CARBON ACCOUNTING CHALLENGES AND SOLUTIONS

Digitizing Measurement, Reporting and Verification of Climate and Sustainability Activities for Trust, Efficiency and Utility

CONTEXT

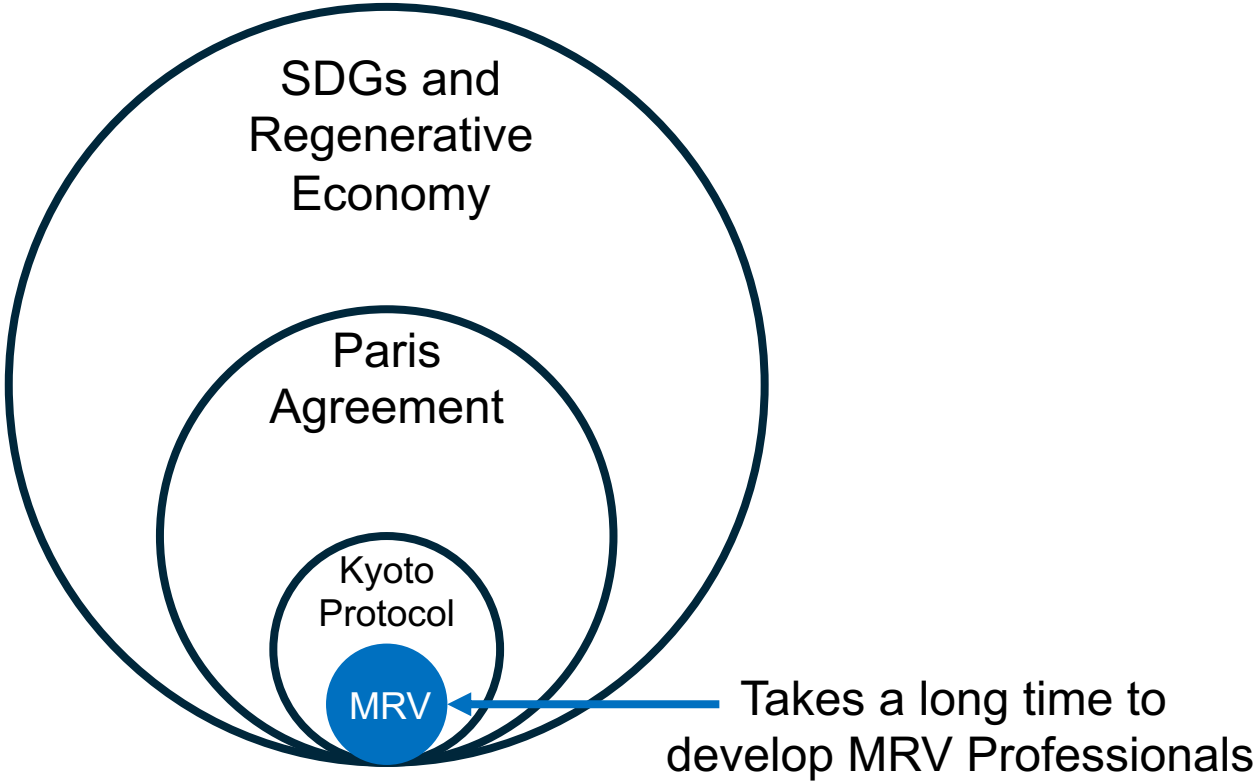
“Carbon Accounting”

- Paris Agreement goal to limit global warming to 1.5C
- 1.5C has a “carbon budget” (how much more GHG emissions the atmosphere can take) of approx. 320* Gt of CO_2 (billion tonnes)
- Annual GHG emissions are approx. 40* Gt
- Less than 8 years until the 1.5C carbon budget is used
- The 2C carbon budget is used in about 25 years
- Macro-level carbon accounting (national, international) errors 10 - 30%
- Micro-level carbon accounting (facility, company) errors 30 - 40% ... >100%

