%, mainly driven by Hong Kong and Guangdong-domiciled issuers.⁶

As one of China's economic powerhouses and a leading manufacture hub, the GBA is an integral part of the country's overarching national strategy to reach its nationally determined contribution (NDC) and has an instrumental role to play in decarbonising its economy by pushing ahead with the low-carbon transition of hard-to-abate sectors.

Closer collaboration between Hong Kong and other GBA cities would facilitate a coordinated effort in strategic sectoral planning, standard setting, and carbon emission data collection for a more comprehensive approach to decarbonisation.

Government of the Hong Kong SAR's **Green Bond Programme – leading by example in striving for a net zero carbon future**

Following the commitment made in November 2020 to achieve carbon neutrality by 2050, the government has announced a revamped "Hong Kong's Climate Action Plan" on 8 October 2021, with more aggressive carbon reduction strategies and measures.

Turning pledges to intended outcomes requires a holistic approach with coordinated efforts between the government, regulators, banks, investors and the private sector in devising decarbonisation strategies and action plans at sectoral level, underpinned by a series of effective policy (monetary, macroprudential and fiscal) and financing tools.

⁶ See Climate Bonds Initiative, Green Infrastructure Investment Opportunities, June 2021, https://www.climatebonds.net/files/reports/cbi_gba_giio_02c.pdf.

As of August 2021, the government had issued USD3.5bn worth of green bonds (including the inaugural USD1bn in 2019 and USD2.5bn in February 2021), leading the sovereign green bond space in Asia. In early 2021, it announced its intention to issue about USD23bn (HKD175.5bn) of green bonds in next five years, taking into account the market situation and aiming to cover a larger variety of project types and bond features.

Working towards achieving a carbon neutrality target will entail not only promoting green industry, but also supporting traditional, carbon intensive industries to embark on “brown-to-green” transition, i.e. decarbonising the high emitting and hard-to-abate sectors. Demonstration issuances by the government that finance ambitious transition pathways could allow deeper engagement between various governmental bureaus, ensuring funding allocation matches with decarbonisation strategies and sectoral priorities, showing clearly that the city will be gradually moving away from the current fossil-fuel-reliant energy mix.

Demonstration issuance would also benefit the market by giving clear guidance on domestic decarbonisation pathways and best practices on target setting and disclosure requirements, thereby strengthening Hong Kong’s role as Asia’s sustainable finance hub.

Credible and ambitious transition finance can support Asia’s carbon neutrality goals

Addressing climate change requires fundamental and rapid transformation across all sectors of the economy. The question is no longer why or whether the global economy needs to move towards a low carbon, climate adapted, sustainable model, but rather how rapidly the required transition can be financed and operationalised.

Transition finance and the understanding of sufficiently ambitious transition pathways are still at a nascent stage. Hong Kong could play a crucial role in lending a voice of support and contemplating how regulation could assist in incentivising the Asian market to scale. The robust development of transition finance hinges on credibility and ambition, as the transition strategies and pathways set out by issuers will come under even greater scrutiny than other instruments.

In Asia, transition finance is taking shape with a growing number of issuers raising funds from transition bonds or loans. While the first movers have played a vital role in bringing attention to this space, the link between individual deals and wider transition pathways to net zero by 2050 has been limited thus far. Science-based and sector-specific transition pathways are essential for issuers to understand what is eligible to be financed.

To attract more and larger transition finance deal flows, Hong Kong policymakers will need to take a proactive role in leading the collaborative effort with the investment community, scientists, subject matter experts and intermediaries in reinforcing the idea of an ambitious and robust transition model. In the “Financing Credible Transition” whitepaper published last September, the description of Climate Bonds stresses that transition has to be science-based and in line with 1.5-degree global warming outcomes, i.e., it should not simply be a transition to another transition⁷

1.1.4. Closing Thoughts

Cumulative issuance of global green bonds to date has now reached USD1tn, but there is still a long way to go. To finance the goals of the Paris Agreement, it is estimated that green bond issuance needs to reach USD1tn per annum by the early 2020s.⁸ Hong Kong’s leadership in mobilising capital for environmental and climate change solutions, aligning to international green finance best practices and coordinating actions across the financial system to support economy-wide low carbon transition would be pivotal in raising awareness of the climate emergency in the region.

⁷ See Climate Bonds Initiative, Financing Credible Transitions, September 2020, https://www.climatebonds.net/files/reports/cbi_fin_credtransitions_final.pdf.

⁸ See Climate Bonds Initiative, COP22 Green Bond Directions: Green Finance For Mitigation and Adaption, November 2016, <https://www.climatebonds.net/2017/10/cop22-green-bond-directions-green-finance-mitigation-and-adaptation-usd-1-trillion-2020>.

1.2. Dive into the Opportunities

By the Hong Kong Exchanges and Clearing Limited

1.2.1. The 14th Five-Year Plan

In 2019, the Government of the People's Republic of China designated Hong Kong as the green finance centre of the Greater Bay Area. "The Outline of the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Long-Range Objectives Through the Year 2035"⁹ sets out a plan that



Grace Hui is the Head of Green and Sustainable Finance at Hong Kong Exchanges and Clearing Limited (HKEX) with responsibility for the development of HKEX's green and sustainable finance program. She is a member of both the Regulatory Oversight Board and the Sustainability Committee of the Hong Kong Institute of Certified Public Accountants; and co-chairs the Market Development Work Stream and the Carbon Market Working Group of the Green and Sustainable Finance Cross-Agencies Steering Group established by Hong Kong Monetary Authority and Securities and Futures Commission.

promotes a comprehensive green transformation for economic and social development and endeavours to achieve carbon neutrality before 2060. The Government of the Hong Kong SAR also announced it would strive to achieve carbon neutrality before 2050. These developments present great opportunities for Hong Kong given its status as an international finance centre and the gateway between China and the rest of the world.

To ensure we capitalize on these opportunities, the Hong Kong's Green and Sustainable Finance Cross-Agency Steering Group (CASG)¹⁰ announced¹¹ its strategic plan in December 2020 which sets out six key focus areas and five near-term action points for strengthening Hong Kong's financial ecosystem to support a greener and more sustainable future in the longer term. In addition, the government has offered tremendous support by announcing its plan to issue green bonds regularly and expand the scale of the Government Green Bond Programme by doubling its borrowing ceiling to HKD200bn with the intention of issuing retail green bonds in the future. Further, the Government also launched the Green and Sustainable Finance Grant Scheme¹² in Hong Kong which provides a subsidy for eligible bond issuers and borrowers to cover their expenses for bond issuance and external review services.

⁹ See the Government of the Hong Kong SAR, Press Releases, March 2021, <https://www.info.gov.hk/gia/general/202103/11/P2021031100512.htm>.

¹⁰ Established in May 2020, the Steering Group is co-chaired by the HKMA and the SFC. Members include the Environment Bureau, Financial Services and the Treasury Bureau, the HKEX, the Insurance Authority and the Mandatory Provident Fund Schemes Authority. In December 2020, the Steering Group published its long-term strategic plan with action points, which aim to coordinate the management of climate and environmental risks to the financial sector, accelerate the growth of green and sustainable finance in Hong Kong and support the Government's climate strategies, <https://www.hkma.gov.hk/eng/news-and-media/press-releases/2021/07/20210715-4/>.

¹¹ See Stock Exchange of Hong Kong Limited, Announcement, December 2020, https://www.hkex.com.hk/-/media/HKEX_Common/Market/Stage/News-Centre/Cross-Agency-Steering-Group-Announcement_20201217.pdf.

¹² See Financial Services and the Treasury Bureau, https://www.fstb.gov.hk/fsb/en/business/funding_schemes/green-and-sustainable-finance-grant-scheme.html.

1.2.2. An Ambitious Goal

In the past few years, China's green finance has developed rapidly. By the end of 2020, China had become the largest green credit market in the world with a total lending of RMB12tn and the second largest green bond market in the world, with a total volume of issuance of RMB813.2bn billion.

Meeting China's carbon neutrality goal is ambitious and expensive. China's energy ecosystem and its industry will need to be transformed. There will be the increasing uptake of renewable energy and bioenergy, a new era of electrification from pump to plug, an upgrade of industrial plants using cleanest available alternative technology, an upgrade of heating infrastructure, and finally a greater focus on carbon sequestration (natural sinks and carbon capture).

In the research report "China's Long-term Low-carbon Development Strategy and Pathway", Professor HE Jiankun, the Vice Chairperson of the National Expert Committee on Climate Change, stressed that:

"To achieve the transformation of China's energy system, in line with the 2-degree goal of the Paris Agreement, will require new investment around RMB100tn, or 1.5-2.0% of China's annual GDP between 2020 and 2050."

In line with 1.5-degree goal, the investment need will be even higher, i.e. RMB138tn, or over 2.5 % of annual GDP.

The message from these figures is clear: both the investment need and the public financing gap for green and climate-neutral transformation are huge. Indeed, in mid-July, China's National Development and Reform Commission said it would encourage domestic enterprises to issue green bonds in the offshore market.

At present, international investors have little exposure to Chinese bonds. The Bond Connect scheme, which allows foreign investors to invest in Mainland China's USD\$17.5tn domestic bond market via the Hong Kong Stock Exchange will play an important role. It could encourage international investors to participate in China's green bond market.

In terms of opportunities in GBA, the Climate Bonds Initiative has released a report¹³ assessing the state of the market for green infrastructure projects in the GBA, one of the economic growth engines and leading green finance regions in China. As of 31 December 2020, green bond issuance from the GBA entities amounted to USD16.9bn and the market is growing.

The report points out that the major infrastructure projects in the 14th Five-Year-Plan (FYP) of Guangdong Province are expected to have a total investment of RMB5tn (USD776.9bn), of which green infrastructure investment is to be not less than RMB1.9tn (USD299bn), including rail transit, wind power, modern water conservancy, ecological civilization construction and new infrastructure construction. Along with the infrastructure planned in Hong Kong and Macao, the GBA presents immense opportunities for international investors who are eyeing onshore green assets.

In order to attract investors looking for green opportunities, there needs to be a visible pipeline of infrastructure investment opportunities that align with internationally accepted definitions of green. In other words, there must be viable alternatives to non-green assets and projects, and investors can make their preferences for green heard, which will in turn spur the creation of a larger pool of green investments. A large and visible GBA green infrastructure pipeline could also help investors to understand that there is a sufficiently large pool of financially attractive investments that are also green.

¹³ See Climate Bonds Initiative, Green Infrastructure Investment Opportunities, June 2021, https://www.climatebonds.net/files/reports/cbi_gba_giio_02c.pdf.

There is often limited awareness and appreciation of what qualifies as ‘green investment’ beyond solar and wind energy. This knowledge gap has been holding governments back from developing pipelines of commercially viable, green infrastructure investment opportunities that would otherwise play a vital role in supporting the region’s transition to a low-carbon economy. Improving the general investment environment as well as promoting more green finance will help to fund the infrastructure necessary to meet climate targets. This means continuing to open up to investors looking for green and ensuring there is a pipeline of bankable, investment ready projects. These measures will ensure that the GBA is on the path to transitioning to a low-carbon economy and becoming more resilient to the impact of climate change and other global shocks.

Currently, much of the investment in infrastructure in the GBA is being carried out through public funding and Public Private Partnerships (PPP) ventures. However, public funding is not sufficient to meet the growing demand for green infrastructure; new channels will be necessary to mobilize private capital. That said, green debt instruments, such as green bonds, green asset-backed securities, and green loans, have been increasingly deployed to raise funds for infrastructure projects in the GBA. As China works towards achieving carbon neutrality target, with a raft of policy measures in the growing green finance market from governments on both national and local levels, the potential of green debt instruments as an infrastructure refinancing tool will be further unleashed.

1.2.3. Closing Thoughts

The Government of the Hong Kong SAR and its finance regulators are enhancing efforts to promote market development and encourage more entities to make use of Hong Kong’s capital markets as well as financial and professional services for green and sustainable investment, financing and certification. We will continue to develop green and sustainable finance to boost investments conducive to reducing carbon emissions and building a low-carbon economy and capitalize on the enormous green finance opportunities presented by the GBA. Project Genesis undertaken together with the BIS Innovation Hub offers a glimpse into several innovation aspects touched upon in this report – from securities tokenization for increased placement efficiency, to green disclosure and transparency on blockchain as immutable ledger.



Section 2: Spotlight on Tokenisation

2.1. Securities Market Perspective

By the Asia Securities Industry & Financial Markets Association and BNY Mellon



Laurence van der Loo is Executive Director, Technology and Operations at ASIFMA, the Asia Securities Industry & Financial Markets Association. Based in Singapore, Laurence is responsible for coordinating ASIFMA's regional Operations and Technology advocacy efforts including regulatory implementation, cost efficiencies, KYC/AML, fintech/regtech and cyber and cloud.



Laurence Kehoe is a global director and senior digital assets and blockchain lead within BNY Mellon's Digital Assets Unit. Lory works across the BNY Mellon enterprise to lead client engagement on digital assets and blockchain.



Johnny Wijaya is the Head of BNY Mellon APAC Innovation Center. Johnny works across the enterprise to drive rapid execution of ideas and concepts in collaboration with clients, fintechs, big techs and internal teams, while creating an environment that accelerates and promotes experimentation and incubation of new products and services

2.1.1. Ongoing Evolution

As explored in Project Genesis, tokenised securities bring the benefits of blockchain into the securities lifecycle to create an innovative new financing and capital raising model. This approach can bring efficiencies, is scalable and could provide liquidity and compliance opportunities that are evolutionary to traditional finance. Whilst still at an early stage, tokenised securities will impact traditional finance and act as a bridge between legacy finance and the new digital world, taking benefits from each.

The link between traditional financial products/instruments and blockchain technology offers stakeholders the reliability of a regulated instrument combined with the benefits afforded by a blockchain. Because tokenised securities are generally regulated as securities, they offer the opportunity to bring greater degrees of trust and support to the digital asset marketplace. Blockchain technology can deliver improved transparency, security and accuracy, enhancing efficiency throughout the value chain, as well as providing the opportunity to leverage smart contracts that build in compliance. Issuers and financial institutions can also manage a larger number of investors with the expanded geographic reach offered by the technology. There could also be more efficient secondary market operations which would help issuers to access new capital and investors that require liquidity.

2.1.2. Possible Advantages of Tokenised Securities¹⁴

- 1. Speed of settlement:** Whilst the settlement process has shortened over the years, it generally takes 2 days for a security to settle. Much of this delay relates to a need for sequential steps to happen in a chronological manner, the purpose of which is to prevent counterparty risk since the buyer of a security does not interact directly with a seller. With smart contracts and information symmetry in real time, much of these processes can be automated and happen in parallel.
- 2. Automated compliance:** Because tokens are programmable, compliance with regulations can be programmed into smart contracts, reducing and automating the regulatory compliance burden. The smart contract will be able to execute, regulate and govern the token. For example, during a transfer of asset, tokens can be programmed only to be transferable to certain wallets and therefore restrict transfer of the token to ineligible counterparties.
- 3. Globalised markets:** Tokens have no physical form – they exist only in digital form and can be accessed via the internet. Accordingly, tokens can be issued and traded globally via the internet, subject only to specific restrictions that are programmed into the token's smart contracts (e.g., in order to comply with applicable legal and regulatory requirements) and the availability and restrictions of any relevant intermediaries (e.g., exchanges and custodians).
- 4. 24/7 trading:** Traditional securities have strict trading hours on business days only, so investors cannot trade on news and developments over the weekend. They are also subject to the operating hours and procedures of clearing and settlement systems. Tokenised securities can trade and settle 24/7 which eliminates these inefficiencies. This needs to be balanced against any operational requirements that 24/7 trading might bring with it.
- 5. Transparency:** Provides a single source of information for all market participants, which also facilitates the recording of ownership and makes beneficial ownership transparent throughout the lifecycle to permitted persons.
- 6. Programmable features:** e.g., automating dividend pay-outs, easing voting processes, automating vesting periods etc.
- 7. Immutability:** Transactions on the blockchain are immutable, providing an accurate record of ownership of securities.
- 8. Increased efficiencies and cheaper fees:**
 - a. Blockchain and smart contracts lead to increased internal efficiencies for financial institutions, some of which will be passed on to end issuer or investors.
 - b. Potentially financial institutions can now serve smaller deals which was previously infeasible. i.e., bond origination is traditionally > USD300m.
 - c. Lower trading costs.

¹⁴ See Asia Securities Industry and Financial Markets Association, Tokenised Securities, November 2019, <https://www.asifma.org/wp-content/uploads/2019/11/tokenised-securities-a-roadmap-for-market-participants-final.pdf>.

- 9. For issuers:** Advantages include a more efficient fundraising process (in terms of speed and reach), lower origination fees, table management cap, real time reporting and ownership structure, and access to a larger investor base of smaller investors.

2.1.3. Institutional Expectations

With the increasing relevance of digital assets clearly established, institutional demand for a global infrastructure to provide stability and safety is evident. In a BNY Mellon study in August 2021, 72% of institutional asset managers said they plan to develop solutions for asset tokenisation.

Investors expect the same institutional level of service as in the traditional space. In addition, institutional stakeholders of all stripes require stable, reliable servicing of the entire asset lifecycle from issuance to custody, trading, and settlement to core fund servicing, accounting, and payments. Such requirements fall into three categories:

- **Trust and financial soundness:** Given the potential of the digital space, institutions are looking for the same level of risk management, focus on regulatory compliance, and rigorous safety and security standards that are available for traditional assets.
- **Institutional readiness:** Institutions are looking for scalability, transparency, and full-spectrum support to help them navigate the risks of the ecosystem for digital assets. Multi-jurisdictional regulatory reporting, resilience, and experience in handling complex institutional scale scenarios will set some providers apart from others.
- **Seamlessness:** Institutions want a one-stop shop to support the expanding use cases of digital assets as well as delivering value across the full financial lifecycle of digital assets (such as trading, safekeeping, collateral management, and lending).

2.1.4. Need for Collaboration

Because digital assets and markets are inherently tightly connected, delivering on these requirements takes close collaboration within the industry and with fintech providers. In the world of traditional assets and markets, asset owners, asset managers, institutional investors and service providers already work closely together. Similarly, collaboration will be essential for bringing digital assets to full maturity. If technology developers, financial infrastructure and service providers, and stakeholders along the whole value chain come together to create and deploy integrated solutions, rather than a collection of one-off innovations, the end result will be much more robust.

2.1.5. Closing Thoughts

Tokenised Securities leveraging new or emerging technologies such as blockchain or distributed ledger technology (DLT) could bring about a major reduction in settlement time, settlement risks, and administrative costs associated with, for example, Know Your Customer (KYC) and reconciliation functions, alongside the implementation of automation of data and compliance management. While tokenisation does not change the underlying risks in the settlement cycle, it can transform and change how they are managed (e.g., timing, custody and clearing cycles), and help eliminate the need for constant reconciliation of multiple ledgers within and across organisations. It can also provide a reference source of truth for any analytic and reporting purposes.

Another key advantage of Tokenised Securities is the ability to improve secondary market liquidity through digital fractionalisation/democratisation, which enables expansion into newer customer segments, improves accessibility and options for diversification, and expands access to new market participants by increasing the pool of investors through global outreach. By creating new investment structures, firms can bring to market new types of assets and create new marketplaces for previously illiquid assets.

As we stand at the cusp of digital assets becoming institutionally ready, we expect the emerging world to be “multi-centred,” with global institutions and their collaborative partners all playing their part. This new ecosystem, which must be grounded in both trust and innovation, will provide significant opportunities for growth.

2.2. Primary Placement

By Clifford Chance



Connie Heng is Clifford Chance's Regional Managing Partner for Asia Pacific. She has assisted many Hong Kong and Chinese issuers with their securities offerings in the international debt capital markets and has advised on many landmark transactions. Connie is a member of the Firm's Global Executive Leadership Group and has represented the firm as part of its delegation to the World Economic Forum in Davos since 2012.



Mark Chan is a Partner of Clifford Chance (Hong Kong) in the Global Financial Markets Group. Mark specialises in a wide range of debt and equity-linked capital markets products. He advises both issuers and underwriters on any type of debt issuances. He is focused on the transition to security tokens and digital debt capital markets products.



Rocky Mui is a Partner of Clifford Chance (Hong Kong) funds and investment management team. He specialises in fund establishment, authorisation of funds, licensing and regulatory advice, PRC investment programs (QFI/Stock Connect/Bond Connect/CIBM Direct Access), cross-border mergers & acquisitions and general corporate related work.

2.2.1. Regulatory Principle of Technology Neutrality

With the spotlight on tokenising traditional securities in recent years, we have seen genuine interest in the market for such tokenised securities, and questions arise as to the differences between the primary distribution of tokenised securities and securities sold as a traditional offering. This bird's eye view article will address the key

differences in respect of such primary distribution by looking at the regulatory landscape in Hong Kong, key player¹⁵, documentation and other mechanics (settlement), along with a brief discussion of the associated advantages and disadvantages of tokenised bonds as against traditional issuances in the primary distribution stage of the lifecycle. The tokenised bonds considered in this paper have substantially similar features to traditional bonds but would be issued, cleared, traded, settled and ownership validated by way of a digital distributed ledger utilising blockchain technology.

In Hong Kong, regulators generally have adopted a technology neutral regulatory approach and are seeking to regulate tokenised securities and related activities based on the existing legislative framework with additional regulatory guidance provided by regulators. Tokenised bonds would be classed as securities under the Securities and Futures Ordinance (SFO) and its offering would be regarded by the Securities and Futures Commission (SFC) as a security token offering (STO), structured to have features of a traditional securities offering, and involving security tokens which are digital representations of ownership of assets or economic rights utilising blockchain technology.

The offering of tokenised bonds will be subject to the same product authorization (and related private placement safe harbours) and licensing requirements (such as dealing, advisory and asset management involving securities) as traditional bonds under the SFO. However, there are additional regulatory considerations applicable to tokenised bonds and the SFC has reminded licensed intermediaries to discuss their offerings with the SFC before engaging STO-related activity. Licensed intermediaries are also expected to conduct proper due diligence to develop in-depth understanding of the tokenised offerings and provide adequate risk disclosures covering risks associated with the tokenised bonds to their clients.

