Risk, Carbon Credits, and Blockchain

UN CEFACT 40th Forum

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Global Risks and Trends

- Climate Change - Rising CO2 levels
- Erosion of Social Cohesion
- Increasing National Sentiments
- Asset Bubble
- Cyberattacks
- Inflation
- Migration Continues
- Russian Ukraine Conflict
- Syrian Conflict
- Increasing Polarization of Society
- Turkey intervention EU / Russia
- Yemen Crisis
- Increasing Urbanization
- Extreme Weather Events
- Japanese Earthquakes
- South China Sea Conflict
- N. Korea Weapons Testing
- Aging Population
- Fiscal Crisis/ Sovereign Debt
- Illicit Trade
- Increasing Global Cyber Dependence
- Income & Wealth Disparity
- Increasing Polarization of Society
- Income & Wealth Disparity
- Increasing Urbanization
- Extreme Weather Events
- Increasing Global Cyber Dependence
How to Integrate Strategy and Global Risks and Trends

Organizational Vision & Strategy
Risk Appetite Statement

Key Insights
New and profound insights regarding the interplay of risk and trends to enlighten and enhance strategic decision making

Key Strategies & Strategic Assumptions

Correlations
Scenarios

GRAFT

TRENDS
RISKS

Urgency
Impact

Geopolitical
Economic
Societal
Technological
Environmental

Global Risks & Trends

How to Integrate Strategy and Global Risks and Trends
Understanding of Global Risks & Trends

Geopolitical

Risks
1. Geoeconomic Confrontations
2. State Collapse or Crisis
3. Failure of Regional or Global Governance
4. Terrorist Attacks
5. Failure of national governance
6. Weapons of Mass Destruction

Trends
1. Increasing National Sentiments
2. Changing Landscape of International Governance

https://fragilestatesindex.org/

2023 Fragility Map
Understanding of Global Risks & Trends

Societal - Trends
1. Cost of Living Crisis
2. Increasing polarization of societies
3. Aging Population
4. Rising Urbanization
5. Rising Geographic Mobility
6. Rising Chronic Diseases

Risks
1. Spread of Infectious Diseases
2. Erosion of Social Cohesion
3. Livelihood Crisis (employment, food, water, housing)
4. Large-scale involuntary migration

Situation by WHO Region

Water Scarcity Map, 2 Billion People

https://covid19.who.int/

https://carnegieendowment.org/publications/interactive/protest-tracker#
Understanding of Global Risks & Trends

**Economic - Trends**
1. Rising Income and Wealth Disparity
2. Growing Middle Class in Emerging Economies

**Risks**
1. Fiscal Crisis/Sovereign Debt
2. Inflation
3. Unemployment and Underemployment
4. Energy/Commodity Price Shock
5. Asset Bubble
6. Failure of Financial Mechanism or Institution
7. Illicit Trade

(World Bank, there are more than **1.7 billion** unbanked people)

Price Change of Consumer Goods & Services

[Image: World Wealth Map 2021]

[Image: Global Wealth Pyramid 2021]

Understanding of Global Risks & Trends

**Technological**

**Risk**
1. Cybersecurity failure
2. Digital inequality
3. Failure of Critical Infrastructure/Information Breakdown
4. Adverse Effects of Technical Advances

**Trend**
1. The Rise of Cyber Dependency

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https://www.digitalattackmap.com/#anim=1&color=0&country=ALL&list=2&time=18573&view=map

https://f.hubspotusercontent40.net/hubfs/2477095/Tsunami%20Report/IRIS-Tsunami-Final-Oct-2021.pdf?__hstc=127855378.f723ff8e4604c6e9202b70cc3fc2a543.1637249057367.1637249057367.1637249057367.1&__hssc=127855378.1.1637249057367&__hsfp=3541367438&hsCtaTracking=35e6c4be-1d8d-4b62-9739-4b8a13a9289700ec7927-4025-4800-9498-79766ce21341
Understanding of Global Risks & Trends