* estimates vary by a lot

CHALLENGES

Challenge: Not Enough MRV Professionals



Challenge: Greenwashing Data & Metrics

"Garbage in = Garbage out"

Bad data (low quality, out of date, incomplete, not relevant) = **Bad results**
*(rather than data as "**the new oil**" … bad data can be damaging like "**plutonium**")*

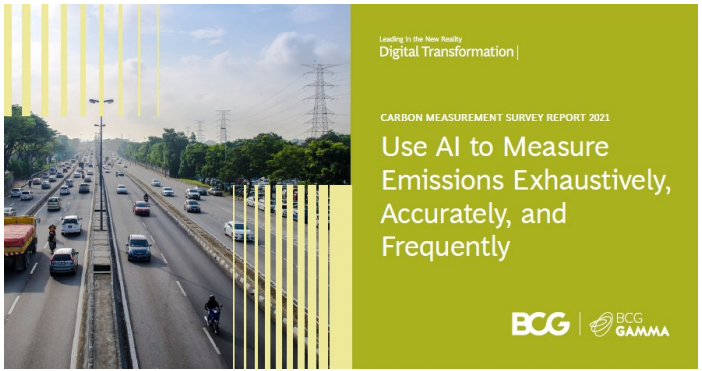
is a different problem than

Good data in + using bad standards = Garbage out

Good data (IoT digital sensors, into a DLT) + bad standards = **Bad results**
*(mismatch of current "manual" standards processes relative to digital solutions that can turbo-boost greenwashing like going from "**green lipstick on a pig**" to … I'm sure you can imagine)*

Challenge: Errors, Errors… Everywhere

BCG GAMMA Report, 2021



"· 85% of organizations are concerned about reducing their emissions
· But only 9% are able to measure their emissions comprehensively
· And only 11% have reduced their emissions in line with their ambitions in the past five years
· Overall, respondents estimate a **30% to 40% average error** rate in their emissions measurements"

Nature Climate Change, 2021

"A **mismatch of ~5.5 GtCO2 yr−1** exists between the global land-use fluxes estimated with IAMs and from countries' GHG inventories [**12% error**]. Here we present a 'Rosetta stone' adjustment to translate IAMs' land-use mitigation pathways to estimates more comparable with GHG inventories."

Challenge: And More Errors, Errors…

Environmental Defense Fund & Google, 2019

“The team discovered that fertilizer plants emitted… total annual methane emissions of 29,000 metric tons — **more than 100 times higher** than the fertilizer industry's self-reported estimate of 200 metric tons.

This figure also far exceeds the EPA's estimate for the entire U.S. industrial sector of 8,000 metric tons of methane emissions per year.”

Environmental Science & Technology, 2020

Environmental Science & Technology

“Eight-Year Estimates of Methane Emissions from Oil and Gas Operations in Western Canada Are **Nearly Twice** Those Reported in Inventories”

Challenge: Finance Greenwashing

The Economist, 2021

“Hot air

Sustainable finance is rife with greenwash. Time for more disclosure

Supposedly green and cuddly funds are stuffed full of polluters and sin stocks.”

Bloomberg, 2021

Bloomberg Green

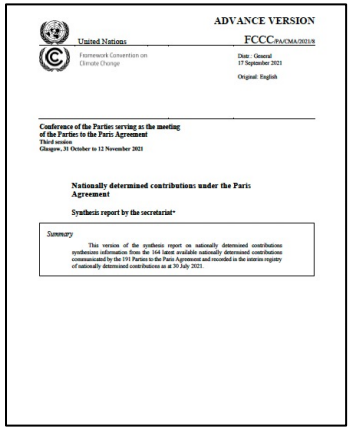
“Regulators Intensify ESG Scrutiny as Greenwashing Explodes

Pressure is increasing on fund managers to show they’re being truthful with customers about what they’re selling.

The Global Sustainable Investment Alliance **erased $2 trillion** from the European market for sustainable investments after anti-greenwashing rules were introduced in March by the European Union.”