2.2.2. Considerations for Key Players

Issuers

While issuances of tokenised bonds will pose the same considerations as traditional issuances, such as which entity should act as issuer, accounting and taxation issues and the composition of proposed investor groups, additional considerations also come into play for tokenised bonds. Issuers need to consider whether there is regulatory support for such issuances in the jurisdiction of the issuer and in the investor base (or at least regulatory neutrality towards tokenised bonds). Licensing and selling/ on-selling restrictions in respect of digital/ virtual assets also need to be considered to the extent they are additional to the existing requirements for traditional offerings.

Managers and Underwriters

Managers, underwriters and advisers will play a role similar to the traditional one when handling tokenised securities but will also need to be more heavily involved in the mechanics of the issuance and be ready to provide advice on blockchain selection, exchange possibilities and suitable investors who are already familiar with such offerings and are jurisdictionally allowed to participate. To the extent such investors are able to participate but are not as knowledgeable in the space, advisers will also need to spend time skilling up such investors prior to their participation in the offering. Lawyers for participants will also need to be up to speed on the digital aspects of such offerings on top of bringing their existing capital markets expertise to bear.

DLT Technology Providers

Tokenised bonds will add an additional layer of technology to issuances (while also replacing some existing infrastructure). Careful selection of the blockchain platform to be utilised will be critical along with the

¹⁵ We will not seek to discuss the additional players that may spring up in the space owing to article size constraints but would expect to see specialised AML, KYC, blockchain and cybersecurity entities spring up to service the evolving market along with specialised market platforms, an expansion in the number of OTC players and additional access points for ease of on-ramping and off-ramping of funds. See also Asia Securities Industry and Financial Markets Association, Tokenised Securities, November 2019, <https://www.asifma.org/wp-content/uploads/2019/11/tokenised-securities-a-roadmap-for-market-participants-final.pdf> for a similar discussion.

tailoring of the proposed token and underlying smart contract tied to the offering. Issuers will need to determine whether such technology is developed in-house or outsourced and understand the associated third-party and smart contract risks involved. The utilization of such technology will also need to be battle tested by cybersecurity and technology auditors.

Registrar, Custodians, Trustees, Depositaries and Distributors

One of the key potential benefits of tokenising securities utilising blockchain technology is the possibility of removing different layers of intermediaries between issuers and investors for a more efficient primary issuance process and post-issuance servicing of the security. In an ideal world, investors could subscribe directly with the issuer where the records of ownership (and subsequent transfers) would be managed under the 'bond register' of a digital distributed ledger. However, whether the 'bond register' can be tokenised (thus doing without a registrar) would need the laws of the issuer's jurisdiction to accommodate digitisation of each step of the bond issuance and securities transfer process. Also, in practice various key intermediaries in traditional bond primary distribution may continue to have a place in the tokenised bond space.¹⁶

2.2.3. Considerations from a Tax, Accounting and Legal Expertise

Traditional issuances require taxation, accounting and legal expertise, but tokenised offerings add a further layer of complexity and the need for specialist advice in certain jurisdictions on the classification of such offerings (assuming of course the relevant jurisdiction has even contemplated/ classified such offerings) and the associated regulatory treatment which can vary markedly across jurisdictions. As such, even though tokenised bonds are in essence bonds in digital wrappers, how they are classified and regulated continues to evolve with jurisdictions taking diverging approaches necessitating a wider range of specialist advice and inputs to ensure regulatory and general legal compliance.

2.2.4. Legal Documentation Requirements

There is considerable overlap and equivalence in the documentation used for tokenised bonds compared to that for traditional issuances. Outside of a private sale, an offering document/ information memorandum is still likely to be utilised, but disclosure will need to be further adapted to take into account the use of tokenisation and to address the regulatory position, the nature of the target investor base and the additional technology related to the offering. Consideration will also need to be given to marketing and advertising in respect of the offering, which again will depend on the approach of the jurisdiction and regulator in question.

Purchase, subscription and underwriting agreements are still likely to be utilized but will be adjusted depending on the token mechanics and distribution process and whether the subscription is to happen on or off-chain and/or through intermediaries. Tokenised bonds may still need to be constituted by way of a deed of covenant, trust deed, indenture or similar mechanism depending on the governing law.

While many of the mechanics of tokenised bonds will remain the same as traditional bonds, from a legal perspective, terms and conditions may need to be built into the smart contract to set out and establish a clear link between the tokens and the underlying bond that they represent, along with establishing ownership criteria and register / ledger maintenance mechanics.

Additional custody arrangements may also need to be put in place along with separate agreements entered into with technology providers of the blockchain and platform technology. Agreements with exchanges may also need to be considered.

¹⁶ For example, Trustees will still play an important role for investors in tokenised bonds. Custodians/depositaries/distributors would still be valuable where their functionalities may involve a regulated service in respect of which they are licensed to perform, wider regulatory consideration (e.g. how simplified AML/KYC checks may be performed through regulated intermediaries), existing market infrastructure (e.g. pre-existing contractual relationship and system linkages of intermediaries) and investor familiarity and convenience (e.g. investors can deal with their existing financial intermediary without the need to be brought onboard by the issuer directly).

2.2.5. Closing Thoughts

While many of the players, much of the documentation and many of the concepts embedded within tokenised bonds will be familiar to participants in the traditional space, many of the adjustments will be new at this point in time. The additional layer of technology and the potential benefits it provides are expected to attract interest of a wider range of issuers. It is envisaged that as time progresses and the technology gains a greater network effect with increasing familiarity amongst regulators, market participants and investors, there will be wider adoption of tokenised bonds.

2.3. Secondary Trading

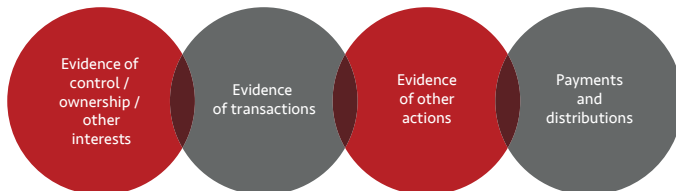
By King & Wood Mallesons



Urszula McCormack is a partner for Cross-Border Finance and Technology at King & Wood Mallesons. Urszula advises global banks, payment institutions, large technology companies, exchanges, virtual asset issuers and software developers on new products, cross-border transactions, compliance and licensing. In her data practice, Urszula advises on privacy regulation, algorithmic design, encryption technologies and data-sharing arrangements. Urszula is a leading specialist advising governments, multilaterals and regulators on building robust enabling environments for digital payments, digital identity, financial crime controls, cross-border data flows and innovation.

2.3.1. How does DLT change Things?

The impact of DLT depends on its precise role and what it records. By way of example, it can play a role in the following key areas:



How this impacts secondary trading and the model ultimately adopted then requires consideration of **how ancillary technologies are used and how applicable rules and parameters are integrated**. The following diagram brings together a number of the key factors.



- Mirror register or definitive record?
- Legal and/or beneficial interest?
- Evidence of other actions?
- DLT-based payment asset?
- Wallet architecture - open vs centralised / permissioned
- Price discovery mechanisms
- Counterparty identification
- Negotiation and agreement
- Settlement
- Lifecycle payments or adjustments
- By design
- Via intermediary controls
- Via participant
- Via intervention

DLT can therefore have a profound, or minimal, impact on secondary retail bond trading, depending on how it is adopted.

Hypothetical retail bond scenario in Hong Kong

A retail bond can integrate DLT in multiple ways, leading to the possibility of a largely traditional “innovation light” secondary trading scenario, or alternatively a highly innovative “blue sky” model.

For example:

Sample “innovation light” model	Sample “blue sky” model
<ul style="list-style-type: none"> • Retail investor’s bond interests held in securities account • Institution records retail investor’s interest using DLT as part of its internal record-keeping only • Institution still holds bonds with in CMU as normal • Trading and settlement occur in a traditional manner using a stock exchange and banking intermediaries for fiat transactions 	<ul style="list-style-type: none"> • Retail investor holds bond directly • Restrictions on ownership applied through permissioned wallet architecture • Trading occurs with pre-approved (KYC-cleared) participants via a decentralised exchange with pre-programmed/configurable smart contracts • Settlement occurs with virtual assets on an atomic basis • Bonds can also be “staked” (locked in a smart contract) as collateral

2.3.2. Key Legal and Regulatory Issues

The legal and regulatory issues that are typically involved when examining secondary market trading of tokenised bonds include:

Matters flowing from issuance

- **Legal formalities for the register**, unless (as has been the case for many bond issuances to date) a mere “mirror” register is contemplated, in which case reconciliation between the DLT record and the register will be an essential legal issue to avoid disputes and challenges on insolvency.
- **Legal formalities for bearer instruments** (evidencing investors’ legal interests), where applicable.
- **Offering and marketing rules**. For example, in Hong Kong, unless exempted, retail bonds must be approved by the SFC under section 103 of the SFO. Any offshore restrictions must also be factored in, particularly if they require sales to be restrained for a certain period of time (or altogether).

Matters flowing from transfers

- **Legal formalities for transfer**. For example, in Hong Kong, there is a statutory regime for the legal assignment of debts and choses in action under the Law Amendment and Reform (Consolidation) Ordinance (Cap. 23 of the Laws of Hong Kong). It provides that, if the relevant processes are followed (including notice), an assignment will be effective in law.
- **Electronic transactions and signatures** to ensure transactions can be effected in digital form. In Hong Kong, this is enabled via the Electronic Transactions Ordinance (Cap. 553 of the Laws of Hong Kong), but a number of exclusions apply.

- **The need for settlement finality.** This can be achieved through regulatory designations¹⁷ for approved financial market infrastructure or by agreement as to the pre-conditions for a transaction to be deemed concluded and irrevocable. This is important not only for the bond, but also in respect of any counter-asset – for example, as settlement finality is probabilistic for many virtual assets, it is reasonably common to pre-agree the number of confirmations required before the transaction is “final” or grant one party the discretion to do so.
- **Licensing requirements and prudential conduct standards,** both to avoid inappropriately falling within a traditional category of licence, and to ensure there is a legal basis for the issuance and transfer processes being contemplated. This goes beyond ensuring legal enforceability – for example, is there a clear regime for what happens when something goes wrong? How should regulation best address the need for integrity in systems, especially if they are decentralised and automated?

A snapshot of key intermediary licensing touchpoints in Hong Kong is set out below:

Intermediary activity	Licensed activity
Brokerage	Bonds and interests in bonds are “securities” and dealing in bonds requires a Type 1 licence under the Securities and Futures Ordinance (Cap. 571 of the Laws of Hong Kong) (“SFO”).
Stock exchanges and other key entities	An operator of a stock market must be recognised under section 19 of the SFO. In addition, the SFO and related rules govern clearing houses, exchange controllers and investor compensation companies and also authorise the creation of rules by certain of those entities.
ATS	Providing an “automated trading service” in bonds requires a Part III SFO authorisation or Type 7 licence under the SFO.
Custodians	A person who provides escrow or other custody services may require a “trust or company service provider” licence under the Anti-Money Laundering and Counter-Terrorist Financing Ordinance (Cap. 615 of the Laws of Hong Kong) (“AMLO”).
Fiat payment and wallet providers	A person who assists with remitting funds and/or changing currencies will typically require either a “money service operator” licence under the AMLO or a banking licence under the Banking Ordinance. A fiat wallet provider will typically require a “stored value facility” licence under the PSVFO or (in the case of a bank) will need to register such a facility with the HKMA and comply with related conditions.

A range of technology solutions may also support secondary market trading, which may/may not require licences.

- **Prudential standards applying to intermediaries,** including how they onboard and sell to clients, conduct suitability and other assessments needed, organise themselves and manage risk from a governance standpoint, and operationalise relevant trading and settlement flows. In Hong Kong, the SFC has specific requirements for those involved in DLT-based assets, including ATS providers (“SFC VASP Regime”).¹⁸
- **Stamp duty requirements or other laws** which might require particular documents, or copies of them to be kept, on paper, parchment or vellum rather than in electronic form, or electronically but in a particular format. In Hong Kong, the Stamp Duty Ordinance (Cap. 117 of the Laws of Hong Kong) does not apply to bonds.
- **Locations (and different jurisdictions)** of the issuer, trading facility, register, bondholders and potential licensing, marketing and conflict of law considerations.

¹⁷ For example, the HKMA has the power to issue certificates of finality to designated clearing and settlement systems, subject to meeting certain requirements, under the Payment and Stored Value Facilities Ordinance (Cap. 584 of the Laws of Hong Kong) (“PSVFO”). See generally at https://www.hkma.gov.hk/media/eng/doc/key-functions/banking-stability/oversight/explanatory_note.pdf.

¹⁸ See Securities and Futures Commission, Position paper on Regulation of virtual asset trading platforms, November 2019, <https://www.sfc.hk/-/media/EN/files/ER/PDF/20191106-Position-Paper-and-Appendix-1-to-Position-Paper-Eng.pdf>.

- **The nature, limitations, rules and regulation of the intended trading platform and other intermediaries used.** Examples of such rules and why care is needed when examining them as part of building new architecture for tokenised assets is set out below.
- **Data and confidentiality requirements.** The flow of data is integral to secondary market trading. In Hong Kong, various provisions of the Basic Law enshrine privacy protection principles and the collection, use, processing, storage and management of personal data in Hong Kong must comply with applicable data protection requirements. In Hong Kong, the primary piece of legislation is the Personal Data (Privacy) Ordinance (Cap. 486) ("PDPO"). However, regulated intermediaries may be subject to additional regulatory requirements. There may also be general law and contractual duties of confidence that need careful assessment. The key upshot is that data flows locally and to any other relevant jurisdictions must be carefully mapped and addressed through appropriate disclosures in plain language and depending on the circumstances (including existing consents and disclosures in place), consent. Importantly, even pseudonyms such as public keys can constitute "personal data" depending on all the facts, and encrypted data may not be sufficiently anonymised in context. An appropriate data model is therefore essential.
- **Analytics, automation and technology standards.** These are a rapidly growing area of focus for policy makers and regulators globally. In general, most apply in Hong Kong through a combination of underlying legal precepts (such as data protection), prudential rules imposed on regulated entities (eg on technology resilience, vendor procurement and algorithmic trading) and thematic guidance.
- **Other key requirements** that must be mapped and factored in appropriately, including:
 - o contractual agreements between stakeholders at each level;
 - o market misconduct and short selling restrictions;
 - o AML/CTF and sanctions-related due diligence and ongoing monitoring requirements, including the use of on-chain analytics as necessary;
 - o taxation; and
 - o competition law, including the nature and degree of stakeholders' access to information.¹⁹

¹⁹ For completeness it should be noted that intermediaries such as exchanges may impose platform rules – these should be distinguished from fundamental legal and regulatory requirements, and may not necessarily limit innovation.

Matters flowing from payment of consideration

These will involve a combination of factors already addressed above. For example, the proposed new regime for certain virtual asset service providers under review by the Financial Services and Treasury Bureau,²⁰ and the current SFC VASP Regime, has to be factored in in Hong Kong to the extent that virtual assets are involved.

Matters flowing from ESG compliance or other thematic pre-requisites

Finally, if an instrument is to have a certain “flavour” in the sense of being structured in such a way as to meet a certain ESG or other aim, any necessary requirements that flow from that must be addressed.

Globally, there is a rapidly developing body of law and regulation relating to ESG, ranging from enhanced disclosure obligations and principles of responsible investment through to granular pre-requisites, decision-making standards, new product and service channels and incentives. In Hong Kong, this includes various emerging obligations, expectations and guidance issued by HKEx and the SFC, amongst others. ESG standards at an investor level (for example, green investment mandates) also strongly shape market developments and can drive legal structures and contractual obligations.

Several consequences flow from this – for example, for a tokenised green bond, it will be important to articulate what “green” means and how this is evaluated, and for this to be a “living” (dynamic and ongoing) assessment during the life of the bond, with any necessary updates factored into workflows and documentation. The integration of technology within this process (for example, leveraging IoT) can be extremely helpful, but requires care. Proper diligence, disclosure, systems and data integrity, oversight and ongoing review are essential.



²⁰ The draft proposals are available at Financial Services and the Treasury Bureau, Public Consultation on Legislative Proposals to Enhance Anti-Money Laundering and Counter-Terrorist Financing Regulation in Hong Kong, November 2020, https://www.fstb.gov.hk/fsb/en/publication/consult/doc/consult_amlo_e.pdf, with consultation conclusions available at https://www.fstb.gov.hk/fsb/en/publication/consult/doc/consult_conclu_amlo_e.pdf.



“

The HKMA welcomes the collaboration with BIS Innovation Hub on this novel experimentation on the symbiosis of sustainability and tech. Technologies such as blockchain and smart contracts, combined with the internet-of-things, could streamline the bond issuance process, improve efficiency in distribution and facilitate reporting on the use and environmental impact of green bonds proceeds, thus enhancing transparency to green bond investors.

Edmond Lau

Deputy Chief Executive of the Hong Kong Monetary Authority

Section 3: Strengthening the Foundations

3.1. Need for Transparency

By the Carbon Disclosure Project



Pratima Divgi is leading CDP's regional efforts in Hong Kong, Southeast Asia, Australia and New Zealand since 2019. Founded in 2000, CDP is a global not-for-profit. To support mandatory disclosure and ensure consistency of information, CDP has developed fully-TCFD aligned, standardized reporting questionnaires for the real and financial sectors. Today, over 10,000 organizations representing 54% of global market capitalization and 75% of the S&P 500 respond to CDP's platform. In her role as Director, Pratima engages with corporates, capital markets, policy and subnational governments in their efforts to measure and manage climate and environmental impact.

3.1.1. The Need for Transparency and Disclosure across Asset Classes and Portfolios

As noted in 1.1., recent years have witnessed a strong global demand for sustainable finance with sustainable debt expected to exceed USD1tn in 2021.²¹ Green finance is a subsector of the wider Sustainable Finance market. It aims to accelerate adoption of sustainable development solutions, specifically in the climate and environmental sphere. The rise in sustainable and green financing however has not been matched with a decline in global emissions. On the contrary, the world is now expected to see new records in greenhouse gas emissions, raising concerns about the extent of the impact that green finance is having in meeting the objectives of the December 2015 (COP21) Paris Agreement.²²

It is not enough to merely ensure green financing opportunities meet the objectives of climate resilience, minimizing negative impacts on the environment and leveraging nature-based solutions to address the current climate crisis. It is equally important that the scaling of green finance corresponds to genuine reductions in financing activities that exacerbate climate change and environmental destruction.

A transformational shift in our financing behaviour requires robust monitoring of overall green vs. brown investing and lending strategies of financial institutions. It also requires greater transparency and disclosure across asset classes and portfolios. More importantly, this disclosure should aim to develop our long-term understanding of the risk-adjusted returns of low-carbon transition and sustainable development.

3.1.2. Taskforce on Climate Related Financial Disclosure and Policy Action

Reporting leads to awareness and action. In a recent working paper, Banque De France observes that investors that were subject to mandatory disclosure requirements curtailed investments in fossil energy companies by 40% compared to other investors in its control group study.²³

²¹ See Reuters, Global Sustainable Debt Issuance Will Crack \$1 Trillion Mark in 2021 -IIF, July 2021, <https://www.reuters.com/business/sustainable-business/global-sustainable-debt-issuance-will-crack-1-billion-mark-2021-iif-2021-07-15/>.

²² See Financial Times, Carbon Emissions Headed for New Record in 2023, Says IEA July 2021, <https://www.ft.com/content/abf39e99-b667-4d6c-a172-e0fdea39675a>.

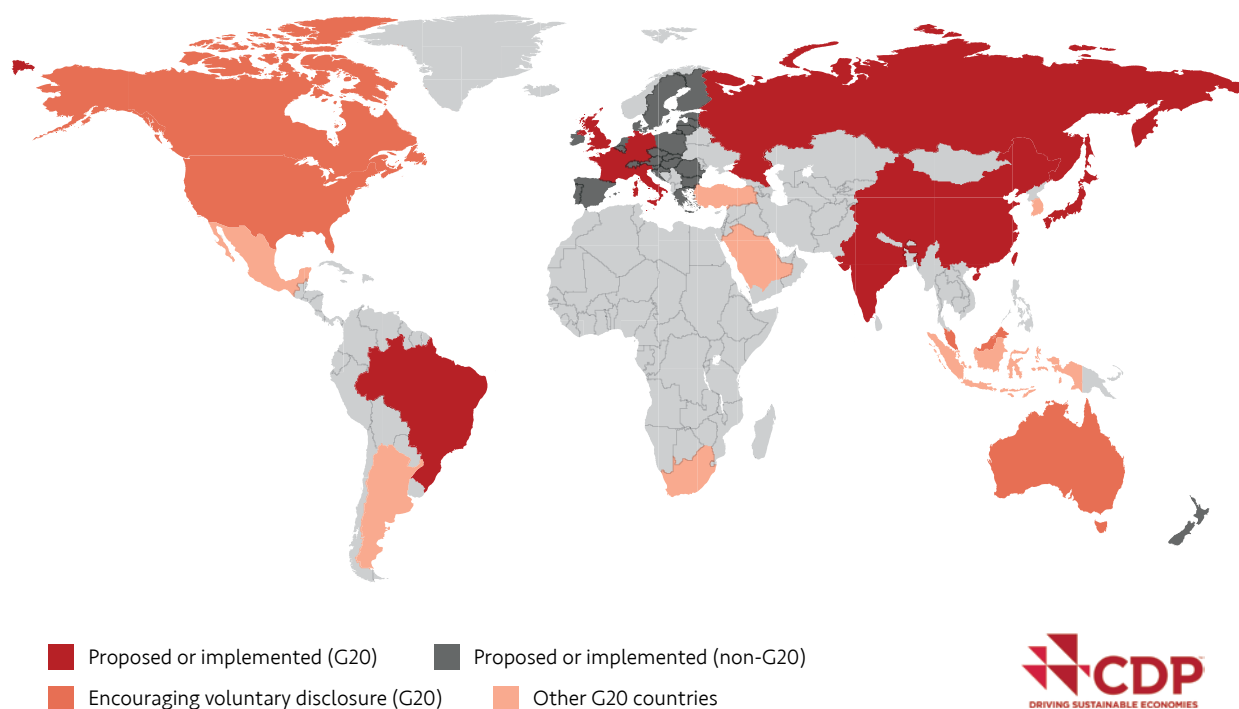
²³ See Banque de France, Showing Off Cleaner Hands: Mandatory Climate-related Disclosure by Financial Institutions and the Financing of Fossil Energy, January 2021, <https://publications.banque-france.fr/en/showing-cleaner-hands-mandatory-climate-related-disclosure-financial-institutions-and-financing>.