- **Trends**
  1. Climate Change
  2. Environmental Degradation

- **Risks**
  1. Extreme Weather Events
  2. Natural Disasters
  3. Failure of Climate-Change Mitigation and Adaption
  4. Man-Made Environmental Disaster
  5. Biodiversity Loss and Ecosystem Collapse

**Climate Change Effects**
- **CO2 levels dangerously high**
  - URL: https://www.ipcc.ch/ipccreports/tar/wg1/088.htm

**Heat and fire**
- FT, Climate experts warn extreme weather has veered off, scale, July 24, 2021

**Flooding**
- 330 million people across India are affected by this drought.

**How the jet stream influences weather**
- A large pressure difference helps keep the jet stream on a straighter path, keeping cold air over the Arctic, and warm air at lower latitudes.
- When the jet stream weakens it becomes more wavy. This can create stationary weather systems, sometimes pulling hot air northwards, or drawing cold air southwards.
Identify Correlations

**CLIMATE CHANGE**
- CO2, GHG, Rising Temperature, Rising Sea Levels

**FAILURE OF GLOBAL GOVERNANCE**
- Reduction in Support of WHO, IMF, UN
- Failed Climate Agreements

**EXTREME WEATHER EVENTS**
- Rain, Hurricanes, Snowstorms

**NATURAL DISASTERS**
- Forest fires, Flooding, Drought

**WATER CRISIS**
- 2 Billion people environmental or infrastructure water scarcity

**FOOD CRISIS**
- 828 Million People famine like conditions

**LARGE INVOLUNTARY MIGRATION**
- 60 Million Migrants

**ENERGY PRICE SHOCK**
- Oil Price Shock Falls 50% then rises 100%

**INCOME & WEALTH DISPARITY**
- Economically Vulnerable have limited access to Health Care

**INTERSTATE CONFLICT**
- Russia/Ukraine, US/China, N.Korea/Japan
- War, Damming major waterways

**INFECTIONOUS DISEASE**
- Corona Virus, Swine Flu (HOGS)

**FAILURE OF GLOBAL GOVERNANCE**
- Reduction in Support of WHO, IMF, UN
- Failed Climate Agreements

**RISE IN NATIONALISM**
- Nations Promoted at the Expense of Others

**RISE OF SOVEREIGN, CORPORATE & PERSONEL DEBT**
- $299 Trillion 2022

**ASSET BUBBLE / INFLATION**
- Market Volatility

**CYBER DEPENDENCY**
- AI, Blockchain, Deep Fakes, Cyber Attacks

**NATURAL DISASTERS**
- Forest fires, Flooding, Drought

**LARGE INVOLUNTARY MIGRATION**
- 60 Million Migrants

**ENERGY PRICE SHOCK**
- Oil Price Shock Falls 50% then rises 100%

**INCOME & WEALTH DISPARITY**
- Economically Vulnerable have limited access to Health Care

**COST OF LIVING CRISIS**
- 71 Million more people pushed into poverty
UN Sustainable Development Goals
World Bank Summary of Carbon Credit Pricing Initiatives

https://carbonpricingdashboard.worldbank.org/map_data
Carbon Credit Price by Country

- Argentina
- California
- Chile
- Colombia
- EU, Norway, Iceland, Liechtenstein
- Finland
- Fujian
- Ireland
- Latvia
- Kazakhstan
- Ireland
- Luxembourg
- Latvia
- Poland
- Northwest Territories
- New Brunswick
- Netherlands
- RGGI
- Shanghai
- Singapore
- South Africa
- Sweden
- Switzerland
- Tokyo
- United Kingdom
- Ukraine
- Uruguay
- Venezuela
- Vietnam
- Western Australia
- Wisconsin
- Wyoming

https://carbonpricingdashboard.worldbank.org/map_data
Sustainable Disclosure Regulation Continuum