Challenge: Greenwishing

UNFCCC Report, 2021



ADVANCE VERSION

United Nations

FCCC/PA/CMA/2021/8

Framework Convention on Climate Change

Date: General
17 September 2021

Original: English

Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
Third session
Glasgow, 31 October to 12 November 2021

Nationally determined contributions under the Paris Agreement

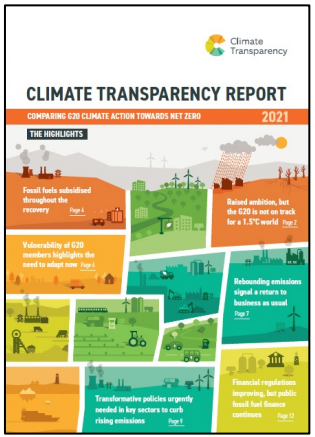
Synthesis report by the secretariat*

Summary

This version of the synthesis report on nationally determined contributions synthesizes information from the 164 latest available nationally determined contributions communicated by the 191 Parties to the Paris Agreement and recorded in the interim registry of nationally determined contributions as at 30 July 2021.

"The total global GHG emission level in 2030, taking into account implementation of all the latest NDCs, is expected to be 16.3 per cent **above** the 2010 level… to be consistent with global emission pathways with no or limited overshoot of the 1.5 °C goal, global net anthropogenic CO2 emissions **need to decline** by about 45 per cent from the 2010 level by 2030."

Climate Transparency Report, 2021



"In CAT's [Climate Action Tracker] new rating system, most G20 members' [NDCs – representing about 75% of global GHG emissions] are rated overall as "**Highly insufficient**" or "**Critically insufficient**".

Challenge: Summary

- Not enough trained professionals to do the MRV
- Huge errors in collected and reported Data
- Lack of credible Standardization
- Finance and policies lack major Credibility
- Have you read MRV Disclaimers?

- These challenges are for “carbon accounting”, which is so much easier than adaptation to climate impacts or other sustainability issues

- If carbon accounting has errors of10-20% (global), 30-40% to 100% to 1000% (for big corporations and developed country industries), and the 1.5C carbon budget is estimated to be depleted by 2030, then seriously…[fill in the blank]

Challenge: Carbon Footprint of Digital

Internet energy consumption ~ 6th largest economy

Bitcoin energy consumption > Philippines or Malaysia

Digital sector = 1.4% of global emissions and digital energy consumption forecasted to increase

On the other hand,

- Increasing renewable power consumption
- Enables material and energy efficiency (both end-use efficiency and system efficiency (IEA) in other sectors)
- Potential to achieve 15% of the Paris Agreement emission reductions goals

Good news: very energy efficient DLTs now exist!

SOLUTIONS

Overall Digital Solutions for Climate and Sustainability

Global-level digital ecosystem and digital transformation of socio-economic activities and systems (ex: UNEP, WBGU)

Digital solutions to enable climate action solutions (ex: smart sustainable cities, GeSI) and digital climate value chain

DLT for climate markets (ex: World Bank Climate Warehouse for tracking climate market transactions)

Climate fintech, DeFi, Tokenization

Next Generation Digital Solutions for MRV

MRV standards (natural language) upgraded and transformed into Digital MRV Standards (smart contracts)

Online platforms to engage more stakeholders to develop and harmonize MRV standards

DLT-enabled registries and tokenized climate units

Data marketplaces to connect & support data owners/providers & users

Digital MRV Solution

Automated application of the MRV Standards

IoT sensors, remote sensing, DLT, Digital Twins, AI, Smart Contracts,

DigitalMRV for different types of climate actions

Financial Audit >> Digital Transformation

- Major assurance companies (EY, PwC, KPMG, Deloitte…) are **investing billions of dollars** internally on digital transformation of the audit capabilities
  - Online data-driven platforms
  - Big data analytics
  - Machine Learning Algorithms, Artificial Intelligence, Natural Language Processing
  - Blockchain, IoT, 5G…
- Changing needs
  - Audit standards
  - Auditor skills