Most climate data related to finance reported today is voluntary. Companies that report do so for a combination of reasons such as preparing for mandatory reporting across jurisdictions, responding to stakeholder pressure, or developing long-term transformational business strategies. Two-thirds of the 3000+ companies in Asia Pacific that respond to CDP's TCFD-aligned disclosure platform have already identified climate risks, physical and transitional, that have the potential to make a substantial impact on their business.²⁴

Due to the voluntary nature of reporting, however, financial institutions and policy makers have been rightly concerned about the quality of disclosed data. Financial decision making especially relies on data that is accountable and verifiable. It is essential therefore that the increase in climate-related data is matched with a commitment from policy makers to enforcement systems such as mandatory reporting.

Representatives of capital markets, policy makers and regulators have come together to support the recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) and have taken action to improve understanding of financial risks and opportunities in relation to climate resilience and decarbonization. In December 2020, the Cross-Agency Steering Group in Hong Kong formally announced its intention to make TCFD-aligned disclosure to relevant sectors by no later than 2025.²⁵ The Singapore Stock Exchange has also provided guidance on how companies should create a credible pathway towards decarbonization and report on their actions.²⁶ Supervisors too are taking an interest in TCFD-aligned disclosures. The NGFS, Bank of England, and the European Central Bank, all refer to the Task Force's framework in their climate-related publications.²⁷

Mandatory environmental disclosure around the world



²⁴ See Carbon Disclosure Project, Asia Pacific's Race to Net-zero, May 2021, <https://www.cdp.net/en/articles/climate/asia-pacifics-race-to-net-zero>.

²⁵ See Stock Exchange of Hong Kong Limited, Announcement, December 2020, https://www.hkex.com.hk/-/media/HKEX_Common/Market/Stage/News-Centre/Cross-Agency-Steering-Group-Announcement_20201217.pdf.

²⁶ See Singapore Exchange, Credible Decarbonisation and Transition for Corporates in Asia, June 2021, <https://api2.sgx.com/sites/default/files/2021-06/Decarbonisation%20Report%20%282021%29.pdf>.

²⁷ See Network for Greening the Financial System, A Call For Action, April 2019, https://www.ngfs.net/sites/default/files/medias/documents/ngfs_first_comprehensive_report_-_17042019_0.pdf. Also see Bank of England, The Bank of England's Climate-related Financial Disclosure 2021, June 2021, <https://www.bankofengland.co.uk/prudential-regulation/publication/2021/june/climate-related-financial-disclosure-2020-21>.

Also see European Central Bank, Guide on Climate-related and Environmental Risks, May 2020, https://www.bankingsupervision.europa.eu/legalframework/publiccons/pdf/climate-related_risks/ssm.202005_draft_guide_on_climate-related_and_environmental_risks_en.pdf.

In anticipation of upcoming regulatory changes and policy requirements, such as climate-stress testing of the banking system, the financial sector has also started to disclose data on climate-related issues. However, this has largely been in relation to their direct operations: in 2020, 332 financial institutions globally disclosed data related to TCFD-aligned requirements voluntarily through CDP's platform;²⁸ only 25% of them were able to report on their financed emissions in 2020,²⁹ which were on average 700 times larger than operational emissions, underscoring the importance of monitoring and tracking emissions across investing and lending portfolios.³⁰

Today, more than 1800 companies globally have committed to decarbonization pathways in line with the Paris Agreement.³¹ Understanding how these targets set by companies are integrated within financial sector due diligence will be fundamental. For example, how can financial institutions benchmark decarbonization goals within sectors? Will committing to decarbonization and demonstrating climate resilience lead to better access to capital or stronger equity performance? Answering these questions will require accounting mechanisms that better interpret climate and environmental goals within financial terms and enable year-on-year performance analysis.

3.1.3. Closing Thoughts

Since the development of the TCFD framework, there has been a tremendous momentum to mainstream reporting on climate disclosure by companies. This reporting now needs to translate into concrete financial action. Mandating disclosure and reporting will ensure the right tracking and verification mechanisms are in place to monitor climate-conscious financial performance. More importantly, it will inform how financial portfolios are developing their thinking around low carbon opportunities and nature-based solutions, while de-risking existing portfolios from climate and environmental uncertainties. With a 55% expected growth, 2021 is expected to be another stellar year for green and sustainable finance.³² Our enthusiasm for green finance needs to ensure that we remain focused on our key goals – climate resilience and decarbonization. The world needs green finance, but currently it is still in the process of becoming fully green. More on this and possible technology driven approaches in the contributions below.



²⁸ See Carbon Disclosure Project, The Time to Green Finance, 2021, <https://6fefcbb86e61af1b2fc4-c70d8ead6ced550b4d987d7c03f-cdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/005/741/original/CDP-Financial-Services-Disclosure-Report-2020.pdf?1619537981>.

²⁹ See Network for Greening the Financial System, A Call for Action, April 2019, https://www.ngfs.net/sites/default/files/medias/documents/ngfs_first_comprehensive_report_-_17042019_0.pdf. Also see Bank of England, The Bank of England's climate-related financial disclosure 2021, June 2021, <https://www.bankofengland.co.uk/prudential-regulation/publication/2021/june/climate-related-financial-disclosure-2020-21>. Also see European Central Bank, Guide on climate-related and environmental risks, May 2020, https://www.bankingsupervision.europa.eu/legalframework/publiccons/pdf/climate-related_risks/ssm.202005_draft_guide_on_climate-related_and_environmental_risks.en.pdf.

³⁰ See Carbon Disclosure Project, The Time to Green Finance, 2021, <https://6fefcbb86e61af1b2fc4-c70d8ead6ced550b4d987d7c03f-cdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/005/741/original/CDP-Financial-Services-Disclosure-Report-2020.pdf?1619537981>.

³¹ See Science Based Targets, Driving Ambitious Corporate Climate Action, 3 August 2021, <https://sciencebasedtargets.org/>.

³² See Environmental + Energy Leader, Sustainable Finance Expected to See 55% Growth in 2021, says Credit Agricole Group, January 2021, <https://www.environmentalleader.com/2021/01/sustainable-finance-expected-to-see-55-growth-in-2021-says-credit-agricole-group/>.

3.2. Mitigating Greenwashing

3.2.1. Greenwashing



Frank Packer is Regional Adviser at the BIS Representative Office for Asia and the Pacific. He currently represents the BIS on the G-20 Sustainable Finance Working Group, and co-chairs the Market Transparency Subgroup of the Network of Central Banks and Supervisors for Greening the Financial System (NGFS). Frank has published regularly on issues related to green finance in both BIS and external publications. The present contribution does not necessarily reflect the views of the Bank for International Settlements.

Ensuring private sector flows towards supporting the transition for greening of economic activity is one of the high-level policy objectives of the Paris agreement.³³ To this end, the rapid growth of the green bond market is indicative of enormous progress.³⁴

And yet, there is widespread agreement that more needs to be done, and more than simply increasing the amounts of funding to currently labelled green projects. The main issue is that having a green label attached to a financial instrument does not necessarily imply that a reduction in carbon emissions is occurring that is material relative to the goals of the Paris accord.

The term “greenwashing”, by evoking the echoes of the much older term “whitewashing”, with its sense of active covering up of activities,³⁵ is strongly suggestive of malfeasance. The term is best considered more broadly, without necessarily implying fraudulent behaviour in the legal sense.³⁶ Greenwashing can be a simple outcome of the inadequacy of green labels, the processes for validating those labels, as well as the insufficiency of available data.

Even if bond proceeds flow into green projects, issuers can be heavily engaged in carbon-intensive activities elsewhere. Further, the wide variation in green bond standards means that green bond issuing firms can be deemed to be green for different reasons. Thus, it comes as little surprise that Ehlers et al (2020)³⁷ show that green bond labels under the current system do not necessarily signal a material reduction in carbon emissions at the firm level (see next page).

³³ See United Nations, *Making Finance Flows Consistent With a Pathway Towards Low Greenhouse Gas Emissions and Climate-resilient Development*, article 2.1 (c), December 2015, https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

³⁴ Despite Covid, green bond issuance reached a record \$270 billion in 2020. See Climate Bond Initiative, Record \$269.5bn Green Issuance for 2020, <https://www.climatebonds.net/2021/01/record-2695bn-green-issuance-2020-late-surge-sees-pandemic-year-pip-2019-total-3bn>, January 2021. By mid-2021 it was projected to reach \$450 billion for 2021. See Moody's Investors Service, Sustainable Bond Issuance to Reach a Record 850 billion, July 2021, https://www.moody.com/research/Moodys-Sustainable-bond-issuance-to-reach-a-record-850-billion--PBC_1297595. An increasing number of private and public sector entities have explicit mandates for portfolio allocations to support the mitigation of climate change. See Bolton, Despres, Pereira da Silva, Samama and Svartzman, Bank for International Settlements and Bank of France, *The Green Swan*, January 2020, <https://www.bis.org/publ/othp31.htm>. Also see Fender, McMorrow, Sahakyan and Zulaica, BIS Working Papers, Reserve Management and Sustainability: the Case for Green Bonds?, March 2020, <https://www.bis.org/publ/work849.htm>. Also see Financial Times, Climate Change: Asset Managers Join Forces With the Eco-warriors, August 2021, <https://www.ft.com/content/78167e0b-fdc5-461b-9d95-d8e068971364>.

³⁵ Greenwashing is defined by Merriam Webster as “expressions of environmentalist concerns especially as a cover for products, policies, or activities”. The term was first used in 1989, see Merriam-Webster, <https://www.merriam-webster.com/dictionary/greenwashing#h1>.

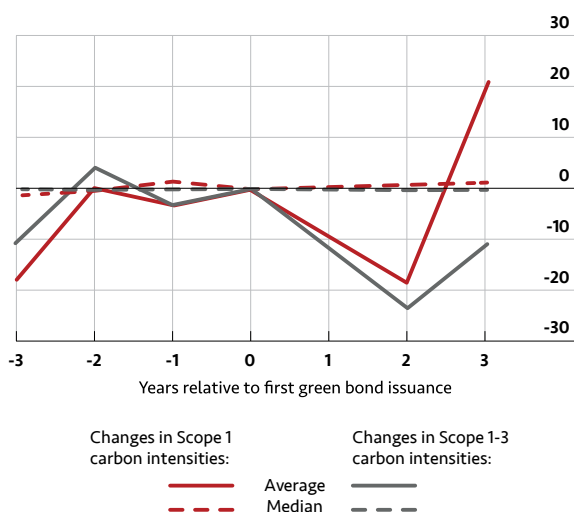
³⁶ Namely, most current green bond certifications are neither designed to maximise carbon reductions nor are they based on measurable environmental impacts, but rather are intended to ensure that bond proceeds flow to green projects. Whether these projects ultimately achieve carbon reductions (or other environmental benefits), however, is not a decisive factor for determining whether an issuer receives or retains a green label for its bonds.

³⁷ Ehlers, Mojon, and Packer, BIS Quarterly Review, Green Bonds and Carbon Emissions: Exploring the Case for a rating system at the firm level, September 2020, https://www.bis.org/publ/qtrpdf/r_qt2009c.pdf.

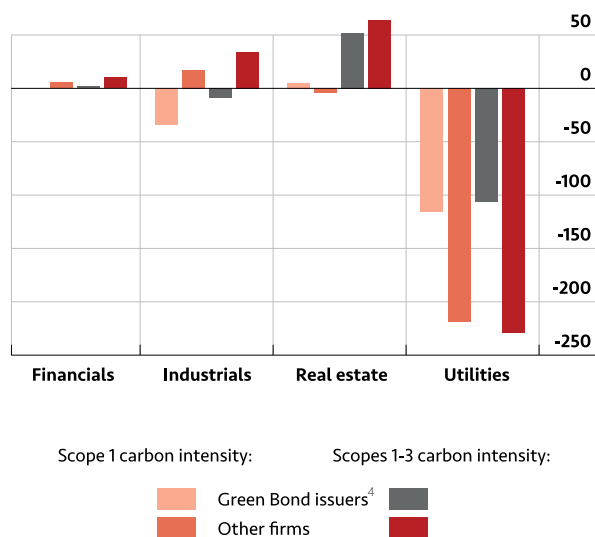
Green bond issuance and changes in issuers' carbon intensity¹

CO2 tonnes per USD million of revenue

Total change in carbon intensity before and after green bond issuance at T=0²



2015–18 average changes in carbon intensity, by sector³



¹All firms included, no correction for outliers. As the sample of firms for 2019 was limited, 2019 data are excluded to avoid potential sample bias.

²Based on 2015–18 data. There are bands are not based on 20 15–18 data. Error bands are not reported as they are too wide to be shown. Changes in scopes 1–2 carbon intensities are almost identical to those of Scope 1 intensities only. ³For sectors with more than 10 firms that have issued green bonds. ⁴Firms that have issued a green bond at least once since 2015.

Sources: Bloomberg; Climate Bonds Initiative; Dealogic; Environmental Finance Bonds Database; S&P Trucost limited © Trucost 2020; authors' calculations.

This contribution will make the case that three building blocks are particularly critical to mitigating the risk of greenwashing as climate finance moves forward to the next stage of its development:

1. First, the development of taxonomies that enable investors to identify assets and activities that hold the prospect of making material progress towards high-level green objectives.
2. Second, the development of methods of certification and verification that ensure that the labelling of green entities and activities within the taxonomies is reliable.
3. And third, enhanced data availability and disclosure will be critical as well.



3.2.2. The Importance of Improved Taxonomies

Improved taxonomies will play a critical role in minimizing the risk of greenwashing. The following are characteristics of such taxonomies.³⁸

Outcome-based using key performance indicators (KPIs)

Most current taxonomies are mainly input based and assume that a given technology will yield benefits. A taxonomy should be based on measurable outcomes that provide clarity for investors on the non-financial benefits conveyed by an asset, activity or entity. KPIs should be technology neutral, namely, new and alternative technologies can be certified based on the same KPIs (e.g., carbon emissions).

Alignment with high-level policy goals

A green finance taxonomy that is not aligned with high-level policy goals³⁹ will subject the labelled activities, assets or entities to transition risk, as policy makers become aware of the taxonomy's inadequacies. When policy objectives extend into the far future, realistic and measurable interim targets should be used that provide clarity on how the target can be measured. A science-based approach should be utilised to translate the policy goals into concrete targets.

One objective, one taxonomy

For taxonomies to provide the clearest signal and minimise greenwashing there needs to be a direct link with the underlying objective. Aggregating several objectives naturally reduces information value of the signal.⁴⁰ Aggregation of objectives facilitates greenwashing in that poor performance in one area can be underweighted or covered by better performance in other areas.⁴¹

Incorporation of entity-based information whenever possible

It is important that taxonomies affect incentives on the level of the entity, at which most investment decisions are made. To achieve the Paris Climate goals, there should be a sharp reduction in emissions on the part of firms.⁴² However, most taxonomies to date have focused on labelling green activities, which runs the risk of encouraging greenwashing, since projects promising carbon reductions could be offset by carbon increases of the same firm elsewhere.

Coverage of issuers with bad environmental performance

An important feature of the green performance of issuers is its often highly skewed distribution. For instance, the 1% of firms with the highest carbon intensity produce close to 40% of global carbon emissions. Improvements of firms with low environmental performance is essential to achieve climate goals on a global level. A taxonomy targeted only at firms with a very good environmental performance (e.g., "green" firms) cannot hope to capture those firms whose change in performance is essential for achieving high-level policy goals.

³⁸ This section in particular draws upon BIS draft input to the G-20 Sustainable Finance Working Group. See Ehlers, Gao, and Packer, Input Paper to G-20 Sustainable Finance Working Group, A Taxonomy of Sustainable Finance Taxonomies: Principles for Effective Taxonomies and Proposed Policy Actions, forthcoming 2021. More generally, the paper has drawn upon my work in green finance with BIS colleagues, in particular Torsten Ehlers.

³⁹ High-level policy goals, which can include the transition to a climate-resilient economy, the protection of natural resources and the ecosystem, and the promotion of sustainable cities and communities. Concrete targets that could correspond to high-level goals, include a benchmark reduction of GHG emissions, a lower rate of deforestation, or a desired level of species diversity.

⁴⁰ See Berg, Kölbel, and Rigobon, Aggregate Confusion: The Divergence of ESG Ratings, May 2020, <http://dx.doi.org/10.2139/ssrn.3438533>.

⁴¹ An ancillary argument can be made that use of the common "do-no-significant-harm" principle (DNSH), in which it is ensured that negative outcomes on other objectives are to be avoided, should be sparing, either by setting the thresholds very high or limiting to those cases where the measurements of alternative objectives are relatively straightforward.

⁴² See Intergovernmental Panel on Climate Change, Special report - Global Warming of 1.5°C, October 2018, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf.

Granularity

Many taxonomy outputs are binary at present (e.g., “green” vs. “not green”), which not only greatly limits the range of possible investment strategies, but encourages the sort of greenwashing whereby the entity does the minimum possible to gain the binary green rating. While there are costs to reporting outputs of finer granularity, the fewer the cut-offs, the greater the risk of greenwashing and cliff effects.

Flexible thresholds that can be dynamically adapted to country circumstances.

An outcome-based taxonomy can be relatively easily adapted to different circumstances. For instance, thresholds can be lowered if firms do not have access to the technology required to achieve better green performance. Similarly, as high-level policy goals evolve or faster improvements become necessary over time, thresholds can be tightened.

3.2.3. The importance of Improved Methods of Certification and Verification

For investors in green financial instruments to look past the potential for greenwashing, they need confidence in their ability to verify that the promised environmental benefits are, in fact, delivered.⁴³ To be sure, well-informed investors can perform due diligence and evaluate the expected environmental benefits of the underlying projects. But not all investors have these capabilities and resources, particularly at the retail level.

In practice, specialised firms exist to certify an asset’s green benefits, which operate under defined institutional processes, and possibly regulation. But processes should also include verification of the certification, which can be efficient and low cost, if the green taxonomies discussed above are fashioned to be based on simple and already disclosed key performance indicators (KPIs). Official approval processes for rating providers – similar to the proposed third-party verification of green labels in the European Union – could furnish the certified labels with additional credibility.

Who pays for the green label is an important consideration that will also receive increasing attention as the industry develops. Just as with conventional credit ratings, with a number of current green labels, firms receiving a green rating often pay for the rating themselves. But carbon intensive firms, whose inclusion is vital to achieving higher-level climate goals, may not be willing to do so. As an alternative, labels based on firm carbon emissions could be provided by third parties that collect, tabulate and verify carbon emissions data to investors at potentially very low cost.

In the green bond market, one aspect of verification which is gaining increasing attention is the provision of “impact reports”. While use of proceeds reports are more common, impact reports that quantify the climate or the environmental benefit of a project are being found with greater frequency as well. Major investment managers also increasingly engage with issuers to provide such reports.⁴⁴ With improved taxonomies incorporating outcome based KPIs, impact reports are likely to be a key supplementary requirement going forward, with important information made available on at least an annual or a higher frequency basis.⁴⁵

⁴³ Beschloss and Mashayekhi, IMF Finance and Development, A Greener Future for Finance – Green Bonds Offer Lessons For Sustainable Finance, December 2019, <https://www.imf.org/external/pubs/ft/fandd/2019/12/green-bonds-offer-lessons-for-sustainable-finance-beschloss.htm>.

⁴⁴ See Climate Action 100+, 2019 Progress Report, October 2019, <https://www.climateaction100.org/wp-content/uploads/2020/10/English-Progress-Report-2019.pdf>.

⁴⁵ Various attempts have been made to standardize impact reporting, including by international financial institutions, Nordic countries, ICMA and CBI. See Asian Development Bank, Green Bonds: Working Towards a Harmonized Framework for Impact Reporting, December 2015, <https://www.adb.org/sites/default/files/related/40378/green-bonds-framework-reporting.pdf>; Nordic Public Sector Issuers, Position Paper on Green Bonds Impact Reporting, February 2020, https://www.kuntarahoitus.fi/app/uploads/sites/2/2020/02/NPSI_Position_paper_2020_final.pdf; International Capital Market Association, Handbook of Harmonised Framework for Impact Reporting, June 2021, <https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Handbook-Harmonised-Framework-for-Impact-Reporting-June-2021-100621.pdf>; Climate Bonds Initiative, Post Issuance Reporting in the Green Bond Market, May 2021, https://www.climatebonds.net/files/reports/cbi_post_issuance_2021_02f.pdf.

3.2.4. The Importance of Enhanced Data Collection

Many expect the future to be characterised by a much greater availability of data; some even posit an “age of radical transparency”.⁴⁶ This will allow for more granular taxonomies, and easier alignment via the one objective/one taxonomy principle outlined above. As disclosures improve and suitable KPIs become more widely available across countries and firms, the range of measurable outcomes and therefore environmental objectives that can be covered by green taxonomies will broaden. For one, firm-level metrics will become more common. For another, greater data availability will make it easier to scale thresholds and parameters to accommodate small and medium sized firms (SMEs) or issuers from emerging markets (EMEs). It will also make it easier to ensure interoperability of national taxonomies, by facilitating comparability across firms and markets.