- Australia 2022 Climate Change Act
- China Std Carbon Emission Acct system
- Finland, Iceland, Ireland, Norway, Luxenburg CARBON TAX
- Germany national ETS heating, transport 2021
- USA reversal of Dept of labour pecuniary factors
- Canada Prov ETS 2024 OSFI B-15 FCPPBS
- Japan Cabinet Ordinance in Disclosure aligned IFRS Sustainable disclosure Standards
- EU ETS 2021 SFDR, CSRD Jan 1 2023, ESRS 2024

FCPPBS – Federal carbon pollution pricing backstop system
A successful transition to net-zero GHG emissions requires policy packages that deliver affordable access to low and zero carbon options for household and businesses.

Looking at the evolution of carbon prices, energy taxes, and subsidies that lower pre-tax energy prices. In 2021, more than 40% of GHG emissions were covered by carbon prices, up from 32% in 2018. Carbon prices have increased in 47 or the 71 countries studied by the OECD. Introduction of explicit or the extension of carbon pricing mechanism in several countries including China, Germany and Canada.
In March 2021, the European Union’s Sustainable Finance Disclosure Regulation (SFDR) came into force.
The SFDR is designed to help institutional asset owners and retail clients understand, compare, and monitor the sustainability characteristics of investment funds by standardizing sustainability disclosures.
Under the SFDR, firms must make both firm and product-level disclosures about the integration of sustainability risks, the consideration of adverse sustainability impacts, the promotion of environmental or social factors, and sustainable investment objectives.

Implementation of the EU Sustainable Finance Action Plan continued throughout 2022.

The Commission adopted much anticipated SFDR technical standards for entity and fund-level investor reporting, which will apply from 1 January 2023. Such reporting will be supported by the newly adopted Corporate Sustainability Reporting Directive, a milestone which should provide investors with comparable and meaningful sustainability data (the first set of European Sustainability Reporting Standards will be finalised next year).

The Commission has also commenced new work, proposing a directive on Corporate Sustainability Due Diligence and calling for technical advice from EIOPA regarding the evaluation and review of the IORP Directive, looking at concepts such as the “long-term best interests of members and beneficiaries” and the “prudent person rule”.

Finally, the EU continues to drive crucial real economy reforms to meet their 2030 climate and environmental objectives (Fit for 55) – covering carbon pricing, renewable energy, and energy efficiency to name a few.

https://www.unpri.org/download?ac=17663
Sustainable Finance Disclosure Regulation

• **ESG-related EU fund naming rules:** A consultation paper on guidelines for fund names using ESG or sustainability-related terms was issued by ESMA in November 2022, addressing how funds may be named1.

• **UK disclosures and labels:** As noted earlier, in October 2022 the UK Financial Conduct Authority (FCA) issued a consultation paper with regards to Sustainability Disclosure Requirements and investment labels (UK SDR)2, creating a parallel disclosure framework that goes beyond the EU SFDR by (among other items) introducing investment labels.

• **Evolution of regulations:** Additional developments driven by both the European Platform on Sustainable Finance and the European Commission will need to be reviewed, particularly their focus on a potential social taxonomy3, an extended environmental taxonomy4 and enhancements to minimum safeguard requirements5.

• **Parallel regulations:** Third-party ESG-related industry standards will need to be reviewed as they get updated to align with the EU SFDR and the EU Taxonomy Regulation.

• **Additional ex-EU developments:** Parallel regulatory labelling requirements and/or related regulatory disclosure requirements from regulators in other regions, such as the Hong Kong Securities and Futures Commission, and the Security and Exchange Commission amendments to the fund “names rule”6, may interact with the EU SFDR and have an aggregated impact on products and disclosures.

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Beginning in 2024, Canada’s financial regulator OSFI will require federally regulated financial institutions to publish climate disclosures aligned with the TCFD framework beginning in 2024. Guideline B-15: Climate Risk Management

It will use a “phased-in” approach for the requirements. Federally regulated entities in Canada include all of the country’s banks, as well as insurance companies, and federally incorporated or registered trust and loan companies, among others.