- **Similar case for non-financial audit/MRV (climate, sustainability…)**

Existing >> Emerging Digital for Climate

- Calculators (often MS Excel)
- GHG inventory software and data management systems
- LCA databases
- Emission factor databases
- Social and Knowledge hubs
- Remote sensing
- Mobile sensors
- Continuous Emissions Monitoring Systems (CEMS)
- Online reporting and registries
- Geospatial Information Systems (GIS)

- Distributed Ledger Technology (Blockchain)
- Smart Contracts and Tokenization
- Billions of connected devices (IoT)
- Big Data Analytics
- Spatial Web and Semantic Web (3.0)
- Spatial Web
- Artificial intelligence (AI) and machine learning
- Industry 4.0, 3D printing, Drones
- Mobile economy, Sharing economy
- 5G networks
- Data Marketplaces
- Digital Twins

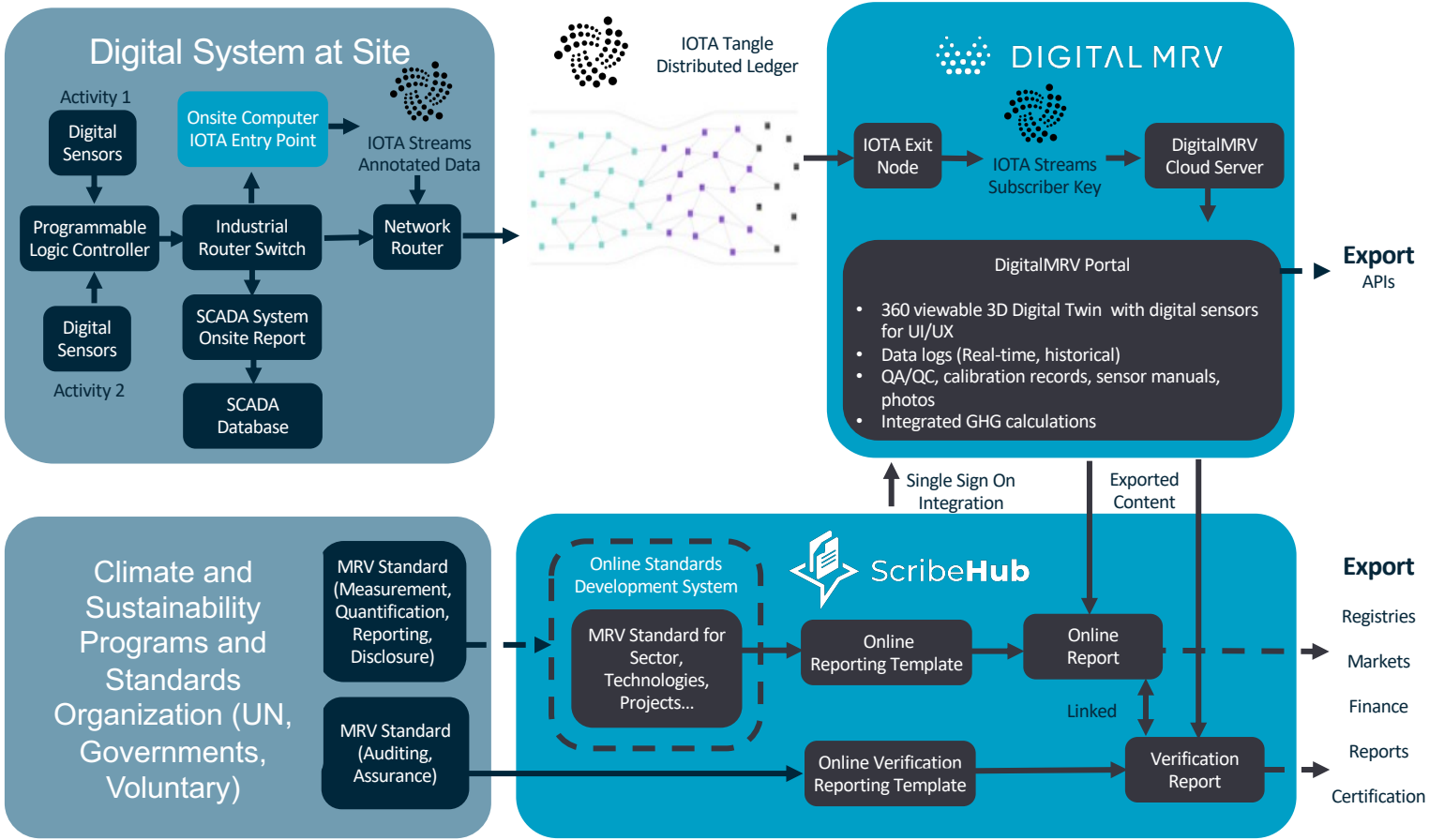
What is Digital MRV? Scope of Activities