GHG emissions are best measured at the highest available scope (currently scope 3), and cover all relevant greenhouse gases emitted, which can be converted into CO₂ equivalents via readily available conversion tables.⁴⁷ Scope 3 emissions cover indirect emissions from production inputs as well as emissions from product distribution and usage. This mitigates so-called emission exporting, another form of greenwashing, whereby emission-intensive activities are outsourced so that emissions caused by the firm appear low.

For example, improved data and disclosure on carbon emission outcomes will allow investors to differentiate all firms by such outcomes. Technological advances in measuring carbon emissions will further increase precision and reduce data collection costs. Real time monitoring of labels of this sort based on readily available data will complement current project-based green labels, and provide investors, regulators and policymakers with increasingly material firm-level information. A growing number of third parties already verify, disseminate and use such data, and prominent private sector efforts to improve company disclosures have long been under way.⁴⁸ Mandatory reporting based on legal standards and audits are likely to further enhance data quality and consistency.

Longer-term targets for carbon emission reductions can be broken down into annual targets, as done by the EU (GHG reduction of 5% per annum).⁴⁹ Future disclosures may include expected future emissions, which would be a highly useful KPI for transition taxonomies.

3.2.5. Closing Thoughts

Improved taxonomies are crucial to mitigating the risk of greenwashing. At the same time, improved certification and verification processes, greatly aided by enhanced data availability and disclosure, will be critical as well. Progress on these dimensions will hopefully feed into efforts such as those of the Project Genesis prototype to provide transparent, real-time measures of the impact of tokenised green bonds for retail investors.

⁴⁶ Gore, Speech at the BIS-BdF-IMF-NGFS Green Swan Conference, Our climate crisis, The Financial System and the Sustainability Revolution, June 2021.

⁴⁷ See, for instance, Greenhouse Gas Protocol, Global Warming Potential Values, 2014, https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf. A question arises of what should be the best normalisation for measuring carbon emissions. A strong argument can be made that the most economically sensible measure would be a carbon intensity measure gauging carbon emissions relative to a normalizing factor such as revenue, rather than absolute carbon emissions. See Ehlers, Mojon, and Packer, BIS Quarterly Review, Green Bonds and Carbon Emissions: Exploring the Case for a Rating System at the Firm Level, September 2020, https://www.bis.org/publ/qtrpdf/r_qt2009c.pdf.

⁴⁸ FSB Task Force on Climate-Related Financial Disclosures, Final Report - Recommendations of the Task Force on Climate-related Financial Disclosures, June 2017, <https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf>; Ceres, Disclose What Matters: Bridging the Gap Between Investor Needs and Company Disclosures on Sustainability, August 2018, <https://www.ceres.org/resources/reports/disclose-what-matters-bridging-gap-between-investor-needs-and-company-disclosures>.

⁴⁹ In the case of the EU, for instance, the interim target for emission reductions is currently a 55% reduction in GHG emissions by 2030. As a reduction of about 26% had already been achieved by end-2019, the 2030 interim target implies a reduction of about 40% over the following 10 years, or about 5% per annum. See for instance the EEA greenhouse gases data viewer and the numbers therein. European Environment Agency, EEA Greenhouse Gases - Data Viewer, April 2021, <https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>.

3.3. Green Auditing Challenges

By PwC



Cindy Ngan is a Partner in the Climate and Sustainability Practice of PwC Hong Kong. She has over 20+ years of audit and consulting experience primarily focusing on banking and capital market clients. More recently, she is dedicating the majority of her time to leading ESG research and development and implementation of solutions for clients across the financial services sectors in Hong Kong.

3.3.1. Challenges of Green Auditing Today

While green assets have become more popular in the last decade, providing assurance on such assets has not become any easier for the following reasons:

Lack of universal definition of Green

To assert whether a bond is green or not, we need benchmarks or criteria to evaluate the product against. There are various international and local frameworks that provide guidance for issuers to develop their internal “green framework” for investment/project selection, monitoring and reporting purposes. Green Bond Principles (**GBP**), Climate Bonds Standard (**CBS**), China Green Bond Endorsed Projects Catalogue (**China Catalogue**), and European Union Taxonomy on Sustainable Finance (**EU Taxonomy**) are examples of such frameworks. However, they differ in terms of level of granularity and technical criteria employed.

- **Level of granularity:** The GBP provides only broad categories of eligible assets and projects which would qualify as green. This is highly dependent on a practitioner’s professional judgement and interpretation⁵⁰ of the guidelines to determine whether the assets or projects are indeed green. The CBS does provide specific scientific criteria. For example, solar electricity generation facilities are categorised as “renewable energy” under the GBP.⁵¹ However, these facilities would not be eligible under the CBS unless a minimum of 85% of electricity is generated by solar energy resources.⁵²
- **Specificity of technical criteria:** The China Catalogue and the EU Taxonomy share a similar level of granularity. However, they differ in certain specifics of technical criteria. For example, “buildings that lead to significant emission reduction” are eligible under the China Catalogue as “sustainable building”.⁵³ However, these buildings are excluded by the EU Taxonomy if they “lock-in into carbon-intensive assets” (e.g., “buildings that are used for storage of fossil fuels”).⁵⁴

⁵⁰ See International Capital Market Association, Guidance Handbook, June 2021, <https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/The-GBP-Guidance-Handbook-June-2021-140621.pdf>.

⁵¹ See International Capital Market Association, Green Bond Principles, June 2021, <https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Green-Bond-Principles-June-2021-140621.pdf>.

⁵² See Climate Bonds Initiative, Climate Bonds Standard and Certification Scheme, Version 2.1, https://www.climatebonds.net/files/files/standards/Solar/Sector%20Criteria%20-%20Solar%20v2_1.pdf.

⁵³ See Climate Bonds Initiative, Notice on Issuing the Green Bond Endorsed Projects Catalogue, April 2021, <https://www.climatebonds.net/files/files/the-Green-Bond-Endorsed-Project-Catalogue-2021-Edition-110521.pdf>.

⁵⁴ See EU Technical Expert Group on Sustainable Finance, Taxonomy Technical Report, June 2019, https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/190618-sustainable-finance-teg-report-taxonomy_en.pdf

The lack of a set of clear, globally consistent and measurable criteria may result in differences in concluding whether an underlying investment or project can be considered green.

Lack of high-quality data

As noted in 3.1. and 3.2. availability of high-quality climate related data such as emission related data is a major challenge. Key issues include accessibility, relevance, accuracy and reliability, timeliness and comparability. Different types of data would vary in degrees of quality across these dimensions. Without high quality data, the credibility of any assurance report may be adversely impacted. For example:

- To verify whether a building under construction is really green, one would need to assess whether the materials used really meet applicable green standards. Currently, assurance practitioners may have to obtain invoices from the construction company to get information on the vendors and materials being used. The extent of details in the invoices, availability/reliability of information about the vendor and completeness of such information may not be sufficient for a valid green assessment.
- Certain types of data are not readily accessible or cannot be collected on a real time basis depending on how the infrastructure is set up. For instance, to gather data on electricity, fuel and water consumption, one may need to collect the billings from utility companies and extract the data manually for further analysis.

Whilst there are data product providers in the industry, a study performed by the International Organization of Securities Commissions (IOSCO)⁵⁵ found a lack of transparency and consistency in the methodologies underpinning the development of the data products. In addition to that, the lack of common accounting and reporting standards around ESG (Environment, Social and Governance, of which “green” is related to the “E”) has also contributed to issues with data quality.

Lack of common reporting standards

As discussed in the articles above, the lack of common sustainability or green reporting standards also creates challenges as to transparency, comparability and reliability of data/ information from the underlying investee companies or projects.

Limited assurance as a result of the above

There are established assurance frameworks which provide general auditor review approaches and methodologies that can be applied to different subject matters. Green auditing easily fits into these frameworks. However, the key challenge, as discussed above, is that the criteria to measure or evaluate “green” may not be sufficiently specific to allow an assessment to be performed consistently within the context of professional judgment. Without the frame of reference provided by suitable criteria, any conclusion is open to individual interpretation and misunderstanding.

The upshot of all these issues is that currently the majority of the assurance reports issued for the purpose of green or climate bond certification only provide limited assurance. That is, practitioners conclude that “nothing has come to [their] attention” that causes them to believe that a green bond should not be issued, in all material respects, in accordance with the relevant framework or principles. This level of assurance is lower than if a reasonable assurance report is issued under which practitioners positively assert that the green bond is clear for issue.

For green auditing, involvement of industry experts and/or reliance on other practitioners is very likely and expected given the wide range of the underlying assets or projects. Proper integration of the work performed by these experts and practitioners and quality control are crucial elements to the reliability of the audit/ review conclusions.

⁵⁵ See Board of the International Organization of Securities Commissions, Environmental, Social and Governance (ESG) Ratings and Data Products Providers, July 2021, <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD681.pdf>.

3.3.2. Virtual World vs. the Physical

Whilst tokenising green bonds is not likely to be the solution to the above challenges or greenwashing, it does provide a much more efficient platform for transacting these instruments. The platform is built on the foundation of blockchain technology. Settlements can be done through digital wallets. Transaction rules and terms of the bonds can be automated and executed through smart contracts. Everything can be done virtually but we must not forget that green assets/ projects funded by the bonds remain in the physical world.

The connections between the virtual and the real worlds associated with this kind of structure include the linkage between the tokens and the underlying assets that establishes the investors' ownership of the underlying assets and the feeding of external data (e.g., "green" reference data which may not be in digital form in its original state) into the blockchain. Reconciliations between records on the chain and those "off chain" (e.g., reconciliation between custodial records of underlying assets and the digital inventory of tokens) will ensure that both worlds are in sync. But when data external to the chain (e.g., the "green" reference data) is not readily available or not reliable, even the most perfectly designed platform will not produce the most accurate and reliable information for investors. This brings us back to the initial question – are such bonds really Green?

3.3.3. Upcoming Developments

The challenges we discussed are well recognised and acknowledged by policy setters, market players and some investors. We are seeing concerted efforts to drive convergence of various green frameworks and taxonomies. Development of new regulatory and supervisory frameworks, accounting and disclosure standards are also underway. We expect advances in technology to also play a key role in improving the effectiveness and efficiency of green auditing/ reviews.

Concerted effort to align frameworks and taxonomies

The International Platform on Sustainable Finance (the "IPSF") was launched in October 2019 by EU, China and 6 other territories. Currently the EU and 17 other territories are members. It offers a multilateral forum where policymakers can exchange and disseminate information to promote best practices, compare different initiatives and identify obstacles to and opportunities for sustainable finance, whilst respecting national and regional contexts.⁵⁶ The IPSF Working Group on Taxonomies, co-led by China and the EU, is developing the Common Ground Taxonomy, which will provide a more unified set of global criteria for defining what we mean by "green".

New accounting and disclosure standards

In April 2021, the IFRS Foundation issued an Exposure Draft that outlines proposed targeted amendments to its Constitution to accommodate an International Sustainability Standards Board (ISSB) to set IFRS sustainability standards. The ISSB is expected to develop a common set of global sustainability standards to help meet investor needs and to set a sound baseline for jurisdictions to consider when setting or implementing their sustainability-related disclosure requirements. The standards are expected to be built on the existing Task Force on Climate-Related Financial Disclosures ("TCFD") framework and the work of sustainability standard-setters. This will drive consistency and comparability of corporate reporting, which in turn will provide a more solid foundation for high quality ESG related data.

Technology and blockchain as parts of the solution

Data and technology will be key to bringing the quality of green audits to the next level. If data can be standardised and made more easily accessible, technologies such as blockchain, the internet of things and artificial intelligence may be applied to capture, process, analyse and validate data in real time and more efficiently.

The Project Genesis prototype is designed to do just that: capturing data (i.e., electricity generated by a solar farm) using smart meters at the ultimate source, and using blockchain technology to preserve the integrity of the data

⁵⁶ See <https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/international-platform-sustainable-finance> for or an overview on members.

throughout the transaction life cycle. Conceptually, the key terms of green bonds (including financial and settlement terms; green performance indicators; rights of token holders etc.) could also be programmed into smart contracts that are coded onto the blockchain. Changes to the terms of the bonds (e.g., changes to the bond coupon rate) based on the green performance indicators could be automatically triggered when thresholds are exceeded. Limited manual intervention throughout the transaction lifecycle would enable the auditors to apply a more digital approach to perform validation and testing. The focus of the audit would be on the design of the infrastructure and any potential manual interception or "handshakes" between the virtual and physical worlds, such as smart contracts.

From the technological standpoint, there are different approaches to ascertaining ownership of tokens and the occurrence and accuracy of transactions on this kind of tokenised platform. Common practices include testing the controls over the design and development of the blockchain, change management controls, reviewing source codes of smart contracts to ensure that business rules and the terms of the bonds are built into the platform appropriately, interrogating 100% of the transactional data and simulating certain functions coded into the chain. But beyond these, can practitioners go the extra mile to provide additional security for different stakeholders? Governance and controls on the issuer, cyber security risk, regulatory compliance risk (e.g., KYC (Know Your Customer) and AML (Anti-Money Laundering) procedures), liquidity risk of the underlying assets and safe custody of the real assets are relevant areas for evaluation. In addition, subject to further clarifications on the profession's independence guidelines, auditors can even operate a blockchain node, and have the option of accessing the necessary data in real time.

Requirements for external reviews

Currently, external reviews to assess compliance with the relevant green/ climate/ sustainability-linked bond issuance frameworks or programmes at pre-issuance, post-issuance or ongoing reporting are generally not mandatory (except for Climate Bonds issued under Climate Bonds Standard⁵⁷ and Sustainability-Linked Bonds issued under Sustainability-Linked Bond Principles)⁵⁸ but are highly recommended. Third party assurance will provide investors with the confidence that the bond proceeds are managed appropriately and directed to intended projects and/or assets in accordance with the relevant frameworks and standards. However, the cost of engaging in such external reviews should not deter issuance of this type of instrument. Incentive schemes such as the Green and Sustainable Finance Grant Scheme⁵⁹ launched by the Government of Hong Kong SAR to subsidise the cost of issuing green and sustainable bonds certainly help balancing issuance costs and encourage issuers to seek independent reviews.

Quality control

Assurance practitioners are in the "trust" profession. Quality is the foundation for building trust. Stakeholders are looking for something which is more than a "tick the box" exercise to provide them with the confidence that the bond is truly green. Beyond attesting the underlying investments to be "green", are there other aspects that practitioners need to challenge to sufficiently mitigate the risk of greenwashing? The robustness of a practitioner's risk assessment and responses to risks identified (including fraud) is key. Standardised industry practice guidelines (e.g., planning and risk assessment requirements; recommended test procedures; suggested best practices) for practitioners building on the foundation of existing assurance frameworks and ESG related frameworks, accounting and disclosure standards are very much needed.

3.3.5. Closing Thoughts

The accelerated growth in demand for green solutions or products has also contributed to expansion in the ESG consulting and assurance industry. However, the gaps noted in this section need to be filled for auditors to be able to give more than limited assurance. There is a need for developing frameworks around quality controls that would apply to different types of players consistently in the market. In addition, technology will be part of the journey and the solution, as the next section delves deeper into.

⁵⁷ See Climate Bonds Initiative, Certification under the Climate Bonds Standard, September 2021, <https://www.climatebonds.net/certification>.

⁵⁸ See International Capital Markets Association, Sustainability-linked Bond Principles, June 2020, <https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/June-2020/Sustainability-Linked-Bond-Principles-June-2020-171120.pdf>

⁵⁹ See Hong Kong Monetary Authority, Tax Concessions and Incentive Schemes, <https://www.hkma.gov.hk/eng/key-functions/international-financial-centre/bond-market-development/tax-concessions-and-incentive-schemes/>.

“

As the project lead for Genesis I am convinced that blockchain technology can help make green bond issuance more efficient, while reducing the risk of greenwashing.

Marcel Bluhm

Advisor, BIS Innovation Hub



Section 4: Goal in Sight

4.1. Blockchain as Base Infrastructure

By Allinfra



With a background in finance at Goldman Sachs and Morgan Stanley, Dave Sandor co-founded Allinfra in 2018 to solve issues existing in real asset investment, climate products and related data. The team developed Allinfra Climate, a blockchain-based environmental platform that helps corporates and institutions achieve verifiable climate and sustainability goals, and Allinfra Digital, an asset tokenisation platform.

4.1.1. Need for Transparency, Granularity and Verifiability

With the evolution of green finance and a focus by governments, corporates, institutions and individuals on environmental risk, we are seeing a significant increase in the volume of environmental financial products and green/sustainability linked financing (together “Green Finance Products”) come to market, from renewable energy certificates to voluntary and compliance emission reductions, mitigation outcomes, green bonds, sustainability linked loans and other derivative products.

As Section 3 delved deeper into, these products, both from a creation and use perspective, are only relevant and meaningful if the underlying data supporting such Green Finance Products is measurable, verifiable and ultimately able to be relied upon by a third party.

As global policy and regulatory focus on climate change continues to increase, there exists a growing demand, from both the public and private sectors, for transparency, granularity and verifiability of the data that underlies and supports Green Finance Products. Blockchain technology offers an efficient and effective tool in the monitoring and use of the underlying data that defines these products.

4.1.2. Blockchain Technology in Product Creation and Monitoring

In purchasing a carbon credit, renewable energy certificate or indeed any other environmental financial product, the buyer must be certain of the product’s provenance - that the data has been collected in a verifiable way, can be traced back to the relevant asset and has not been used as the basis for claims under multiple products. In a traditional model this is possible with physical manual checks by independent parties, periodic inspections and other verification processes. These processes typically come with lengthy and unpredictable timelines, significant cost, potential for human error, and the resulting non-digitized data sets are not easily referenced over time, nor do they fit neatly into future carbon accounting, ratings and reporting regimes.

Solutions exist that leverage traditional systems for Green Finance Product creation but that are materially enhanced by new technologies. A blockchain-based system layered into the measurement, reporting and verification (MRV) of an asset’s carbon footprint is proving to materially accelerate and reduce the cost of data collection, reduce the volume of manual work and errors, reduce MRV timeframes from months to immediacy and ultimately lead to a product with superior provenance that can be issued on an expedited basis and traded with underlying data that is more transparent and timelier.

Similarly, in the monitoring of green/sustainability bond compliance, technology solutions exist that provide asset owners, lenders, ratings agencies, insurers and other stakeholders with verifiable, real time, asset level information

on underlying asset performance. In the Project Genesis prototypes described in the sister reports (Project Genesis - Report 3 "A prototype for green bond tokenisation by Digital Asset and GFT" and Project Genesis - Report 2 "A prototype for green bond tokenisation by the Liberty Consortium") to the present report, AllInfra implemented a blockchain-based system to provide a verifiable, auditable data feed to lenders on a real time or periodic basis. As also observed in Section 3.3. above, such digitised framework can support numerous finance related activities concurrently (e.g., for reporting, accounting, ratings, etc.) at a fraction of the cost & time and should enable better financing terms overall.

Critically, a digitised MRV process combined with a digital instrument, whether that be a carbon credit, a renewable energy certificate, a green bond or otherwise, results in a product that is easily provenanced, permanently tied to its source data and in time, able to be created, traded and retired with few friction costs and intermediaries, thus benefiting all stakeholders in the environmental financial product (EFP) space, i.e. asset owners, users of product, regulators and third parties relying on these products for specific environmental outcomes. Such digitally enabled EFPs are essentially "future proofed" to sync with the myriad of Paris Agreement-related reporting frameworks that are under development.

4.1.3. Blockchain Technology in Environmental Financial Product Purchase and Use

The management of climate related risks is a high priority topic for a broad spectrum of public, private and government related entities. Decarbonisation goals set by countries and corporations necessitate the monitoring of environmental performance in an auditable and verifiable way. The importance of this has become appreciated market wide.

In a case where an entity is calculating its carbon footprint, it will gather and report data from disparate sources across its business. As emphasized in Section 3.1. and 3.2., without accurate underlying data captured in a verifiable way from appropriate sources, the resulting footprint has little meaning. Consequently, reporting to stakeholders or purchasers of environmental products to offset such footprint becomes inaccurate and of limited value.

Similar to the creation of environmental financial products on a blockchain-based system, the collection and storage of data utilising such a system helps to ensure that reporting and offsetting of environmental impact is based on the best possible, verifiable data.

4.1.4. Regulatory and Policy Impact

A by-product of the tracking of green outcomes in a blockchain environment, together with a digital form of instrument tied to those outcomes, is ease of regulatory compliance and carbon accounting across organisations and nations, which is delved further into in Section 6.

The Paris Agreement focused attention on the climate targets set by individual nations and how an emission reduction or mitigation outcome may be claimed by multiple actors, for instance where an outcome from a project in host country is claimed towards that country's Nationally Determined Contribution (NDC), with that same outcome being claimed by a cross border voluntary buyer of emission reductions produced by that project. Without a corresponding adjustment at the national level, this significant risk of double counting can potentially lead to disputes, liquidated damages and/or penalties under contracts and in turn jeopardises efforts to reduce global emissions.

A universal system linking underlying project data to environmental financial products and ultimately national targets, will help to mitigate these double counting risks, with a transparent record of product custody from data source to retirement and claim.

4.1.5. Closing Thoughts

The health of the Green Finance market and its long-term viability will require products that stakeholders trust implicitly, where the positive environmental impact of each single product is known and verifiable. Blockchain technology is fast becoming a core tool in helping to achieve this outcome.

4.2. Connecting IoT and Blockchain

By HashKey



With over 13 years of experience in Silicon Valley, Mainland China, and Hong Kong, Ben El-Baz is Head of Ecosystems at HashKey Group, a regulated digital assets company. At HashKey, he has led the Group's strategic partnerships and corporate investments in asset tokenisation and blockchain applications. Ben also leads HashKey's trade finance blockchain partnerships with the Singapore Government and Hong Kong Monetary Authority.