While the rules do not yet apply to other companies, OSFI will also expect the financial institutions to collect and assess information on climate risks and emissions from their clients, and the budget notes that the government is committed to move towards mandatory TCFD reporting “across a broad spectrum of the Canadian economy.” The government also expects to require ESG disclosures from federally regulated pension plans.

Federal Government Improved Forest Management, sell to the cap-and-trade system methane capture sell to large emitters. For existing forest then we can tap into we can go a price of 25/tonne or 65/tonne, 2030 170/tonne.

Output based system, relative OPPS Alberta, 2023 summer similar to federal one, compliance market, criteria stricter.

Green and transition policies.

Canadian market on IFM system. If buy land, maintenance – credits removal improve the health, avoidance credits (Vera, Southpole – allowing to issue credit if not protecting would be cut down, these trees would not have been cut because they were not close to the road), but if buy land that has been cleared and put a covenant on the the title avoidance will not be cut, sceine based pathway, scope 1 & 2, residual everything than cannot be avoided or reduced. Removal higher priced, that they shouldn’t be credits at all. Science based pathway. Reduce this .... Claim that should not have offsets, more physical risk.

Inset self generated offset in supply chain, help suppliers to reduce their supply chain, sustemic reduction. OTC
1. The FRFI understands and mitigates against potential impacts of climate-related risks to its **business model and strategy**.

2. The FRFI has appropriate **governance and risk management practices** to manage identified climate-related risks.

3. The FRFI remains **financially resilient** through severe, yet plausible, climate risk scenarios, and **operationally resilient** through disruption due to climate-related disasters.
The UK government has made little progress on 2022 planned policy work from the Greening Finance Roadmap. This includes delays on the UK Green Taxonomy consultation, on the update to the Green Finance Strategy, and decisions not to legislate on the Sustainability Disclosure Requirements (SDR).

However, some progress was made: the Department for Work and Pensions introduced new disclosure requirements for pension schemes, regulators have continued the roll-out of Task Force on Climate-related Financial Disclosures requirements, the Financial Conduct Authority published a consultation on SDR, and the Transition Plans Taskforce launched a consultation on a Disclosure Framework and Implementation Guidance intended to create a gold standard for transition plans.

The PRI has championed high ambition from policymakers. In October we published “A Legal Framework for Impact UK: Integrating sustainability goals across the investment industry”, setting out recommendations to better enable investors to work towards sustainability impact goals. The PRI also convened a joint letter calling on the UK government to uphold net zero ambition and implement green finance policy reforms despite changes in leadership.
Since the publication of a series of sustainable financial policies by the White House, including Executive Order 14030, signed by President Biden on May 20, 2021, there has been a surge of legislative and regulatory developments and initiatives in the US financial services industry this year.

For instance, the Securities and Exchange Commission (SEC) has released a series of sustainability related proposals that PRI supported, such as proposals that would enhance and standardize registrants’ climate-related disclosures for investors. The SEC also proposed adviser and fund disclosure as well as fund names requirements, whose main purpose is to reduce greenwashing. It is noteworthy that the Supreme Court rendered a decision on June 30, 2022, that could adversely impact climate-related proposals of US federal agencies.

Another major development is the Inflation Reduction Act’s adoption, enabling climate actions in various sectors and paving the way for a just and inclusive transition to net zero.

Moreover, the Department of Labor issued a new rule allowing private pension managers to consider ESG factors in their investment practices.
USA ESG Regulations

Nasdaq’s board diversity - In August 2021, they released new requirement criteria for companies to be listed on their exchanges. This was the diversity statistics at the board level for each company listing. Nasdaq also set minimum criteria for diversity and required reasoning from every company that did not meet the minimum criteria.