- What MRV activities have been digitized?
- Data collection? From which sources/activities?
- Data analytics?
- Calculations automated to assess data and compute results?
- What data QA/QC?
- Online reporting?
- Virtual/Remote/Online verification activities?
- How much human involvement?

What is Digital MRV? Digital Technologies

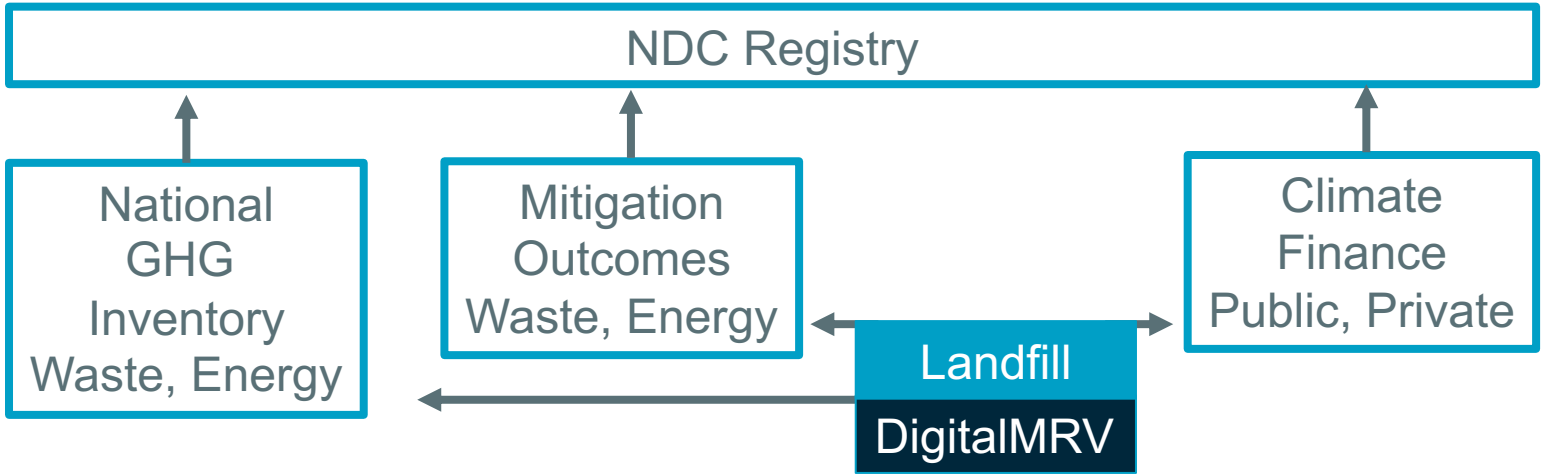
- How have MRV activities been digitized?
- IoT connected devices, digital sensors, remote sensing?
- 3D Digital Twins of objects and the site?
- Real-time data records accessibility?
- Which blockchain/DLT?
- Using smart contracts?
- Artificial Intelligence?
- Machine Learning Algorithms?
- What level of maturity/sophistication?
- Etc…