4.2.1. Need for Deployment of Real-time Data Acquisition Devices

In BlackRock's 2020 Global Sustainable Investing Survey, over 53% of 425 investors from 27 countries, representing USD25tn in assets under management, responded that "poor quality or [un]availability of ESG data and analytics is the biggest barrier to deeper or broader implementation of sustainable investing, higher than any other barrier".⁶⁰ In response to this data problem, the use of the internet-of-things ("IoT") and blockchain technology presents a compelling way to both increase the quality and availability of data in green or ESG projects. Deploying these technologies together allows a project to generate transparent, trusted data flows. More internet-connected sensors on the ground means more real-time data generation (transparent data). Storing data to a blockchain database means stronger tamper-resistance data storage (trusted data).

Creating trusted, more transparent data flows for ESG projects is a key way to improve ESG information disclosures. One recommendation for financial regulators would be to mandate that green financing projects disclose environmental impact data using real-time trusted data technology solutions – solutions, for example, that use IoT devices interfaced with blockchain software which are certified by independent 3rd-party vendors. In Hong Kong, for example, the Hong Kong Quality Assurance Association ("HKQAA") performs certifications for green projects. If the HKQAA, with guidance from local regulators, were to expand its offerings to include certifying deployments of real-time data acquisition devices for green projects, it would represent a huge step forward for ESG information disclosures and solving concerns from investors related to green finance's data problem.

4.2.2. How IoT and Blockchain Deployments Work

IoT is a fancy buzzword that merely describes all the electronic devices that have the capability to measure environmental inputs from the physical world, record them, and then upload them to the cloud or some other software platform. These include devices like temperature sensors, weight and pressure sensors, GPS location trackers, electric current sensors (for energy generation or consumption monitoring), image sensors (cameras), audio sensors (microphones), infrared sensors (motion tracking), air particle sensors (for air quality), water quality sensors, and more. These devices can be deployed in the field to capture real-time data about the environmental impact created by a company or project. For example, air quality sensors can be connected to exhaust pipes in waste recovery plants, or electric current sensors can be connected to solar energy generation plants. These sensors then, in real-time, can generate data about the physical environment and save that data to a database for future reference. In this way, stakeholders can see a real, data-driven picture of a particular asset's environmental impact.

⁶⁰ See BlackRock, 2020 Global Sustainable Investor Survey, 2020, <https://www.blackrock.com/corporate/literature/publication/black-rock-sustainability-survey.pdf>.

As also explained in 4.1. above, blockchain technology adds value by creating a trusted way to store and secure the data being generated. One of the key properties of blockchain technology is its use of mathematically secure cryptography to link data records together, making it computationally infeasible for dishonest parties to unilaterally tamper with data records after these data have been saved. To illustrate how this solution adds value compared to the base-case situation, imagine a scenario where a waste recovery plant installs its own sensing devices on its equipment, and reports back environment impact results on a periodic basis. Assuming the company gets penalized for poor results and also has complete control over the database, there is always a possibility that a company's stakeholders may be incentivized to tamper with the data. In contrast, blockchain databases are uniquely capable of mitigating this type of fraud risk because they rely on a group of multiple distinct parties to maintain the integrity of data updates. This approach should be familiar to compliance professionals in the financial industry, as it is essentially a way to use technology to segregate duties related to data management to multiple, independent parties. This means that no single party has the authority to unilaterally update or modify the data records. Authority for approving additional data updates or modifications to data belongs to a diversified group of entities, which is generally selected in a way to minimize the potential for dishonest collusion. This type of multi-party data collaboration structure has been proven to be secure in the face of strong economic incentives, as seen in the continued growth of cryptocurrency networks that rely on this type of data structure to preserve monetary data records.

Recently, new solutions have been launched that make it easier to deploy IoT devices that can upload data in real-time to blockchain databases in the cloud. For example, in Mainland China, a key growth region for green financing, Wanxiang Blockchain, Aitos.io, and Haier Smart Home launched a collaboration to combine Wanxiang Blockchain's blockchain database and Aitos.io's BoAT IoT module into Haier's smart home devices, in order to monitor energy usage in real-time and provide blockchain-secure incentives back to consumers. Wanxiang and Aitos.io also recently teamed up to deliver this solution within Singapore's largest smart city development, the Punggol Digital District.



Government Green Bond Programme

The Government of Hong Kong SAR established the Government Green Bond Programme in 2018, and had since issued a total of USD3.5bn of green bonds to global institutional investors. Proceeds are to be used to finance or re-finance green projects of the government across eight eligible green categories. Several funded projects to-date include three waste management and recovery projects (USD1393M), five green buildings projects (USD1367M), four water and wastewater management projects (USD405M), and two energy efficiency and conservation project (USD328M).

Some of these projects illustrate how data-driven disclosures can benefit green financing projects. For example, one of the HKSAR's Government Green Bond funded projects is an integrated waste management facility that will process up to 3000 tonnes of municipal solid waste per day once it becomes operational in 2025. This facility is unique because it will employ technology to turn solid waste into steam that can be used to generate electricity for export back to Hong Kong's power grid. It will likely generate about 480 million kWh (1% of Hong Kong's current electricity demand) per year.

To increase transparency and availability of data, this project could benefit by installing internet-connected current sensing devices (installed by an independent 3rd party, such as the HKQAA) that monitor the specific amount of energy generated in real-time, and that data could then be saved directly to an independently managed blockchain database that is publicly-viewable by bond holders in real time. Air pollution monitoring devices could also be affixed to related exhaust pipes to upload data in a similar way.

Similarly, another project funded by these bonds, an organic resources recovery centre in North Lantau, could also adopt similar data-driven disclosure measures. In this facility, anaerobic digestion technology is used to convert food waste into electricity. The facility could install internet-connected current sensing devices to monitor the specific energy generated and save the records to an independently managed blockchain database for public reference.

4.2.4. Closing Thoughts

The transition to a greener economy needs green financing to support the scaling up of new infrastructure. In Mainland China alone, the push to become carbon neutral by 2060 will require over USD21tn in investment.⁶¹ Such massive amounts of investment will, in turn, require adequate amounts of investor protections to ensure capital is actually generating appropriate levels of positive environment impact. Currently, many global investors are still extremely concerned about the lack of data available to measure the impact of green finance projects. Trusted, data-driven information disclosures powered by IoT and blockchain technology provide a compelling way to solve green finance's data problem. Financial regulators can assist by enacting new requirements to mandate data-driven information disclosures. Independent 3rd-parties, like the HKQAA, that are already involved in certifying green projects could be mobilized by local regulators to provide a certification framework for the introduction of these new technologies into the field.

⁶¹ See South China Morning Post, China's Carbon-neutrality Plans Now in the Hands of Central Bank, Which Will Ramp up Green Financing And Establish Carbon-trading Market, April 2021, <https://www.scmp.com/economy/china-economy/article/3129881/chinas-carbon-neutrality-plans-now-hands-central-bank-which>.

4.3. Alliance Blockchain Idea

By Ant Group



Having worked at the International Monetary Fund's headquarter in Washington, DC., Shi Piao is the Director and Head of International Research & Partnerships at Ant Group, where she works in close collaboration with international organizations, research institutions, and business partners to support strategic projects and research.



Nancy Yaling Wu is a Senior Advisor of the Ant Group Research Institute. She is responsible for the green finance policy research and green business innovation incubation at Ant Group Research Institute. Before joining Ant Group, Ms. Wu worked at MEPFECO and MOF, participating in the international cooperation projects in the fields of climate change and environmental protection.

As illustrated in Project Genesis, use-of-proceeds and information disclosure are the most critical issues for developing the green bond market. As explained in this Section 4, blockchain is characterized by traceability, tamper-proofing, openness, and transparency. Pulling these ideas together, an alliance blockchain connecting green bond issuers, trading agencies, registration and settlement agencies, certification agencies, and regulatory agencies could conceptually improve bond issuance and certification, while promoting standardization and greater credibility of disclosure reports.



An Alliance Blockchain

Firstly, connect green bond issuers, trading agencies, registration and settlement agencies, certification agencies, and regulatory agencies as nodes on an alliance chain. Users can upload and query data/documents through the web page. The relevant parties would need to upload in automated fashion (e.g., through IoT and blockchain as shown in 4.1. and 4.2. above) the records related to the use of proceeds and the corresponding environmental benefits. By doing this, the use of proceeds and environmental benefits can be simultaneously recorded, tracked, and certified.

Secondly, as explained in section 3.3., smart contract technology could be used at various parts of the process. Through a series of standardized report formats, this platform could conceptually perform the functions of structured reporting, intelligent calculation of environmental benefits, and automatic generation of disclosure reports. This level of automation would reduce the time to obtain information, automate the routine work, reduce labour costs and the probability of error, thus improving the consistency and quality of information disclosure.

Thirdly, as also shown in the Project Genesis Prototypes, blockchain could reduce communication costs at issuance, which improves the efficiency of agreement negotiation and signing. In addition, as explained in Section 3.3., 4.1. and 4.2. above, staff in the evaluation agencies could be assigned by regulatory agencies to verify the documents and records on the blockchain itself, further automating the process.

Last but not least, as one of the nodes of the alliance chain, regulators could automatically obtain all the data in the ledger, which unifies the regulatory data reporting and verification. Duplication of work is avoided and regulators could compare green bond projects more effectively. By doing so, regulators could mobilize and lead green bond issuance at the macro-level, thereby promoting the long-term prosperity of the green bond market.



A hands-on, collaborative approach between the private and public sector is the key to making innovation a reality.

Asad Khan

Advisor, BIS Innovation Hub

Section 5:

Thinking Further Outside the Box

5.1. Mitigation Outcome Securities

By the UNFCCC



Massamba Thioye is Manager in the mitigation Program of the UNFCCC secretariat where he is leading the development of regulations pertaining to the measurement of the impacts of climate action, including climate action undertaken by financiers. Most of his work currently focuses on the interface of climate/sustainability, finance and digital. This includes the application of digital technologies such as IoT, Distributed Ledger Technology (DLT) and AI to climate and sustainability actions. He is co-Chair of the Climate Chain Coalition, a coalition of more than 200 organizations working on the application of DLT to climate and sustainability action. He is also a member of the Government Advisory Board of INATBA, a global blockchain association supported by the European commission. Massamba co-convened the development of the ISO standard, ISO 14097 "Framework and principles for assessing and reporting investments and financing activities related to climate change".

5.1.1. Mitigation Outcome Securities (MOS)

To progress towards achieving the climate goals of limiting the global temperature increase to 1.5 °C above pre-industrial levels, green finance needs to empirically validate and measure the greenhouse gas (GHG) emission reduction resulting from the real economy projects it funds. By doing so, innovative new financing products that can offer strong returns. Mitigation Outcome Securities (MOS) discussed in this article can drive markets to finance GHG mitigation projects and move towards a sustainable world.

As also motivating Project Genesis, to empirically validate green bonds to advance GHG emissions reduction, there must be a more impactful and more attractive framework that specifically recognises and rewards the climate contribution of bond investors, including retail investors. Many bonds currently promote marginally green activities that could have been financed from a standard corporate bond. Other bonds that address the Sustainable Development Goals can be appealing to issuers, investors and validators/verifiers; however, their UoP often address green uses but do not contribute to the 1.5°C climate goal as they are not enabling green activities that otherwise would not be possible. There is an urgent need to accelerate the reform of the green bond framework to make it support climate goals and drive down GHG emissions.

Mainstream bond investors buy bonds to meet their investment preferences. This means that a bond that funds climate improvements but delivers sub-par returns is not enough for most investors. The source of recourse in the event of default for many UoP green bonds is the bond issuer. The credit quality of the issuer is often higher than the green project and is the primary security (and reason) for the investors purchasing the bond. However, if investors, in particular retail investors, could better visualize, and be rewarded for, the benefits of green projects, as well as the credit quality of the issuer, more liquidity would flow into genuinely green bonds, thus supporting climate goals. The current investment profile of green bonds is a limitation and makes the product incomplete.

MOS address this limitation by offering a new financial product that has in effect a warrant attached to a bond; one that acts as an additional source of return, tied to the amount of GHG emissions reduced by the green project and the price of carbon. This is especially timely as talk of carbon pricing and carbon markets is advancing at pace. The MOS would be a commitment to deliver units of GHG emission reduction (promised mitigation outcome units or MOUs) attached to the bond. It can be sold and traded immediately after the issuance of the green bond, before its maturity date, which is the date on which the actual MOUs become due to the MOS holder. The maturity date of the MOS will be linked to the date on which the GHG emission reduction associated with the green project is

expected to occur. This transforms the current carbon finance, which is an ex-post reward in the current carbon market, into an ex-ante enabler in the form of additional benefit for the green bond issuer in an integrated green bond and carbon market.

To meet the conditions required for the climate bond to be a financial instrument that serves the 1.5 °C climate goal, a new definition of green bond is proposed:

- A green bond is a bond acquired with an appended MOS. Future repayment of the MOS is made using MOUs that are at least partly generated by activities financed by the proceeds of the bond. In exchange for the MOS, the bond buyer pays a premium or provides to the issuer another type of economic benefit compared with its baseline source of financing;
- The future MOUs are intended for the repayment of the MOS and will be generated by the assets or activities financed by the proceeds of the bond, which should firstly be used to compensate any climate performance gaps in the issuer's investment plan. After these offsets, the MOU should be leftover for the repayment of the MOS to the bond buyer;
- As a counterpart of the economic benefit arising from the issuance of the green bond, the issuer fills the viability gap of the climate solutions that generate MOUs. What the proceeds of the green bond were used for becomes irrelevant;
- The shade of green of the bond is measured by the number of MOS appended to the bond per unit of financial resources.

The proposed integrated green bond and carbon market framework has several benefits. If implemented, it will directly contribute to the climate goals by shifting mainstream finance towards effective climate solutions. It will also enhance the transparency, objectivity and environmental integrity of the green bond market by providing an objective definition of green bonds that does not provide room for misinterpretation and that is easy to assess, therefore protecting its users from accusation of 'greenwashing'. It will enhance the efficiency and effectiveness of climate and carbon finance by crowding in private finance. Developed countries buying MOS issued by developing countries can get access to and quantify sources of private finance. Countries buying MOS, by setting as a condition for participation in their bidding processes the disclosure by the financier of the exposure of its financial assets to climate-related risks and opportunities, can incentivize the implementation of initiatives concerning the disclosure of climate-related risks and opportunities. Financiers who are influential stakeholders will have additional reasons to undertake policy advocacy for enhanced climate ambitions, as this will lead to enhanced demand for MOS.

5.1.2. Leveraging DLT for Mitigation Outcome Units (MOU)

The reformed green bond framework offers several benefits. It integrates the green bond and the carbon market and enables the deployment of climate solutions that lead to GHG emission reductions in the real economy, that would otherwise not occur. It is scalable because it provides to mainstream financiers opportunity for additional capital gain, incentivizing them to buy green bonds. In 2020 alone, more than USD250bn in Green Bonds were issued and this represents a very small share of the capital market. The reformed green bond framework will empower financiers, enabling them to play an important role in the carbon market, supplying to governments and other entities the MOS they need for compliance. This is likely to make these highly influential stakeholders more engaged in policy advocacy and more likely to support ambitious commitments from policymakers, thus generating an enhanced demand for MOS. This is critical for a transformative change, under which the financial system contributes to driving an active transition to a net zero carbon economy. However, the implementation of the reformed green bond framework raises challenges that, fortunately, DLT can address. This prompted the UNFCCC secretariat to plan the development of a digital platform for its pilot test.

An important feature of the reformed green bond framework is the transfer of tradable MOS from the issuer of the bond to the buyer of the bond. These MOS and the MOU that will be used to pay for them differ from existing carbon units because they get their value from two sources: (i) the GHG emission reductions they represent and (ii) the amount of finance they have shifted toward activities aligned with the climate goal. Therefore, the framework should be designed so that one MOS (representing the promised product), with a given capital intensity (amount of capital per ton of CO₂ abated during the lifetime of the financed activity) is paid with one mitigation outcome (the delivered product) representing the reduction of one ton of CO₂, achieved through a mitigation activity, with at least the same capital intensity. The MOS issued alongside the bond has also to be paid at maturity, with MOU generated mainly by the projects in the investment plan of the issuer and not MOU simply bought from the carbon market. Finally, the MOU, before being used to pay the MOS, should first be used to fill any climate performance gap from any project in the investment plan of the issuer. This prevents issues related to greenwashing. Only the remaining net MOU can be transferred to pay for the MOS.

As the MOS is a promise to deliver specific MOU, the description of these MOU, including the activities from where they are to be generated and their capital intensity (millions invested per ton of CO₂ reduced during the lifetime of the activity) should be immutably recorded on the MOS. The same information related to the mitigation activity which has generated it and its capital intensity should also be tied to the MOU. It needs to be immutably linked to the mitigation outcome, in addition to a serial number and other information to trace the origin of the mitigation outcome. This allows for trading separately the bond and its green attribute, the MOS.

The transparent reconciliation of the MOS with a mitigation outcome used to pay for it requires trust regarding the production and transfer without alteration of the data they are associated with. The use of emerging digital technologies including IoT, digital methodologies, smart contracts and DLT permits the use of a trustworthy intermediary to build confidence in the data production and obviate third-party verification, which can be burdensome, costly and time consuming.

Furthermore, under the envisioned framework, green bond issuers will be required to process the activity data related to the operation of the assets financed with the proceeds and use the outcome to establish any mitigation outcome claim. They will have to demonstrate that it is in conformity with the guidance the framework provides. This may be challenging for many issuers. The verification of the issuer's claim will also require assessing the data production and processing the verified data. The outcome is expected to be objective and consistent across different issuers. DLT can help drastically simplify and streamline these steps for the issuer and weed out the need for verification.

Finally, as the MOS are tradable assets, they are expected to be exchanged through traceable transactions that do not provide any room for double use. The trading of the MOS represents value-transfer from the seller to the buyer. The use of DLT can ensure their transfer without the intermediation of a third party and without double use.

Pilot Digital Platform

The digital platform would host the green bond framework and its impact measurement standard and run the testing of the framework by simulating the issuance and trading of green bond as well as the subsequent trading of the MOS.

The pilot digital platform would provide all required functionality to capture, store and report data relevant to issuers under the new green bond framework. We envisage the platform to have the following features:

- Functionality for collection and recording of data in an immutable format from underlying assets;
- Tools for visualization, inspection and download/use of data;
- Creation of digital instruments with periodic payments made in emission reductions (stapled to digital security);
- Creation and management of digital securities (green bonds);
- Admin portal for management of relevant instruments, data sources and users;
- Trading venue (peer-to-peer) for both the digital securities and other digital instruments;
- Relevant compliance services (KYC accreditation, FATCA/CRS etc.).

5.1.3. Closing Thoughts

The UNFCCC secretariat has designed the new green bond framework and developed a specific digital standard to measure the impact related to the implementation of mitigation action. The digital standard will determine ex-ante the amount of mitigation outcome a given mitigation activity is expected to generate based on its nature and scale. Applied to all the activities in an investment plan, this will enable determination of the volume of MOS the issuer can append to a bond issuance to make it green. The platform will also simulate the trading of green bonds between issuer and buyer as well as the subsequent trading of the MOS.

The pilot test undertaken by the BIS Innovation Hub under Project Genesis is very relevant to the UNFCCC digital platform to pilot test the reformed green bond and the latter will certainly build on the outcomes of the former. Indeed, lessons learnt can be directly used to streamline the development of UNFCCC digital platform and focus its efforts where it goes beyond Genesis, e.g., linking green bonds to the carbon market.

5.2. Asset Backed Tokens

By the Hong Kong Green Finance Association

5.2.1. Untapped Opportunities



Ben McQuhae is the founder of Ben McQuhae & Co, a commercial law firm committed to sustainability and innovation that only takes on mandates that are aligned with the UN SDGs. Ben has various additional leadership positions, including Co-Founder, Executive Committee Member and Special Advisor to the Chairman, Hong Kong Green Finance Association; Hong Kong representative, United Nations network of international Financial Centres for Sustainability; Project Coordinator, The Greater Bay Area Green Finance Alliance; Member, UN Economic and Social Commission for Asia and the Pacific's Sustainable Business Network; founder of various businesses and associations.

Climate change is a global imperative that requires action and collaboration at every level on an unprecedented scale. Asset backed tokens properly designed and thoughtfully regulated can be effective in helping fund the fight against climate change. This article is intended to briefly introduce some other tokenisation use cases in Hong Kong, focusing on renewable energy (RE) and shipping, two important sectors albeit at the opposite ends of the climate-alignment spectrum.

5.2.2. Solar Energy Tokens

In April 2018, the Hong Kong government announced plans to introduce a feed-in tariff (FiT) to encourage the installation of certain qualifying small-scale renewable energy projects in Hong Kong. The FiT scheme was introduced through the Scheme of Control agreements between the Hong Kong Government, acting through the Environment Bureau, and each of Hong Kong's power monopolies, CLP and Hongkong Electric. The FiT model has been widely adopted worldwide since the 1990s and is designed to accelerate, via incentives, the development of the RE market.

Under Hong Kong's FiT scheme, the relevant power utility is required to pay approved grid connected RE generators a fixed amount for each kWh of energy produced and delivered to the grid. Payment is typically made through a netting off mechanism and the amount payable will depend on the installed capacity of the RE installation and the applicable tariff. The applicable tariff will be HKD3.00, HKD4.00 or HKD5.00 per kWh, depending on the size of the project – the HK\$3.00 applies to projects with installed capacity of between 200 kW and 1MW, HKD4.00 to projects between 10 kW and 200 kW, and HKD5.00 to projects less than 10kW. Individual projects over 1MW must be approved on a case-by-case basis.

In summary, under the FiT scheme the utility company must pay to the RE generator approximately 3, 4 or 5 times (depending on the applicable tariff) the price per unit of electricity (kWh) that the utility charges consumers for electricity consumed.



Solar energy tokens.