Reversal of Trump’s pecuniary factors - During the Trump Presidency, economic factors were considered more important than environmental factors. This meant that anybody who has authority over an investment or asset plan (such as a financial advisor or product owner) must focus on financial returns, and mitigate ESG information. However, Biden’s administration is attempting to reverse or change this ruling so that while financial returns are still a priority, ESG factors are also considered. Under the US Department of Labor, ESG will complement other disclosures since it does impact the level of risk for investments. At a Federal level, this is one of the only sustainability or ESG measures being implemented.
USA ESG Regulations

IFRS/SASB standards - The Sustainability Accounting Standards Board (SASB) in 2022, the organization integrated with IFRS Foundation to create the International Sustainability Standards Board. The board includes ESG disclosures that are relevant to financial performance in 77 different industries. The primary factor for this approach is to enable companies and businesses to effectively communicate with investors and stakeholders on both financial and ESG matters.

SEC’s climate-related disclosures - March 2022 the Securities and Exchange Commission (SEC) announced its proposal for sustainable disclosure regulations. This is similar to the recent EU SFDR, with the proposed rules including risk-management processes for climate-related risks (Determining any principal adverse impact (PAI)). Furthermore, the proposal requires the disclosure of GHG emissions from either side of the supply chain and certain reporting measures. As the SEC notes themselves, much of the compliance for those following the Taskforce on Nature-Related Disclosures will already be accepted.
Activity on climate change and sustainable finance policy in Australia increased significantly in 2022. The year started with the Senate disallowing controversial regulations introduced by the former Treasurer that would have hindered ESG proxy advice. The Federal Government’s approach to ESG issues shifted after the Labor party formed government in May. Shortly thereafter, Australia passed its first Climate Change Act legislating the Government’s emission reduction targets.

The new Treasurer is now focused on hosting investor roundtables to address social housing issues and the clean energy transition. The Minister for Financial Services has also signalled possibly introducing ESG legislation to address greenwashing. Meanwhile, Australian Securities & Investments Commission (ASIC) prioritised action on sustainable finance practices and released guidance for how funds can avoid greenwashing when promoting sustainability-related products. ASIC, Australian Prudential Regulation Authority (APRA), Treasury and the Reserve Bank of Australia (RBA) have also engaged in Australian Sustainable Finance Institute (ASFI) development of a sustainable finance taxonomy.

Through the Council for Financial Regulators, each of these organisations responded to ISSB’s consultation broadly supporting its draft disclosure standards. Finally, to close out the year, the Australian Treasury also released its consultation paper on climate-related financial disclosures.
The development of green finance policies and regulations on sustainable development have become more structured in China. Four main financial regulators issued a plan to improve green financial standards during the 14th FYP period, setting up a basis for ESG regulation plans including disclosure, evaluation and transition finance.

Following that, China established a standardized carbon emission accounting and statistics system and published a self-regulated framework on the green bond to unify domestic green bond regulation.

On the investor regulation and stewardship front, China Banking and Insurance Regulatory Commission (CBIRC) issued Green Finance Guidelines for Banking and Insurance Industry. China Securities Regulatory Commission (CSRC) also encouraged public fund companies to implement responsible investment and promote active ownership.

As for information disclosure, CSRC incorporated ESG information into the Investor Relations Management Guidelines, and State-owned Assets Supervision and Administration Commission of the State Council (SASAC) plans to promote ESG disclosure for all SOEs by 2023.

The Ministry of Finance (MOF) and CSRC sent responses to ISSB on the exposure drafts to reflect current barriers and concerns regarding the implementation in China.

Hong Kong SAR has also continued to make progress on sustainable investment regulation and addressing climate change. Hong Kong SFC published new agenda for Green and Sustainable Finance and the Hong Kong Monetary Authority (HKMA) plans to embed climate risk management in banking supervision processes.
JAPAN

PM Fumio Kishida’s policy priorities became clearer as the Grand Design and Action Plan for a New Form of Capitalism (June 2022) strengthened commitment on sustainable finance policies, particularly on impact investing through public policy.