Software Overview



Chile Pilot Project Rationale

1. Proven, mature technologies (low scientific risk)
2. New build site, modern equipment
3. Digital sensors and data management system enable quick connect for DigitalMRV
4. Chile landfill project MRV methodology
5. Site is relevant to different stakeholders (mitigation, inventories, finance)



Concluding Remarks

- Digital solutions contribute to climate actions mitigation and adaptation
- Digital solutions can advance MRV activities with great benefits (cost savings, scalability, utility, trust…)
- Digital solutions can support next generation MRV systems (match level of ambition)
- Technology innovation progress is happening rapidly, but on a scale of 1 to 10 **digital MRV is currently about 2/10 or 3/10** and needs governance innovation to achieve 10/10 (see www.climate-check.com/open-collaboration)

Thank You

Questions?

Tom Baumann
CEO, ClimateCHECK
Former Chair (2014-2019)
ISO TC207 SC7

ClimateCHECK™
SET THE STANDARD

DIGITAL MRV

Presenter: Tom Baumann

- ISO climate change standards ~ 20 years, former chair (2014-2019)
- MRV expert over 20 years and digital over 10 years
- Performed MRV on climate technologies, value chains, projects, facilities, companies, communities
- Trained MRV for over 15 years (co-founded GHG Management Institute in 2007, over 11400 experts in 187 countries)
- Worked as GHG auditor (DNV)
- Worked with many MRV programs (CDM, Canada, France, ACT, CDP, CDSB, Gold Standard, Verra, GHG Protocol, …)
- Co-founded 5 digital solutions since 2010
- Co-founded and co-chair Climate Chain Coalition (with UNFCCC)
- Participate in Hyperledger, ITU, ISO, InterWork Alliance, INATBA

ISO Side Event at UNFCCC COP21, 2015

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Next Generation Standards Collaboration for Climate Neutrality and Resilience

Digital Technologies, Governance Innovation and Standards Frameworks

ISO Focus Magazine 107

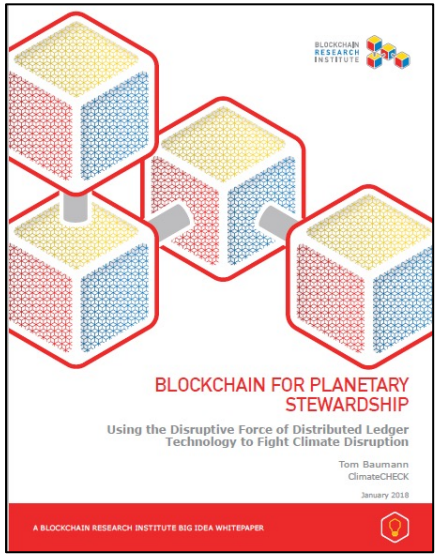
December 2014

Digital and Standards Innovations for the Post-Kyoto Era Solutions

“The road ahead will be challenging, but new information and communication technologies (ICTs) will enable new solutions. Having worked with many organizations over the last ten years that develop and use GHG standards, I think the time has come for **the standardization system to reinvent itself**.

This “standards ecosystem”, in combination with the array of ICTs available, enables standards to become “living documents” that are much more dynamic because they integrate more interactive knowledge management.

Blockchain Research Institute



January 2018

“Blockchain in combination with other digital innovations (e.g., artificial intelligence, sharing economy, Internet of Things, big data analytics) and supported by governance mechanisms such as global solution networks (GSNs) can help overcome market and government failures that impede scalable climate and sustainability solutions.

Informed by the Paris Agreement, blockchain can support a bottom-up approach to collaborating, innovating, and implementing climate solutions.22 During the COP23 UN climate conference in November 2017, climate and blockchain experts announced new blockchain-based climate initiatives. Governance innovation—such as decentralized collaborative systems to establish standards and rules necessary for a cohesive system of blockchain solutions—can support climate actions (e.g., clean energy technologies), carbon markets (e.g., carbon credit trading), and climate finance.