Solar energy	
Proposition	<ul style="list-style-type: none"> Consider other use cases applying the technological, regulatory and practical concepts that have been assessed and proved in the context of tokenised green bonds for retail investments
Tokenisation Potential	<ul style="list-style-type: none"> Leverage the FiT scheme in Hong Kong to create new green digital assets for retail investment in the form of: <ul style="list-style-type: none"> o Debt and/or equity tokens to provide upfront construction capital, or o Digital asset-backed securities (ABS) to refinance projects
Solar Project Development Challenges in Hong Kong	<ul style="list-style-type: none"> High density urban area means projects are typically small Small projects are not bankable, and aggregation is not practical – aggregating multiple assets with multiple owners is complicated and time consuming (if at all possible), and a lender's due diligence and documentation requirements become disproportionately expensive for small projects Need to bridge the funding gap. Many projects will not be built if 100% equity funding is required Availability of FiT on project completion does not help access to up-front construction funding The FiT scheme expires in 2033 so project pay-out needs to occur fairly quickly
Business Case	<ul style="list-style-type: none"> Projects can be installed quickly (in a matter of weeks or months) and relatively cheaply and will earn the applicable FiT tariff immediately on connection to the grid Projects generate essentially fixed and therefore predictable revenue based on the applicable tariff x installed capacity For all projects the utility company (i.e., CLP or Hongkong Electric) is required to make FiT payments to the solar generator. As such, the counterparty risk in a financing structure should reflect the corporate rating of the utility Capital efficiency. Initial funding provider (whether tokenised or traditional) can recover initial investment within months by re-financing through token issuance in the form of digital ABS thereby releasing initial funding for the next solar project

Additional Benefits

- Provide new green investment opportunities to help fund and deliver Hong Kong's net zero carbon commitments
- Tokens can include real time track and trace data to demonstrate the environmental performance of the underlying project
- Facilitate more RE in Hong Kong, contributing to the decarbonisation of the energy sector
- Potentially provide some consumer choice regarding use of RE over fossil fuel generated power
- Facilitate community ownership of solar assets
- Through low denomination issuance, tokenisation can socialize the economic benefits of the FiT scheme within the community at large. While the FiT model has proved to be extremely popular and effective worldwide, there are critics. One of the major criticisms relates to the fact that the wealthy benefit disproportionately from the FiT model. This is because to benefit financially one must own rights to the land or property on which a project is installed, whereas the cost of the FiT scheme subsidy (i.e., payment of the tariff) is ultimately paid for by all consumers, often through a slightly higher electricity price. Hong Kong's tariff is generous relative to other jurisdictions although only the small percentage who own land or property in Hong Kong can benefit financially from the FiT scheme

Hong Kong's FiT scheme was introduced in 2018 and is designed for only small-scale and domestic RE installations. Given last year's 2050 net zero carbon policy commitment and the need for a more ambitious decarbonisation strategy for the energy sector, an extension of the FiT scheme to automatically include RE projects greater than 1MW would be welcome. Such an extension would bring larger RE projects to market, provide a roadmap for meaningful private/public collaboration on decarbonisation (such as privately funded RE installations on public infrastructure), and increase the supply of green investments to investors. As a final thought, as we look for innovative ways in which fintech can contribute to decarbonisation, a new generation of RE projects could be tokenised with RECs or offset credits hardwired into the token design. This would be progress.

5.2.3. Real Asset Tokenisation to Support Decarbonization Transition

Real asset tokenisation at scale has long been a holy grail for fintech. While the prospect of sectors such as real estate opening up to tokenisation has whetted many appetites, asset owners have largely remained unconvinced. In the context of Hong Kong's 2050 net zero carbon policy commitment, fintech can contribute solutions to support the transitions of our most carbon intensive sectors, namely real estate, transport and energy. fintech can support asset owners in these sectors navigate their decarbonisation transition by developing new green finance solutions, including through the creation of digital investments, to help fund asset upgrades and retrofits.

Taking the shipping industry as an example, Hong Kong is one of the main flag jurisdictions and a major international shipping hub. Shipping forms part of our transportation sector and is an industry facing increasing pressure to decarbonise and clean up. fintech can support this.

Tokenisation use case for the shipping sector.

Shipping	
Proposition	<ul style="list-style-type: none">• Consider other use cases applying the technological, regulatory and practical concepts that have been assessed and proved in the context of tokenised green bonds for retail investments
Tokenisation Potential	<ul style="list-style-type: none">• Asset owner issues debt or equity tokens to raise capital for climate aligned use of proceeds to contribute to the decarbonisation of vessels or fleets
Business Case	<ul style="list-style-type: none">• Investors are increasingly seeking green investment opportunities• Financiers are assessing climate alignment of their shipping portfolios• Increasing demand for low-carbon shipping services• More decarbonisation regulations• Regulators committing to decarbonization targets• HKD1tn investments needed to decarbonise the shipping industry
Additional Benefits	<ul style="list-style-type: none">• Provide new green investment opportunities to help fund and deliver Hong Kong's net zero carbon commitments• Tokens can include real time track and trace data to demonstrate the environmental performance of the underlying asset• Tokenisation of real assets within a green finance framework can be applied to other carbon intensive asset classes, such as real estate.

7.2.4. Closing Thoughts

There can be no net zero carbon scenario without a robust global green financial system to fund the transition. fintech solutions and financial innovation are essential to this process because they can deliver green investment opportunities at scale and speed. But innovation in this space needs a supportive regulatory environment to be able to flourish. Regulation is rarely, if ever, able to keep up with the pace of innovation. As illustrated in this article there are many opportunities to create new digital green investments and asset classes in support of our net zero carbon policy commitment. Our collective ability to tackle climate change depends on our willingness to innovate and challenge ourselves.

5.3. Learnings from the Crypto Sandbox

By PwC



Henri is the Global Crypto Lead for PwC. He also advises many of the world's leading crypto exchanges, investors, financial institutions and tech firms on their fintech and crypto initiatives as well numerous governments, regulators and central banks on fintech and crypto regulatory and policy matters. He also is an Adjunct Professor at the University of Hong Kong where he teaches the first fintech university course in Asia. For this article Henri Arslanian was supported by Duncan Fitzgerald, Financial Services & Digital Asset Risk Assurance Leader, Alexandre Tabbakh, Associate Director, Oscar Fung, Manager, Galen, Law-kun, Associate.

5.3.1. The Fintech and Crypto Asset Backdrop

The emergence of fintech offerings and crypto exchanges has allowed a new generation of investors to quickly and easily access different financial tools through a few simple clicks on their phone. Recent industry growth underlines the fact that these new investors want a simple platform that allows them to experiment with different financial and crypto products. Aspects such as investment decision-making, user interface, and terminology should be simple and highly intuitive. Through gamification, new digital online brokers and crypto exchanges are able to empower investors to participate in market activities that were not user friendly before. In addition, these firms keep an active presence on social media to interact with their users and generate a sense of community.

The focus of this article is to provide an overview of the user experience and community building aspects of crypto exchanges and some of the key observations and trends observed across these platforms. The results are based on practical tests carried out across crypto platforms and fintech offerings in Q1 2021. These can provide some insight into what these new markets entrants have been doing, along with some potential ideas for the future of the retail green bond ecosystem.

5.3.2. Fintechs and Crypto Platforms

We have looked at some of the top crypto exchanges and other investment platforms and documented every step of the customer journey from signing up to making the first investment. This covers account creation, completing KYC, setting up payment, and first investment. Our purpose was to gauge how the major crypto exchanges would fare against traditional financial services providers. Overall, the procedures were similar among crypto exchanges and fintechs. The most important issue across all these exchanges is that the onboarding process is easy and stress-free.

Some key takeaways:

- 1. Account creation:** The process never took more than seven minutes. Every exchange required some variation of creating a password, providing name and address, and confirming contact information.
- 2. eKYC:** The individual onboarding process never took more than six minutes and required no paper-based documentation. Every exchange asked for the same personal information (e.g., name, date of birth, government ID number including scan, scan of facial features, address, etc). Some processes required users to answer easy-to-answer questions regarding investor status and conflicts of interest check.

3. Payment set up: The process was uniform across almost all the exchanges, as they use the same technology platform to link bank accounts. However, on average, it took just over 24 hours to execute our first trades with the fintech platforms. By contrast, we were able to execute our first trade as soon as the onboarding process was complete with each crypto exchange.

Account set up									
Exchange	Onboard time	Account creation (number of clicks)	Time to complete account creation	eKYC (number of clicks)	Time to complete eKYC procedure	Banking set up number of clicks	Time to set up banking information	Verification wait time	How soon was the user provided access to exchange?
Exchange 1 (Crypto)	~10 minutes	6	~2 minutes	10	~5 minutes	6	~3 minutes	~5 minutes	< 10 min
Exchange 2 (Crypto)	~9 minutes	7	~3 minutes	5	~3 minutes	7	~3 minutes	~5 minutes	< 10 min
Exchange 3 (Crypto)	~14 minutes	8	~6 minutes	8	~5 minutes	7	~3 minutes	~5 minutes	< 10 min
Exchange 4 (Crypto)	~6 minutes	6	~3 minutes	6	~1 minute	3	~2 minutes	~5 minutes	< 10 min
Exchange 5 (Crypto)	~12 minutes	11	~4 minutes	6	~5 minutes	9	~3 minutes	Instant	< 10 min
Exchange 6 (fintech)	~13 minutes	21	~ 7 minutes	6	~ 3 minutes	8	~ 3 minutes	~24 hours	>24 hours
Exchange 7 (fintech)	~11 minutes	5	~1 minute	10	~3 minutes	6	~ 3 minutes	1-3 business days	1-3 business days
Exchange 8 (fintech)	~10 minutes	4	~1 minute	8	~6 minutes	8	~ 3 minutes	~20 minutes	~23 minutes
Neobank (fintech)	~7 minutes	3	~1 minute	13	~2 minutes	NA	NA	~5 minutes	NA
Note: The number of clicks is an approximation based on US investors. To ensure consistency, we have documented the inputs and have maintained the same testing methodology.									

5.3.3. User Experience

Onboarding process

Easy-to-use onboarding processes have supported the rise of crypto exchanges. Setting up an account involves just three major steps (account creation; know your customer “KYC”; payment set-up). Top crypto exchanges take 21 clicks on average to set up an account and grant access to trading within five minutes. By comparison, based on our practical research, some of the fintech apps take more than 25 clicks, with an average wait of 24 hours before one can start trading. It is uncertain as to whether or not the crypto exchanges had actually conducted real ID verification or ID documentation checks for their KYC process, given the short processing time. This is obviously a key factor for regulators and the industry to consider. We have also compared the process to setting up an account with a particular neobank and noted the process was rather quick, with only 16 clicks, but only basic savings and spending functionalities were offered. Hence the expected onboarding time and steps required was also shorter. The speed of onboarding for the particular neobank has significantly improved over a typical traditional institution’s process, but it is also important to note that such time savings is at the cost of limiting the service scope to domestic individuals with standardised identification documents, while the other crypto exchanges and fintech’s compared have a much wider service scope and client profile.

Considerations of the KYC process aside, for the onboarding process of crypto exchanges, users face almost no hassle as cumbersome processes have been eliminated. Potential investors only face essential questions, and the steps required are straightforward.

Gamification and Marketing

The gamification of crypto exchanges has been popularised recently, with many exchanges adopting this method to attract new retail investors. The user interface across these exchanges is simple, highly intuitive and quick to learn.

Additionally, the “play to earn” phenomenon has made these platforms more engaging, as well as creating reward stimulus through gamification, crypto exchanges have grown their customer base due to their active presence on social media. In some cases, crypto exchanges distribute some sort of token to drive community development, e.g., growing the number of followers on Twitter or active users on Discord or Telegram. Individuals who help the marketing campaign receive tokens for their efforts, often called “Airdrops” in the industry. Many platforms also allow users to share a referral code, so that such new users can invite their network.

Airdrop/lottery system

Once a part of the ecosystem or community, users have the chance to receive free crypto via Airdrops. Tokens are distributed within an exchange as a part of promotional programs and can also be earned by staking and saving certain crypto assets.

Earn & Learn program

Top crypto exchanges may have short videos (under four minutes) on their platform or posted on social media that are used to educate investors about new tokens. They can also reward investors with free tokens for watching the videos to completion. This strategy incentivizes investors to quickly learn more about crypto markets, giving them more confidence when making future investments.

Platform functionality and ease of entry to trading

Another important aspect where the crypto exchanges further elevate the user experience is the low entry barrier and ease for investors to start trading crypto assets. The time before investors are presented with the trading platform were on average less than 10 minutes for crypto exchange and they could begin trading as soon as funds become available. Of the crypto exchanges we looked at, all of them provide details for investors to understand the background and characteristics of each individual token. Some also provide additional functions to favourite and track the tokens and provide notifications on price changes. Coupled with the other gamification, Airdrops and Earn & Learn programs, the barriers to entry are reduced and even when provided with the vast selection of investible tokens, new investors can still be empowered with the confidence to start engaging in trading.

5.3.4. Community Building

Ask Me Anything (AMA)

AMAs, a popular internet concept in which a speaker opens up and answers any questions, have become an outlet for various company founders or development team members to speak to their community through social media. AMAs allow token issuers to update communities/investors about their progress on a monthly or quarterly basis. Some of the top crypto exchanges have posted live AMAs to YouTube and received anywhere from 10,000 to 50,000 views.

Community Outreach

Major crypto platforms use different social media channels to bring news to their investors (e.g., Discord, Telegram, Twitter, and Instagram), as well as the exchange’s own blog. This ensures that the community is informed and updated on any recent project developments. This more active presence on social media also grants legitimacy and transparency to the exchanges, which is crucial when providing services around new and unfamiliar asset classes.

UI/UX of Trading Interface

Crypto exchanges make it very simple for investors to check the price of crypto assets or verify the interest received. Investors themselves can also set up price alerts and notifications.

Retail Green Bond Platform UX/ UI Features

The generational push toward newer and unfamiliar asset classes has given the green bond market a tailwind to establish and further grow this industry. Best practice among crypto exchanges and fintechs could also be a template for a future retail green bond platform. For example, by looking at gamification and media influence on crypto exchanges, new trading platforms have the power to identify the most successful methods of attracting and retaining investors in a new asset class. In particular, some key areas of focus could be:

An 'earn & learn' strategy, as used by top crypto exchanges, could reward investors who learn about the debt markets' environmental impact or projects within the green bond industry.

The introduction of referral programs, which almost all the top crypto exchanges have in some shape or form, would be beneficial to all parties. Investors are incentivised to attract new users, whilst growing both the community and awareness around green bonds.

Working in tandem with the referral/affiliate (influencers) program, green bond projects/exchanges could capitalize on millennial investors pushing ESG developments and be at the forefront of initiatives such as environmental sustainability. The green bond market will be about more than just bonds. It will be selling a call to change. AMAs hosted by leaders in the green bond industry would be ideal for capitalising on community engagement and addressing this new-found investor sentiment.

Handing out Airdrops captures investor attention and raises awareness of new initiatives being funded by green bonds. Additionally, incorporating Airdrops would provide alternative promotional opportunities, as investors will want to share their rewards with friends.

5.3.5. Closing Thoughts

The crypto industry could inspire the green bond market and offer opportunities and areas of focus that can enhance the user experience of the whole ecosystem. Allocating ample resources into constructing an easy-to-onboard process demonstrated by crypto exchanges will further foster innovative solutions built around this industry. Additionally, following best practices, green bond exchanges should follow the simplicity of the platform structure of top crypto exchanges. The gamification of certain aspects of the ecosystem could also come into play. For example, learn to earn, referral programs, as well as referral fee incentives, would allow these exchanges to expand and retain their communities through rewards. Simultaneously, exchanges should work to cultivate a community in the image and likeness of their eco-friendly objectives through social media campaigns.





“

Climate change is a reality we all must face. Governments need to work hard on solutions, but they cannot do it without the private sector. Massive new investment in sustainable solutions will be required. And investors will need to have a clear picture of the environmental impact of their investments. The disclosure of relevant information to the market is therefore critical. Genesis is the BIS Innovation Hub's first effort to support this process.

Ross Leckow

Senior Adviser, BIS Innovation Hub

Section 6: Climate Action, Accounting and Yields

6.1. Target Greater Impact



Katherine Foster is a lead consultant on the UN Task Force Dialogue on Bigfintechs and Sustainable Development, the Community Director of the Open Earth Foundation (USA) and the Social Alpha Foundation Fellow. A former diplomat specializing in human security and climate-change, Katherine has been spearheading innovation at the nexus of technology, policy, finance, climate and sustainable development for 30 years. She has held leadership roles at Climate-KIC (Europe's flagship climate innovation initiative) and the Green Digital Finance Alliance, including as Sherpa to the UN Task Force on Digital Finance for the SDGs.

By the Open Earth Foundation

6.1.1. Quantifying potential Efficiency gains through Tokenisation

As explained in Section 3 and as also illustrated in the Project Genesis sister reports (Project Genesis - Report 3 "A prototype for green bond tokenisation by Digital Asset and GFT" and Project Genesis - Report 2 "A prototype for green bond tokenisation by the Liberty Consortium"), the integration of DLT in the bond market can optimise the performance of the market end-to-end and potentially build an efficient relationship between issuers and investors by decreasing the number of intermediaries. The utilisation of smart contracts in issuing and distributing bonds can significantly improve the efficiency of the market by executing an automated performance of certain events and obligations. Further, a DLT-based bond contract/security token can facilitate instant payment and exchange of digital assets simultaneously. The execution of immediate settlement reduces settlement risk by over 99%, eliminates counterparty risk and reduces costs.⁶² The largest efficiency gains (in terms of money and time saved) are lowered costs for reporting, brokerage, sales, structuring, price setting and risk rating⁶³ Efficiency in use or management of proceeds and proof of impact also offer the potential to unlock sleeping capital for SDGs and the growing corporate and consumer interest in engaging in climate and sustainability challenges.⁶⁴

⁶² See Green Digital Finance Alliance, Blockchain: Gateway For Sustainability Linked Bonds, September 2019, <https://greendigitalfinancealliance.org/wp-content/uploads/2019/12/blockchain-gateway-for-sustainability.pdf>.

⁶³ This aligns with the first two core components of the Green Bond Principles where a number of examples or cases in which DLT and smart contracts are already being used to realize efficiencies.

⁶⁴ Aligning with the third and fourth Green Bond principles on use or management of proceeds and proof of impact is also viable and can be applied to Project Evaluation, Selection and Reporting. See Green Digital Finance Alliance, Blockchain: Gateway For Sustainability Linked Bonds, September 2019, <https://greendigitalfinancealliance.org/wp-content/uploads/2019/12/blockchain-gateway-for-sustainability.pdf>.

Quantifying Potential Efficiency Gains

Integrated technology would allow for 10X efficiency gains in comparison to the non-DLT bond process across the process (from structuring to validation to custodianship to reporting)

1. Minimising the number of intermediaries:

The end-to-end service by the DLT has the potential of substituting a number of intermediaries in the current bond market.

2. Immediate distribution: The utilization of smart contract in the issuance and distribution process can ease the complex rules for competitive bidding through automation.

3. Enhanced security including in secure use of proceeds (automated execution means minimum human oversight).

4. Delivering real time proof of impact in a transparent manner.

5. Efficiency and finality of settlement: The execution of immediate settlement reduces settlement risk by over 99%, eliminates counterparty risk and reduces costs.

GREEN BOND PROCESS (USD)	STANDARD PROCESS	WITH FULL BLOCKCHAIN AUTOMATION
Structuring, price setting, risk rating	1,000,000	20,000
Legal review	100,000	40,000
Investor whitelisting and matchmaking	500,000	n/a
Internal review and green classification	50,000	20,000
Third party validation and green benchmarking	50,000	5,000
Registration and listing	15,000	n/a (if sold on blockchain exchange)
Brokerage and sales	1,500,000	40,000
Payment and settlement	Opportunity cost: 84,000	0
Custodianship	350,000	2,000 (blockchain dependent)
Data gathering (full lifecycle)	1,200,000	350,000 (includes IoT devices)
Data aggregation (full lifecycle)	400,000	115,000
Reporting (full lifecycle)	1,200,000	100,000
Total	6,449,000	692,000

Source: Modified from Green Digital Finance Alliance

6.1.2. Optimising the Benefits of Tokenization through Programmable money

A successful way of digitising green bonds could be to integrate an automatic settlement system through the use of stablecoins and programmable money. This would serve several purposes: bringing immediacy in settlements, paying out to investors efficiently, and providing regulatory authorities with the desired transparency and oversight.

- Two components that are associated with “programmable money” are (1) digital money and (2) a mechanism for specifying the automated behaviour of that money through a computer, termed as “programmability.”⁶⁵ What makes “programmable money” different from the other forms of digital money is that it can be encoded to execute actions based on conditions being met, for example writing records, applying interest or levying penalties. It can also encode who/what class of person is able to hold it, for security.
- A successful public or private blockchain system can closely link digital value and programmability in a single system. A system could be built in a way that it can only operate when both components are present.⁶⁶

A digital bond issued with programmable money can be backed by a “coherent guarantee (an inseparable component of programmable money) ensuring that the technical components of the programmable money are inseparable, consistently functional, and any product that is tied to a programmable money is stable and coherent for users.

⁶⁵ According to the recent Federal Reserve Notes published on the programmable money, the Notes states: “[a]ny “programmability” offered for this money, whether internally to the entity maintaining the database or exposed to its customers via an application programming interface (API), involves another technology system built separately from that database and then connected in some fashion.” The Note further denotes the distinction between the system used by a programmable money with a cryptocurrency system by saying, “[w]hile newer cryptocurrency systems also use a database (often in the form of blockchain data structure), a key difference is that the records in such blockchains either directly incorporate some programmable script (as Bitcoin records do, for example), or sit alongside a general programming functionality within the system that allows for direct manipulation of those records (the model used by Ethereum, among others).” See Board of Governors of the Federal Reserve System, What is Programmable Money?, June 2021, <https://www.federalreserve.gov/econres/notes/feds-notes/what-is-programmable-money-20210623.htm>.

⁶⁶ See Board of Governors of the Federal Reserve System, What is Programmable Money?, June 2021, <https://www.federalreserve.gov/econres/notes/feds-notes/what-is-programmable-money-20210623.htm>.