The Cabinet-approved plans are both compatible with and inform sustainable finance policies led by the Financial Services Agency (FSA), the Ministry of Economy, Trade and Industry (METI) and other key ministries.

The FSA continued to lead on Japan’s sustainable finance policies through advice provided by the Expert Panel on Sustainable Finance, whose immediate priorities were outlined. The FSA published the Supervisory Guidance on Climate-related Risk Management and Client Engagement clarifying its position on climate-related risks for insurance companies and banks. The FSA also provided drafts and opened consultations regarding the IOSCO report-aligned The Code of Conduct for ESG Evaluation and Data Providers and revisions to the Cabinet Ordinance on Disclosure of Corporate Affairs to introduce mandatory sustainability reporting aligned with the IFRS Sustainability Disclosure Standards.

Meanwhile METI is progressing real economy policies to influence corporate action on sustainability issues, publishing Japan's Guidelines on Respecting Human Rights in Responsible Supply Chains and continuing its efforts to establish a climate transition finance ecosystem alongside the FSA and the Ministry of Environment (MOE).
Compliance vs Voluntary Carbon Credit Participants

Optional: Carbon credits from mandatory market can be sold to the voluntary market.

Mandatory market
- Purchase CO₂ (carbon credits)
- Sell CO₂ (carbon credits)
- Excess CO₂ emissions
- Reduced CO₂ emissions
- CO₂ cap

Voluntary market
- Purchase expected CO₂ reduction (carbon credits)
- CO₂ emissions you want to reduce
- Expected CO₂ emissions reduction by project
- Sell expected CO₂ reduction (carbon credits)
Are CCs Commodities or Idiosyncratic Assets? (like a bond, security or NFT)

Commodities

Bonds or Securities
Challenges in Developing and Bringing CC to Market

**Project design**
Project developers conduct feasibility studies, acquire assets and identify potential methodologies for quantifying emissions reductions and removals.

**Monitoring, reporting and verification (MRV)**
Validation and verification bodies monitor the project and verify that emissions reductions or removals have occurred.

**Transaction**
Project developer sells credits either through brokerages, exchanges or directly to buyer.

**Registration**
Project developers register the project under a crediting programme of a third-party standard (e.g. Verra, Gold Standard)

**Issuance**
The third-party standard issues credits to the project developers

**Retirement**
Buyers retire the credits, meaning they claim the tonnes reduced or removed and the credit can no longer be traded

Limited market access, including access to upfront capital

Lengthy process for developing new methodologies

Limited transparency around verification

Limited integration of technology in MRV processes

Mistrust of credit quality

Lack of efficient price discovery

Source: "Carbon Markets Initiative", Rocky Mountain Institute, RMI, n.d.
Early domination of the market in 2005 was the European Union Emissions Trading System (EU ETS), offset by China joining in 2021. The US and India have not yet joined. California state represents 8% of US emissions.
Carbon Pricing Falls Short

While the proliferation of carbon markets is undoubtedly good news, prices are by and large still too low to have a material climate impact. This is particularly true for sectors outside of power generation where switching to low-carbon alternatives remains an expensive proposition.

The World Bank estimates that a carbon price of $50-100 per metric ton of carbon dioxide is required by 2030 to meet the temperature goals of the Paris Accord.

https://about.bnef.com/blog/the-untapped-power-of-carbon-markets-in-five-charts/#:~:text=There%20are%20now%2030%20's%20compliance,of%20greenhouse%20gas%20emissions.
NGEO prices are down due to controversy in the market in 2022, as well as greater supply than demand in the voluntary market.

The EUA market remains relatively stable with demand volatility.

https://carboncredits.com/carbon-prices-today/
Growth Price of EU Carbon Permits vs Lumber Futures

The Lumber Market went “Timber”
1. Booms are unsustainable
2. A Paul Bunyan Federal Banker: higher Interest rates
3. New home builds are down

[Graph showing EU Carbon Permits and Lumber prices from January 2020 to January 2023]

https://tradingeconomics.com/commodity/carbon

Trading Economics Carbon Emissions Allowances Prices are sourced from the European Union Emissions Trading System (EU ETS), the world’s largest cap and trade greenhouse gas emissions market.