New governance platform and restructured MRV system guides digital infrastructure to assure data needed for climate finance/actions/markets has the necessary end-to-end integrity. Smart standards are precursors to smart contracts, software applications that formalize and secure the terms of commercial agreements and that run over distributed computer networks in a trust-minimized manner.”

World Bank Carbon Markets & Innovation

May 2018

“The next generation of bottom-up climate markets must include mechanisms to address these differences so that the technological limits of an infrastructure based on centralized registries does not inhibit achieving the scale, heterogeneity, and functional complexity required.
At the same time, a rapidly evolving technological landscape presents opportunities for efficient and robust design and development of this next generation of climate markets, as well as risks, both in terms of failure to engage, or in failing to understand how to engage effectively.
Blockchain, Big Data, the Internet of Things (IoT), smart contracts and other disruptive technologies hold out the promise of addressing the needs of new generation climate markets post-2020. Blockchain, in particular, provides data sharing and transaction management elements well-aligned with the requirements of climate markets.”

“It is concluded that digital innovations can help address these challenges firstly, through blockchain-enabled distributed ledgers that provide transparency and robust rule implementation via smart contracts; secondly, through collaborative governance systems that enable more efficient development of MRV standards structured as holistic systems of modular, compatible and extensible methods and rules; and finally, through smart meters and other devices associated with the IoT, combined with big data analytics, so as to facilitate the automated data flows necessary to harness the potential of blockchain technology in supporting new generation climate markets.”

ITU Focus Group Distributed Ledger (DLT)

August 2019

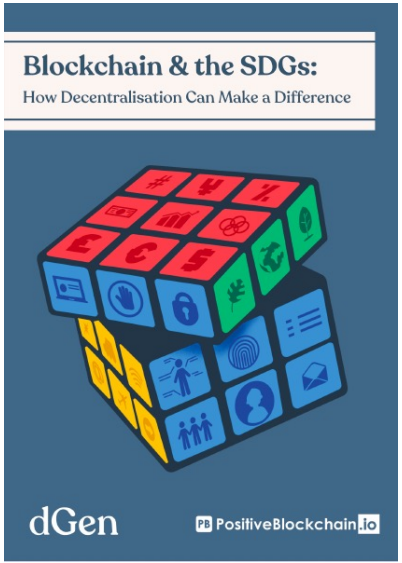
“In the context of current and as well the future outlook for emerging sustainability issues (inter alia, climate change, global loss of biodiversity, plastic pollution in oceans), and also the calls to action recognizing the scale, urgency, policy coherence and financial resources needed to address these issues and to achieve the UN Sustainable Development Goals (SDGs), DLT and related digital solutions can have major impacts in many ways.

Digital solutions, including DLT/fintech, are emerging that can support efforts to scale these financial flows and their development is the focus of the Task Force on Digital Financing for the SDGs established by the UN.

In this regard, a recent report, Digital Momentum for the UN Sustainability Agenda in the 21st Century, recommends the establishment of a ‘UN Framework Convention on Digital Sustainability and Sustainable Digitalization’.

DLT-enabled solutions depend on good data, which depends on good governance and standards, especially in the context of sustainability, in order to Measure, Report and Verify (MRV) the environmental integrity and financial efficacy of effective sustainability activities. A major advantage of DLT-enabled solutions is the ability to internalize and automate, via smart contracts, the execution of procedures such as business and legal processes as well as MRV for sustainability.”