- A coherence guarantee in the mechanism of programmable money thus potentially can create a stable system for digital bond issuance, settlement and pay-out to investors. This system can particularly appeal to retail investors, including millennials.

6.1.3. Exploring End-to-End Integration

Digital technologies improve existing processes and enable creation of completely new programmable sustainable finance instruments, expanding the current digital green bond. Digitised green bonds can play a major role in financing the green transition however to date, no end-to-end digital green bond has been issued. This section explores the end-to-end integration as well as the potential to expand the capacity not only to green bonds but to broaden the parameters of "green" and to leverage programmable sustainable finance instruments.

Current thinking on climate bonds focuses on linking bond level automation with project level automation, which would allow for the aggregation of small assets into a portfolio for larger issuances. Beyond aggregation of assets and issuances, there is also potential for direct individual investment to smaller projects, as well as community-driven projects.

Examples of Portfolio Approaches

1. Aggregation of smaller assets into a portfolio for larger issuances



2. Capacity for fractionalization of a large asset to individual investors



3. Eventual capacity for individual investment into SME or community projects

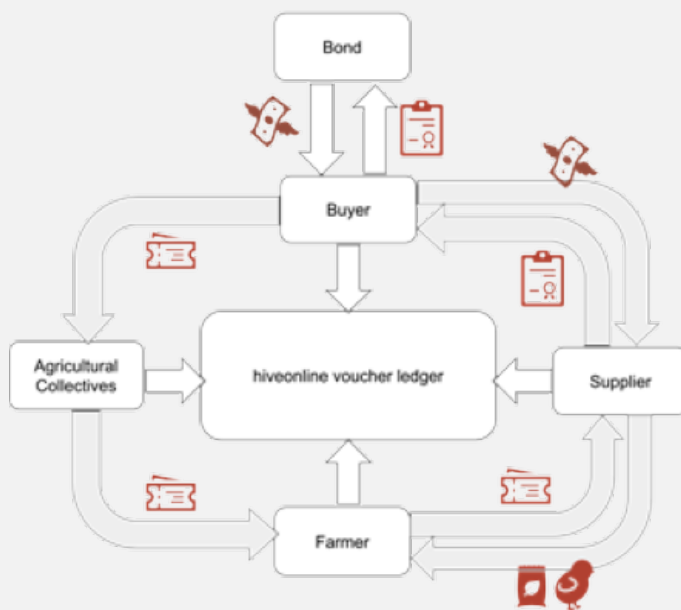


Source: Modified from Green Digital Finance Alliance,⁶⁷

⁶⁷ See Green Digital Finance Alliance, Blockchain: Gateway For Sustainability Linked Bonds, September 2019, <https://greendigitalfinancealliance.org/wp-content/uploads/2019/12/blockchain-gateway-for-sustainability.pdf>.

However, the current perspective is limited to focus on traditional key sectors which comprises the top three sectors in a developing markets context: energy, land and transport with data available that can be harvested and integrated via IoT and AI for green asset performance. As also explained in Section 4, in the not too distant future blockchain technology can be used to create fully programmable digital green and sustainability-linked bonds with any parameters, which will increase flexibility, transparency, as well as significantly lower the cost of sustainable finance. For example, beyond measuring carbon neutral crops, parameters related to greening slums or helping women establish carbon neutral crop practices could be integrated. This would allow for extending to other SDGs initiatives and community fintech instruments bridging to - for example - gender bonds (such as women's livelihood bonds for access to financial services by retail investors).

Example of Community fintech Instrument



Full value chain traceability can be achieved using blockchain based asset tracking and voucher systems for communities who are normally uninvestable, with assets that can be configured to be owned by a certain class of user (e.g. women smallholder farmers) redeemed for certain classes of assets (chicken coops, feed, chicks) from certain retailers. Together with traceability, when linked to financial transactions recorded as blockchain transactions, provides detailed ROI evidence for investors in real time.

This allows for asset financing of microbusinesses and is particularly effective when applied to agricultural communities which are self-policing to ensure that capital is converted into commercial profits.

Example of Gender Climate Bond

Potential Integration with AWAK in Kenya: Gender and climate bond to improve food security and carbon neutral crop practices

Reach: 400,000 women-led smallholder farms

Purpose: Currently helping unemployed women slum dwellers to establish backyard farms, greening slums, creating employment and food security with carbon neutral crop practices.

Impact: Bond investment will enable the women to access better agricultural inputs, sell more crops and expand their farms.

SDG Alignment: growth opportunities to women farmers, financial literacy and capacity building

Monitoring and Evaluation: a monitoring template, market assessment for a baseline of metrics and associated indicators, including:

- Benchmark individual and group commercial activities, income streams, family size, education levels
- Measurements: income per farmer, loan amounts, access to finance, digital literacy
- Determining training required by groups via field agents
- Covid-19 Impact (if applicable)

Indicators can also be accessed in real-time through the dashboard (i.e. hiveonline); investors and project implementers can monitor group progress without physically meeting, reducing costs and allowing for social distancing.

With blockchain traceability, bonds can tap into and expand existing initiatives, drive new initiatives in these ecosystems while augmenting sustainable practices in developing economies. Eventual application across other green assets and general bond issuances include:

- Accessible, democratised process
- Lower cost and reduced friction
- Investments by ordinary people
- Market and business model leadership
- Linking and/or opening up difficult markets

6.1.6. New Instruments and Strategies

The emergence of diverse **synthetic programmable instruments** amplifies the need for open platforms and infrastructure which underpin the capacity for scaling of green bonds. New instruments and strategies can be integrated along with more complex finance instruments that are self-sustaining. This carries benefits for stakeholders from issuers to investors including millennial interests, building on green elements, bridging to carbon credits and nested open accounting.

Examples of Programmability

Illustrative examples:

- A. An extreme event – pre agreement on some conditions for interest rates and penalties that can be programmed or
- B. Additional impact – more impact can interest rates or carbon credits generated to top off benefits
 - Options and situation (scenarios) re use of proceeds for project financing
 - DOW mechanism that could include conditions of the bond with voting capacity to change even while in progress so it does not remain static – more transparent and democratic
 - Linking in with **Programmable Money and special instruments**, examples assets which can carry different levels of value for different purposes – carbon credits with a monetary value being a good example.

6.2. Climate Accounting

By the Open Earth Foundation



Martin Wainstein is the founder of the Open Earth Foundation, a research and deployment non-profit focusing on digital innovations and open collaborations around planetary-scale projects such as Open Climate. He is a resident fellow at the Yale Center for Business and the Environment, where he founded and leads the research efforts behind the Yale Open Innovation Lab. Martin held appointments at the Yale Department of Electrical Engineering, the Tsai Center for Innovative Thinking at Yale, and is a research affiliate at the Digital Currency Initiative of the MIT Media Lab. He is the co-founding chair of the Hyperledger Climate Action and Accounting SIG at the Linux Foundation, and actively advises deep tech start-ups such as the Spatial Web, Verses, and Raise Green.

6.2.1. Need for National Inventories

As supported in the preceding articles of this report, climate bonds represent a unique debt instrument to bundle on-the-ground climate action projects, ranging from renewable energy installations to nature-based solutions. These projects ideally represent a global orchestrated effort to achieve a collective science-based target of emissions reductions; crystallized in an international agreement like the Paris Accord. The initial agreement and process was the Kyoto protocol, which introduced the notion of tracking emissions through national greenhouse gas inventories and reviewing them in the open arena of the UNFCCC Conference of the Parties. For climate action projects and actions financed through financial instruments like bonds to truly prove their worth, their verifiable mitigation units need to roll up to these national inventories and demonstrate how they are the essential muscle for achieving the overall targets.

The Paris Agreement introduced the concept of Nationally Determined Contributions (NDC) to the scientifically defined goals. NDCs, among other things, allow for the accounting and tracking of jurisdictional emissions and mitigation outcomes (MO) with a process that ideally over time makes the former records smaller and the latter larger. The key Paris Agreement exercise entails reviewing the progress that each country achieves in meeting their respective NDCs and further ratcheting the ambitions of NDCs every five years in a process called the global stock take (GST).

For bonds and their underlying financed projects to scale and demonstrate a valid instrument to accelerate decarbonisation, the actions must be traced all the way up to the GST exercises and national inventories; showcasing the additive value that these projects and initiative have in the achievement of the common goal—

preventing warming above 1.5°C. This article discusses the importance of not only properly linking bonds and their scoring to the underlying impact data of on-the-ground projects —a feature that cannot be taken for granted in bonds markets as shown in prior articles— but also properly linking the project's climate accounting to the national climate accounting.⁶⁸ This is particularly relevant for central banks that can bring liquidity to climate bonds markets whilst ideally ensuring this helps their country meet the pledged mitigation targets.

6.2.2. System dynamics to integrate the finance and accounting digital infrastructure

Thus far, the report has reviewed a whole array of technological components and social notions that are essential for advancing next generation climate bonds; ranging from, among others, internet-connected sensors, digital currencies, smart contracts, new investor demands, tokenisation of debt and impact outcomes. This section maps the systems and feedback loops that are key from the perspective of central banks, presenting these in three distinct cycles of: financial risk management, investment automations within bonds' climate action portfolios and the climate accounting of impact units back to the UNFCCC Paris process.

Financial risk management ideally entails the divestment feedback loop from high carbon assets into climate aligned investment. Here, robust climate accounting utilising distributed ledgers can help identify and measure the high carbon risk segments within assets and portfolio. Additionally, they can:⁶⁹

- Track carbon emissions in investment portfolios in real-time;
- Reduce currently high certification and monitoring premiums of green assets (through automation and disintermediation) and address greenwashing concerns;
- Reduce transaction costs thereby lowering bond ticket sizes and improving scalability and applicability of green bonds to make them available for financing SME action.

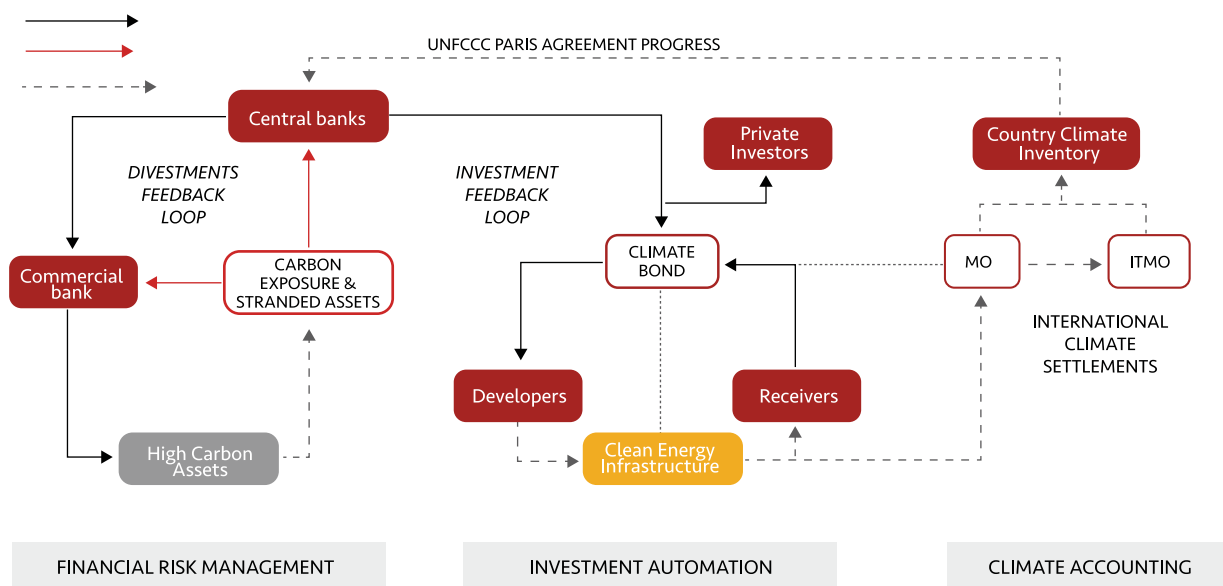
In terms of divestment, central banks can frequently interface with coal-exposed assets through collateral frameworks, which are risky for bringing about stranded assets. A way to counteract this coal exposure can be through both micro-prudential capital requirements and macro-prudential capital buffers, which disincentivise these positions by properly internalising their underlying risks (New Economics Foundation, 2020).

The available capital freed from high carbon assets can thus be mobilised in the climate bonds market alongside private sector investments. This switch could be progressively done algorithmically and, by linking the proper trusted data trails, can eventually rely on smart contract executions. Of course, not all bonds are created equal, so central banks and institutional investors must incorporate mechanisms for investment selections. For this, robust climate accounting and data economics are needed to properly assess the heterogeneity of climate bonds. Conventional bonds are often rated based on their level of risk and performance through independent rating bodies, which do not disclose the calculations and methodologies for their assessment processes. Corporate ESG ratings already showcase a similar level of obscurity in the scoring process. This is something that the climate bonds space must avoid entirely, introducing proper mechanisms to link data trails and trusted assessment of several aspects of the underlying projects within bonds. Data assessment linked to climate bonds rating should include risk but also a granular quantification of impact (e.g., carbon reductions) through standardised and digitised processes of monitoring, reporting and verifying (MRV) the climate actions, as well as the traceability of how the certified mitigation units are accounted for.

⁶⁸ Proper linking and accounting are essential to prevent double-counting risks and mitigating the risk of greenwashing. See Shishlov, Morel, and Cochran, I4CE – Institute for Climate Economics, Beyond Transparency: Unlocking the Full Potential of Green Bonds, June 2016, <https://www.cbd.int/financial/greenbonds/i4ce-greenbond2016.pdf>; Park, Stanford Journal of International Law 54, Investors as Regulators: Green Bonds and the Governance Challenges of the Sustainable Finance Revolution, March 2018, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3142887; Flammer, Journal of Financial Economics, Corporate Green Bonds, January 2021, <https://www.sciencedirect.com/science/article/abs/pii/S0304405X21000337>.

⁶⁹ Schletz, Nassiry and Lee, ADBI Working Paper Series BLOCKCHAIN, (1079), Blockchain and Tokenized Securities: The Potential for Green Finance, February 2020, <https://www.adb.org/publications/blockchain-tokenized-securities-potential-green-finance>.

Mapping the System: Funding

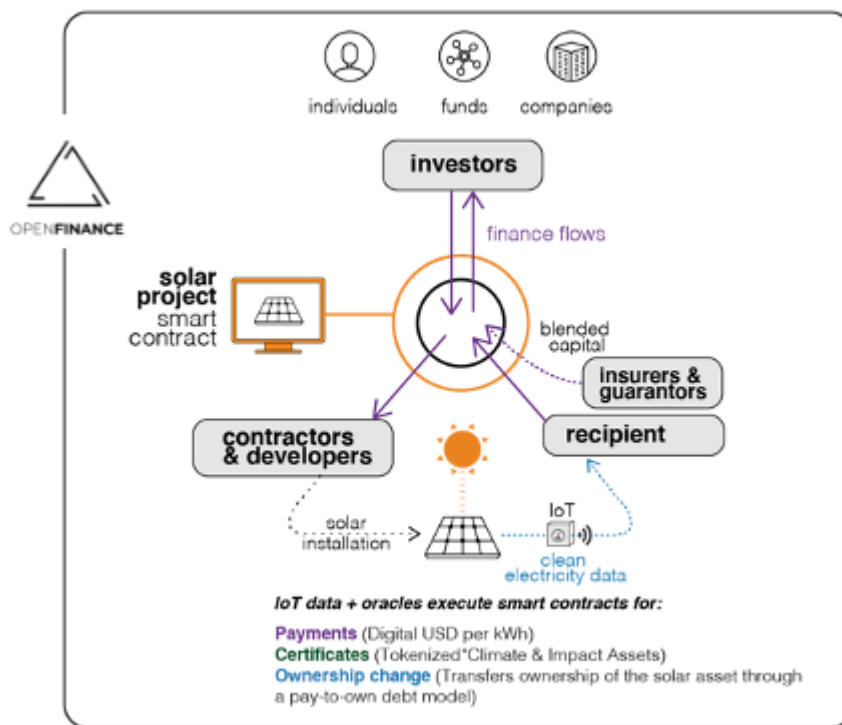


Source: Open Earth Foundation *Digital Green Bonds*: Wainstein and Foster

The figure above traces key dynamics linking central banks to their immediate ecosystem of climate action, climate finance, and the Paris agreements process. This sets the stage for identifying key interventions from digital technologies to address systems pain points and opportunities.

The emergence of digital currencies and smart contracts introduce key opportunities for investment automations that can help reduce frictions and manage the complexity of bundled debt from projects like distributed clean energy resources. Individual investors, developers and receivers in the context of a project-financed installation can form a triad of payments and agreements that can be automated (i.e., self-executed) based on internet-connected sensors, which attest to, for example, the clean energy generated and its marginally displaced carbon (Wainstein, 2019). These techniques present the needed digital infrastructure to converge trusted data of thousands of projects into homogenised financial units. Furthermore, both at the project finance level and the financial instrument level, the role for blended finance automation becomes a disruptive opportunity to include emerging economies and underserved populations into the growing climate action economy. Through blended finance automations, concessionary or first-loss capital can be placed in digital escrow accounts and used to reduce the cost of capital from market-rate capital, essentially by absorbing risk from the project. For example, if a recipient of a solar project financed through a climate bond fails to pay the electricity or debt for several months — within a program that digitally tracks payments and power productions using blockchain records — payments out of a blended finance escrow account can be triggered to meet the scheduled coupons to investors, thus protecting the position of both investors and recipients or borrowers.⁷⁰

⁷⁰ See also Schletz, Nassiry and Lee, ADHI Working Paper Series BLOCKCHAIN, (1079), Blockchain and Tokenized Securities: The Potential for Green Finance, February 2020, <https://www.adb.org/publications/blockchain-tokenized-securities-potential-green-finance>.

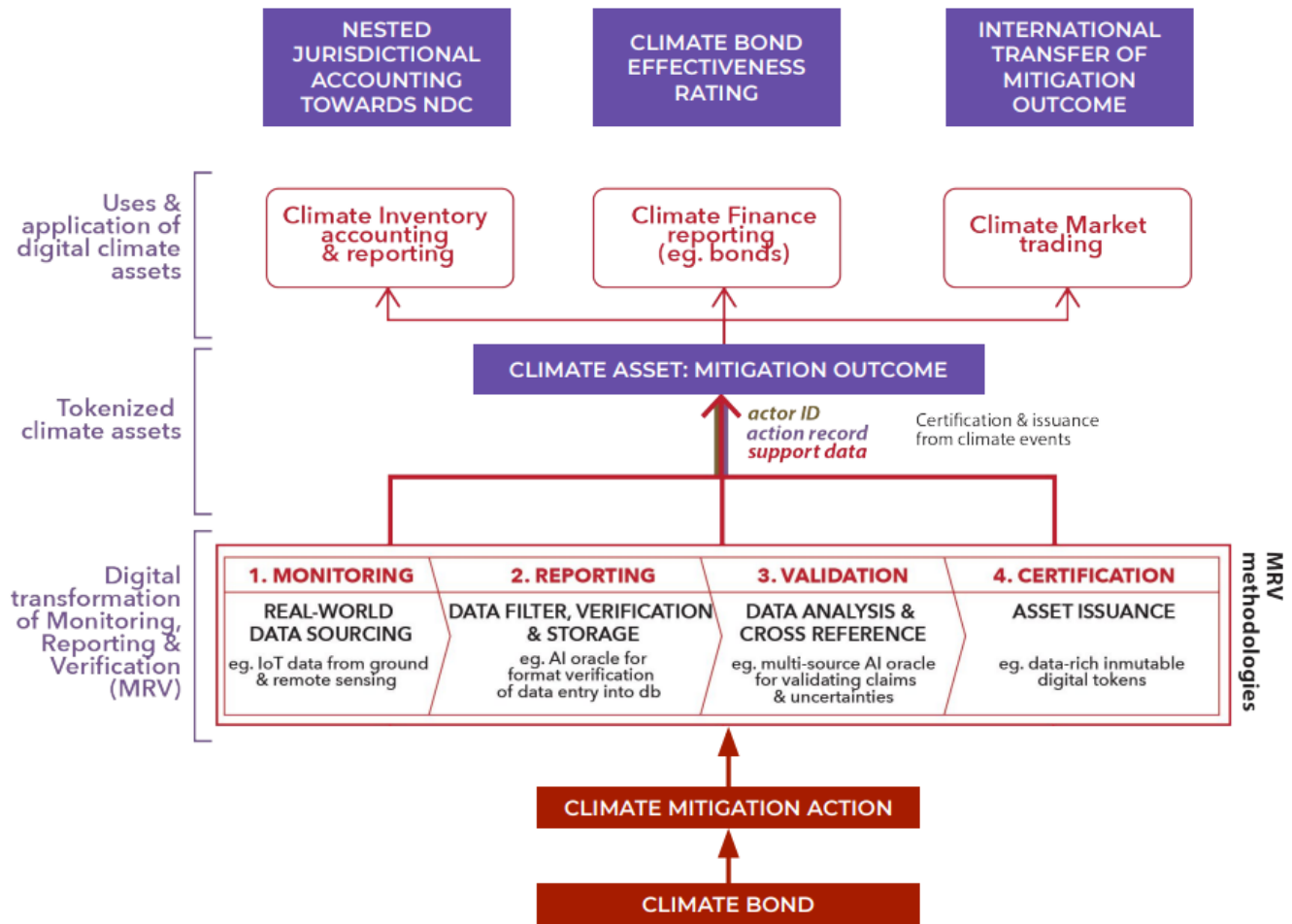


Source: Open Earth Foundation Digital Green Bonds: Wainstein and Foster

As already noted, perhaps the most important step and opportunity when financing climate action projects through tokenised bonds, is to ensure that their mitigation outcomes are incorporated into national inventories and form part of tracking the progress towards NDCs.⁷¹ It is in this step where climate accounting and emerging digital infrastructure becomes essential. Traditionally, subnational and national climate inventories are created by sourcing aggregated datasets from different economic sectors (e.g., energy, waste, industrial processes and agriculture). This means that concrete on-the-ground projects get diluted amidst sector-specific datasets, making it very hard to know, for example, what percentage of mitigations progress can be tracked to projects funded through bonds. In order to do so, we need to shift to a nested climate accounting paradigm, whereby registered climate action projects (e.g., solar deployments) and their verified outcomes (e.g., renewable energy certifications or carbon offsets) are defined by their geographic location and included in a jurisdictionally based registry. This means a solar project in a city like Los Angeles, through its tokenised renewable energy outcomes directly helps achieve the city's climate progress, but also "roll-up" to participate in the state of California's climate inventory, and eventually the national USA inventory to progress in meeting the Paris Agreement goal. As the figure below shows, this creates a closed loop, enabling a central bank that brought liquidity to climate bonds linked to registered climate projects to ensure their finance is helping the sovereign nation accomplish their NDC.