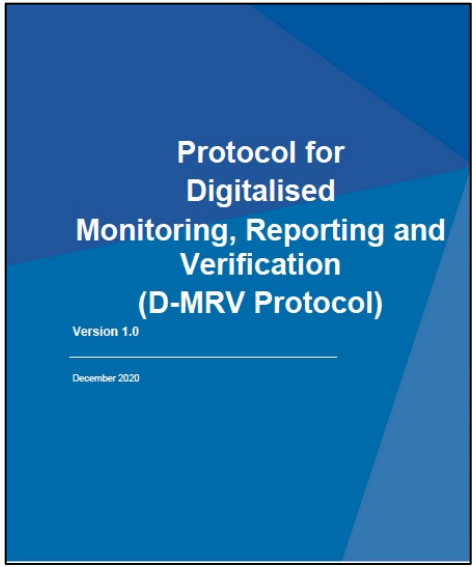
Blockchain and the SDGs



June 2021

“To more equitably divide and improve tracking of the remaining carbon emissions, it is possible to use digital solutions to tokenise the global carbon budget as a finite supply. This can then be allocated to individual accounts (or a trust to hold tokens for individuals until their accounts are activated, for future generations).
Using blockchain would enable to set standards for sustainability and carbon accounting. As data is particularly important, digital sensors, remote sensing, and other technologies would contribute to better and more reliable data. More consistent standards and methodologies to transform raw data into climate metrics are also necessary.
The rules for carbon accounting and transactions can further be enforced through a system of smart contracts. Smart contracts automate many administrative tasks, and could enable a self-enforcing global carbon market. Further, this could also be used to modernize governance. Stakeholders could be incentivised and compensated for updating and maintaining a smart contract system. Tokens could enable a portion of the value generated to be shared among a governance and rules community. Combined with international agreements, globally coordinated regulations and incentives, and smart standards, this will help increase transparency, efficiency, and interoperability of the emission trading systems. Digital solutions have the potential to change the current system and foster fairer natural wealth management. While implementation of new solutions always comes with challenges, and international solutions even more so due to complex social webs, our climate is in dire need of better ways to manage, track, and limit use of our natural resources and carbon emissions.”

Protocol for Digitalised MRV



December 2020

“Past experience with the Clean Development Mechanism (CDM) and voluntary carbon offset standards shows that transaction costs related to conventional approaches towards MRV and issuance of emission reduction certificates has been a prohibitive factor for the financial feasibility of emission reduction projects, especially in the context of low carbon prices. Further, manual processing of required data and information throughout the different MRV stages has often led to errors and misstatements, impacting issuance of certified credits and associated carbon finance flows, thereby compromising efficiency of the carbon markets.”

“With the advent of new technologies and systems, it is possible to significantly reduce MRV-related transaction time and costs, while improving accuracy, transparency and reliability of MRV, and keeping the robustness of data acquisition and processing at the required level. A main limiting factor for a more efficient MRV system are the rules of the emission reductions standards that establish certain requirements for data measurement, data collection and on-site inspections by the verification and validation bodies (VVB) for validation and verification. Existing carbon standards would have to be adapted in order to unleash the cost and time efficiency potential of digital technologies that can not only reduce or eliminate the need for on-site inspections but also to minimize the need for manual checks of data integrity, completeness and accuracy, which can be easily performed by advanced digitalised MRV, and eventually enable close to real-time issuance of certified credits”

Climate Ledger Initiative

December 2020

State and trends of blockchain and climate action

Interoperability & Open Data challenges in implementing digital technologies for climate action

Digital MRV in carbon markets post-2020: next generation quality, integrity and flexibility

Governance challenges in implementing digital technologies for climate action

Outlook and Climate Ledger Initiative’s use case programme

Taskforce for Scaling Voluntary Carbon Markets

July 2021

Taskforce for Scaling Voluntary Carbon Markets
Recommendation 13: Implement efficient and accelerated verification

Data protocol for a digital project cycle can help the verification process become more efficient, effective, and secure

“The Taskforce encourages continued development toward a digitized project cycle, where appropriate, with the aim to reduce lead times and costs and improve integrity. As a first step the Taskforce recommends the development of a shared digital data protocol across standards. This data protocol should be tailored to specific project types by defining necessary project data fields and procedures to protect the integrity of the verification process.

Furthermore, technology is rapidly evolving. The Taskforce recommends that the shared digital data protocol explore the use of satellite imaging, digital sensors, and distributed-ledger technologies (DLT), to further improve speed, accuracy, and integrity. Implementation of the digital data protocol could be a first step toward broader end-to-end life-cycle and value-chain tracking of all carbon credit data.”