⁷¹ See also Schletz, Nassiry and Lee, ADBI Working Paper Series BLOCKCHAIN, (1079), Blockchain and Tokenized Securities: The Potential for Green Finance, February 2020, <https://www.adb.org/publications/blockchain-tokenized-securities-potential-green-finance>.

Mapping the System: Linking to NDCs



Source: Open Earth Foundation Digital Green Bonds: Wainstein and Foster⁷²

⁷² Adapted from Wainstein, Technology Architecture + Design, Blockchains as Enablers of Participatory Smart Grids, October 2019, <https://www.tandfonline.com/doi/full/10.1080/24751448.2019.1640521>.

6.3. Climate Action and Sovereign Yield

By Hong Kong University of Science and Technology



Entela Benz is the CEO and Co-founder of Intensel Limited, a climate tech company that combines climate science with technology for predicting climate change risks. She serves as Adjunct Associate Professor at the Department of Finance, HKUST Business School, delivered several ESG executive trainings for companies, and publishes research and cases on ESG investing.

6.3.1. Scope of Study

Despite the vast amounts of literature documenting the relation between climate risk and its economic implications, there is very little research on the relation between the climate risks countries are exposed to and their sovereign bond yields. This article investigates the relation between climate risks faced by Asian economies and the ability of climate risk metrics - Vulnerability, Hazards and Lack of Coping Capacity - to explain the difference in credit spreads, adjusted for economic factors, among developed economies.

This study was inspired by IMF working paper No.20/79 (Cevik, et al., 2020), which examines the relationship between using sovereign bond yields and climate risk using ND-Gain indices, which score countries on their vulnerability to climate hazards and their resilience to the same. The IMF paper finds that developed economies are more resilient to extreme climate events and are more vulnerable, as intuition suggests, resulting in a lower cost of borrowing after adjusting for economic factors. Developing nations with poor institutional quality see a higher cost of borrowing for government reflected in their bond spreads. The paper finds that countries with high vulnerability show a high cost of borrowing after adjusting for all other variables, and vulnerability explains the greatest variation in bond yields.

6.3.2. Data Support the Link between Coping Capabilities and Sovereign Yield

The study between climate risk and bond yields assumes that, if a country has exposure to severe high frequency climate hazards and a government ill-prepared to cope with a climate event, the cost of capital borrowing will reflect these factors. The foundation of our assumption stems from our intuition and also from well-established data that climate change imposes material macroeconomic risks and costs on economies. Understanding the significance and magnitude of the financial risks helps us price securities to reflect their true risks accurately.

Most studies and traditional fundamental credit analysis methods empirically support the theoretical prediction that the level of a government's indebtedness, size of its economy and other macroeconomic factors have a significant impact on determining a country's cost of borrowing. There is also evidence to suggest that institutional quality also plays a role in determining the cost of a government's debt. Hence, we included the government effectiveness scores developed by the World Bank group as a factor in our study.

The climate indicators we used are from the INFORM Risk Index created by INFORM, which is a collaboration of the Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness and the European Commission. The Joint Research Centre of European Commission's DRMKC (Disaster Risk Management and Knowledge Center) is the scientific lead in this multi-stakeholder forum for developing shared, quantitative analysis relevant to humanitarian crises and disasters.

The INFORM index has three dimensions: Hazard & Exposure, Vulnerability, and Lack of Coping Capacity. INFORM developed categories for each dimension with numerous components, and it delivers comprehensive and categorical scores for all countries across the globe. We leveraged the comprehensive Hazard, Vulnerability and Lack of Coping Capacity scores in our study.

We gathered cross-sectional time series data of 10-year sovereign bond yields, Real GDP, Real GDP growth rate, Inflation, Debt-to-GDP ratio, Forex reserves-to-GDP ratio, Government effectiveness, INFORM's Hazard, Vulnerability & Coping capacity scores along with Intensel's proprietary time series data on monetary damage caused by climate hazards during our study. We built a dataset containing all these factors for 18 countries, predominantly Asian economies, to analyse the relationship of climate risk and yields using two methods.

We developed a simple regression model on cross-sectional timeseries data with the dependent variable being the bond yields and all the other factors being explanatory variables.

$$\text{bond yield} = \alpha. \text{macroeconomic variables} + \beta. \text{climate indicators}$$

This equation is a reduced-form generic linear model and does not allow for making casual statements or quantifying the cleaning effect of climate change on bond yields.

The table below depicts regression results of two linear models, (1) contains data from all the countries in our study, while (2) is the regression output for data exclusively from Asian countries.

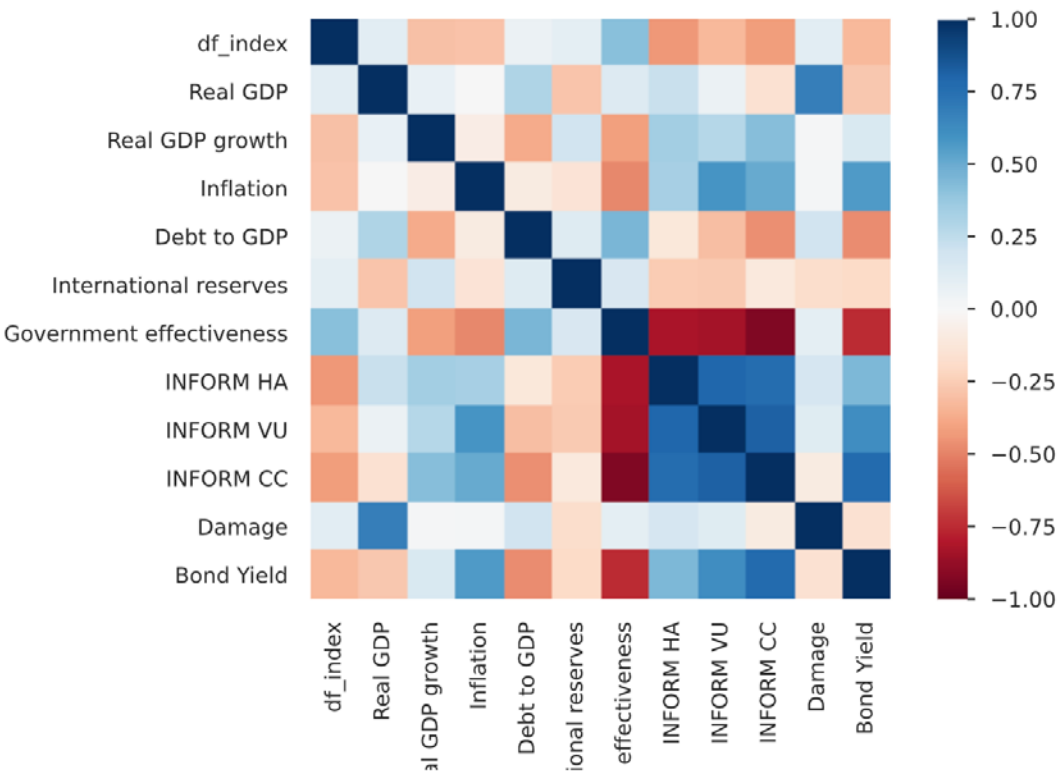
Results		
	<i>Dependent variable:</i>	
	Yield	
	All Countries (1)	Asian Countries (2)
Real_GDP	-0.0001** (0.00004)	-0.0002** (0.0001)
GDP_Growth	0.055 (0.061)	0.089 (0.070)
CPI	0.278*** (0.077)	0.318*** (0.089)
Debt_to_GDP	-0.0001 (0.004)	-0.0004 (0.005)
Deficit	0.142* (0.079)	0.040 (0.098)
Reserves	-0.081*** (0.012)	-0.078*** (0.013)
Gov_Effectiveness	-1.398** (0.614)	-1.789** (0.835)
HA	-0.031 (0.188)	-0.069 (0.266)
VU	-0.218 (0.179)	-0.454** (0.223)
CC	0.972*** (0.278)	0.920*** (0.331)
Damage	0.000 (0.000)	0.00000 (0.00000)
Constant	4.046** (1.612)	5.216** (2.301)
Observations	82	70
R ²	0.872	0.880
Adjusted R ²	0.852	0.857
Residual Std. Error	0.941 (df = 70)	0.957 (df = 58)
F Statistic	43.505*** (df = 11; 70)	38.608*** (df = 11; 58)
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01		

The results indicate that CPI, Forex Reserves and Lack of Coping Capacity have the highest significance in explaining the variation in bond yields. However, Real GDP and Government Effectiveness are significant within a 95% confidence interval across both the models. One of the differences between the model containing data from US & UK and the model with Asian countries' data is that Vulnerability is significant in the Asian model.

This aligns with our intuition that Asian economies are more vulnerable to climate hazards, which should be reflected in their bond yields. The low significance of Hazards may be due to the regional focus giving rise to similar hazard profiles for different countries due to similar geographic profiles and proximity. While there is a minor difference in the explanatory power of models, the model without data from the US & UK does a better job with an R-squared of 0.880.

These results align with the IMF paper's conclusions; however, a direct comparison cannot be made as the IMF uses different climate indicator variables from ND-GAIN index, with only Resilience and Vulnerability scores, while we use more granular INFORM indices scores. The IMF results show that CPI, GDP growth and Debt are the more significant economic indicators, while both Resilience and Vulnerability are significant within 95% confidence intervals.

We ran a correlation matrix to understand how each independent variable correlates with the other in our study. The below figure shows the results.



The results indicate that Government effectiveness is strongly and inversely correlated with Bond Yields and INFORM climate scores. This is obvious as ineffective governments damage the Coping Capacity and increase the Vulnerability of their countries to climate Hazards. It is interesting to note that INFORM scores correlate with each other. But considering regional focus, and emerging economies' institutional quality and geographic profiles, it is logical that all the climate variables correlate strongly.

To aid our regression analysis, we analysed the importance of each variable in explaining the variation in bond yields using random forest models. The results are as displayed below in the table below.

	P-values	Importance
Real GDP	1.46E-81	0.0205
Real GDP growth	2.69E-81	0.0216
Inflation	1.44E-79	0.0232
Debt to GDP	1.72E-62	0.0812
International reserves	6.33E-69	0.0588
Government effectiveness	0.00072624	0.5975
INFORM HA	3.47E-79	0.0270
INFORM VU	4.87E-84	0.0119
INFORM CC	6.81E-42	0.1465
Damage	2.82E-75	0.0600

The important score for each variable lies in the range [0,1]. A higher score indicates a greater importance. Government effectiveness and Coping Capacity scores have the highest importance, while the p-value for the Government effectiveness importance score is the lowest in the analysis. This model aligns with the results from regression consolidating our conclusion from the study. The results of our study align with our intuition that Resilience and a government's Coping Capacity do play a role in the market's assessment of a government's credit risk.

6.3.3. Conclusion

The results of this preliminary study align with our intuition that Resilience and a government's Coping Capacity do play a role in the market's assessment of a government's credit risk. The analysis will be extended to green bonds, and we expect the lack of Coping Capacity in some Asian countries to be a strong factor in determining green bond yields.



“

Financial innovation is a key element in industrial innovation overall, especially to better focus capital on addressing climate change and social equity considerations.

Paula DiPerna
Special Advisor, CDP



Section 7: Back to the Book of Genesis

By the WWF



Jean-Marc Champagne is the Head of Environmental Finance & Bankable Nature Solutions Asia WWF-Hong Kong. His main focus is heading up WWF's newly launched Bankable Nature Solutions initiative for Asia, which aims to originate and develop scalable bankable projects with conservation impact. He is also managing the Asia-Pacific portion of the origination facility for the €160 million Dutch Fund for Climate and Development. He was instrumental in launching the Climate Impact Asia Fund in January 2020 and is a member of its Investment Advisory Committee. He also advises institutional investors, lenders, and underwriters on the financial and economic risks and opportunities related to climate change and environmental issues.



Jochen Krimphoff is an environmental economist by training, has led WWF's advocacy on sustainable debt capital markets since 2014. In this role, he has recently co-authored a WWF publication entitled "[Can debt capital markets save the planet?](#)" In 2018 he has been appointed to represent WWF on the EC-mandated [Technical Expert Group on Sustainable Finance \(TEG\)](#) and since October 2020 he serves as WWF Sherpa on the [Platform on Sustainable Finance](#)², where he leads the WWF team that supports the development of sector-specific technical screening criteria for the European framework to facilitate sustainable investment ("EU-Taxonomy").

7.1. The Make-or-Break Decade⁷³

Global debt capital markets, beyond green bonds, are by far the largest and deepest pool of global capital. As the world economies recover from the COVID-19 crisis, global debt has ballooned to reach more than USD280tn in outstanding financing and investment. At the same time, most of the real-world activities that debt markets finance depends directly on the underlying nature and ecosystems. And ecosystem default is looming, with serious implications for finance, the real economy and very worryingly, life as we know it. Debt capital markets cannot thrive when ecosystem default is looming.

As emphasized in prior articles, global debt capital markets can and must leverage their power to address the environmental challenges of our generation within the critical 'make-or-break' decade from the present to 2030. Disastrous climate change and the alarming degradation of biodiversity and ecosystems constitute a clear and present danger.⁷⁴

The good news is that the rapid changes our planet needs are possible. Key stakeholders in debt capital markets can indeed help save the planet – but only if they pull the right levers. Throughout this piece, we emphasize that the key to change is held by institutional decision makers, but it is important to point out that these decisions can be taken more easily if there is goodwill among the public.

⁷³ This paper is inspired by WWF, Report, Can Debt Capital Markets Save the Planet, forthcoming October 2021.

⁷⁴ See Almond, Brooten and Petersen, World Wide Fund, Living Planet Report 2020 - Bending the curve of biodiversity loss, October 2020, https://www.icriforum.org/wp-content/uploads/2020/09/LPR20_Full_report.pdf.

The past five years have witnessed rapid change in debt capital markets, and tremendous progress has been made:

- **Market growth in new types of ‘use-of-proceeds’ debt capital market instruments**, which finance projects with specific and intentional environmental, social or sustainability benefits, has reached critical mass and is expected to represent almost 10 percent of global bond issuances in 2021.⁷⁵ However, growth is only a means to an end, and that ambition must increase, with impact as the primary focus.
- **Markets have also grown in quality.** Market guidance and standards have moved from the relatively lax principle-based process guidelines that emerged in 2015 to far more prescriptive, taxonomy-based standards with much tighter definitions of intended environmental benefits in 2021. Some standards are becoming regulated in major jurisdictions (e.g., the European Union and China). With that said, definitions and metrics need further development to arrive at a common language of sustainable finance. Taxonomies for ‘green’ and ‘significant harm’ must be developed.
- **Investors are setting targets and shifting their mandates and exclusions**, but there is a long way to go until we see enough green deals by investment banks and their issuing clients to truly turn the tide. One way to accelerate the process is by allowing the public easier access to green deals. This would have a profound impact on bank issuance.

As we have seen with managing today’s global pandemic, rapid changes in behaviour are possible when governments, financial regulators, supervisors, and central banks step up. We must give access to the members of society who want to make a green contribution but are unsure how to do so because capital markets have mainly been set up for institutional players.

What would the world in 2025 look like if debt capital markets demonstrated a willingness to accommodate broader public participation in green investment?

⁷⁵ See Moody’s Investor Services, *Sustainable bond issuance to reach a record \$850 billion in 2021*, , July 2021, https://www.moodyys.com/research/Moodys-Sustainable-bond-issuance-to-reach-a-record-850-billion--PBC_1297595#:~:text=Moody's%20%2D%20Sustainable%20bond%20issuance%20to%20reach%20a%20record%20%24850%20billion%20in%202021,-29%20July%202021&text=Global%20issuance%20of%20green%2C%20social,said%20in%20a%20report%20today .

7.2. What Ifs?

We started the development of these scenarios by asking the question ‘what if...?’ What if debt capital market practitioners forcefully and decisively acted on the International Energy Agency's alarming call to ‘stop investing in fossil fuels to meet net-zero targets’?⁷⁶ What if, as a result, debt capital markets started to finance only those parts of our economies that preserve, restore, and protect the planet, and stopped financing those that hurt it? For example:

- **What if G20 governments**, as part of their ‘inevitable policy response’⁷⁷ to address dangerous climate change, decided to stop fossil-fuel investments and develop taxonomies that define which debt capital market investments are green and which investments involve ‘significant harm’?
- **What if today central bankers announced** that, as of 2025 at the latest, bonds that do not provide information on the taxonomy alignment of use-of-proceeds would no longer be eligible for their asset purchasing programmes and/or as market collateral? Or if regulators required all bond issuers to report on climate and nature-related risks and opportunities under the TCFD and TNFD⁷⁸ frameworks?
- **What if investor coalitions made up of individuals at the grassroots level and institutions at the overarching level** decided that by 2025, they will refuse to invest in debt capital market instruments that do not say anything about the environmental impact of the intended use-of -proceeds, unless these bonds are issued as sustainability-linked bonds tied to ambitious, science-based targets that are aligned with global climate and biodiversity goals?
- **What if investment bankers’ debt capital market teams** systematically asked themselves whether refinancing fossil fuel assets is actually a good idea? If they started worrying about the impact of climate change on their clients and how the debt underwritten would eventually be paid back if these assets became stranded in the very near future? And ultimately decide to pull the plug on these deals? Or, what if the 18 out of the 30 leading underwriting global banks that have set themselves a target of net zero by 2050⁷⁹ announced today that they have instructed their corporate and investment branches to walk away, by 2025 at the latest, from any underwriting deal to re-finance fossil fuel because they would no longer be compatible with the banks’ net zero commitments?

These types of announcements might be unthinkable today and would likely send shockwaves through today's debt capital markets as some of the questions feel uncomfortable, because they seem to point towards an uncertain, and probably disruptive future. With that said, another way to advance the conversation with decision makers is to measure the public's appetite for green investment and increase its involvement. This is where we could look to technology for help, including through public sector experimentation. Project Genesis is an example of such efforts.

⁷⁶ See CNBC, Scrap the sale of gasoline cars and stop investing in fossil fuels to meet net-zero targets, IEA says, May 2021, <https://www.cnbc.com/2021/05/18/stop-investing-in-fossil-fuels-to-meet-net-zero-targets-ia-says.html>.

⁷⁷ That is, a forceful policy response to climate change (and other environmental crises) within the near term. It assumes that it is inevitable that governments will be forced to act more decisively than they have so far, leaving investor portfolios exposed to significant risk, see United Nations - Principles for Responsible Investing, What is the Inevitable Policy Response?, 2021, <https://www.unpri.org/inevitable-policy-response/what-is-the-inevitable-policy-response/4787.article>.

⁷⁸ Respectively Taskforce on Climate-related Financial Disclosures (TCFD) and Taskforce on Nature-related Financial Disclosures (TNFD).

⁷⁹ As of August 8th, 2021, 53 banks from 27 countries have made commitments to the Net Zero Banking Alliance. These banks include, among others, the following leading underwriting banks: Bank of America, Barclays, BBVA, BNP Paribas, Commerzbank, Credit Agricole, Deutsche Bank, HSBC, Nat West, Santander, SEB, Société Générale, Standard Chartered, UBS.

7.3. Future Scenarios

Therefore, WWF is attempting to look into the future, creating future scenarios for what could and should happen next in the debt capital markets, exploring if, and more importantly how debt capital markets can, indeed, save the planet.

These scenarios are glimpses into the future. Each story that has emerged describes a plausible future of the debt capital markets ecosystems, based on real-life examples from deals and practitioners in today's markets. They are not predictions of the future but are rather possibilities. They are intended to provoke readers, challenging their assumptions about what may happen, and provide a useful shared basis for debate. They are not mutually exclusive and can complement each other.

We start off with a scenario that describes ***Business as Usual – using past experience to drive future action***, where weak mandates and vested interests continue to slow down any attempt at rapid change in the investment ecosystem. In stark contrast, we paint four future scenarios for rapid change:


- **Encyclopaedia** – a global common language explores the crucial role that definitions and metrics play in defining what 'green' is, and hence what is unsustainable in finance and investment.
- **Science-Based Central Banking** looks at how central bankers can promote 'ecosystem-stability', recognising that ecosystems and financial stability are intrinsically linked.
- **Investor Pull** – coordinated efforts driven by global investor coalitions. Under this scenario investors, asset managers and investment bankers step up to drive rapid changes in ESG-driven mandates, binding net-positive commitments, and exclusions across the ecosystem.
- **Unveiling** – radical transparency drives fast-paced disruptive change enabled by innovation, technology, and big data so that retail and millennial investors see what their money has been doing and decide to shift, with disruptive outcomes.

These scenarios were created by WWF as a blueprint for further discussion with key stakeholders in the debt capital markets to illustrate the options that each of these actors must effect the transformation we collectively need. As we seek to adapt to climate change that is hitting the world economy, we have yet to see the positive impact of 'green' debt capital markets. We have yet to figure out how they can help preserve, restore, and protect the planet, rather than destroying it. We believe that debt capital market professionals collectively hold the key. They can decide to be part of the solution, rather than the problem.





*Promoting global monetary
and financial stability*



Bank for International Settlements (BIS)
Innovation Hub
www.bis.org
email@bis.org