Lumber per thousand feet
Voluntary Market is Over Supplied

The voluntary carbon offset market, which was worth about $2 billion in 2021, will grow to $10-40 billion in value by 2030, transacting 0.5-1.5 billion tonnes of carbon dioxide equivalent, compared with 500 million tonnes currently, Shell said in the report co-authored by the Boston Consulting Group (BCG).

Increasing effective carbon prices could raise substantial revenues, while cutting emissions. Revenues from carbon pricing can play an important role during the net-zero transition where there will be substantial adjustment costs.

• The World Bank estimates that countries could be able to raise an amount equivalent to approximately 2.2% of GDP on average if they were to raise carbon prices to EUR 120 per tonne of CO2 – a mid-range estimate of carbon prices by 2030.

• The revenue potential from increasing effective carbon prices to the EUR 120 carbon benchmark differs substantially across countries. Some would raise revenues of less than 0.3% of GDP (Costa Rica, Denmark, Switzerland and Uganda), while others could raise revenues in excess of 5% of GDP (e.g. India, Kyrgyzstan and South Africa).
### Integrity Council Voluntary Carbon Markets (ICVCM) Requirements for the voluntary carbon markets Projects

#### Core Carbon Principles (CCPs) Label

| **Catalytic:** mobilizing finance towards mitigation, especially into developing countries, accelerating innovation and market uptake of emerging breakthroughs | **Local:** creating jobs and prosperity in local communities, delivering sustainable development of co-benefits, protecting and enhancing the livelihoods of marginalized groups, | **Empowering:** accelerating implementation of NDCs and Net-Zero commitments, paving the way for increased ambition, helping state and non-state actors go above and beyond. | **Additional:** channeling finance that would otherwise not be available into GHG removals and reductions that would otherwise not happen. | **Nature-positive:** protecting ecosystems, particularly forests and natural habitats, promoting nature-based climate solutions. |

[https://www.icvcm.org/](https://www.icvcm.org/)
Currently 80% of the VCM - Verified Carbon Standard

Status: Implemented
Administrative body: Verra
Year of implementation: 2005
Type of jurisdiction covered: Independent

Description:
The VCS Program was founded by several key carbon market actors:
- The Climate Group,
- the International Emissions Trading Association,
- the World Business Council for Sustainable Development,
- the World Economic Forum.

Its initial purpose was to certify and credit voluntary emission reduction projects. While the main use of VCUs is still predominantly for voluntary offsetting, over 17 million VCUs from VCS projects have been used for compliance under the Colombia carbon tax.

Credits and activities
Registered activities as of December 31, 2020: 1757
Credit name: Verified Carbon Units (VCUs)
Credits issued (MtCO2e) as of December 31, 2020: 835.327491
Credits retired or cancelled (MtCO2e) as of December 31, 2020: 251

Geographic coverage: Global
Countries with project: 72
Carbon pricing initiatives accepting issued credits for compliance
Colombia carbon tax, CORSIA, South Africa carbon tax

Sectors covered:
Agriculture, Energy efficiency, Forestry, Fuel switch, Fugitive emissions, Industrial gases, Manufacturing, Renewable energy, Transport, Waste
Attributes of the Blockchains - Distributed control

- Centralized
- Decentralized
- Distributed Ledgers

Public
Users are anonymous

Private
Users are not anonymous

https://mlsdev.com/blog/156-how-to-build-your-own-blockchain-architecture
Cryptography of the Blockchain

The content of a block is cryptographically protected (locked by a code) and visible only to users with the appropriate “key”.

- **Confidentiality.** The information cannot be understood by anyone for whom it was unintended.
- **Integrity.** The information cannot be altered in storage or transit between sender and intended receiver without the alteration being detected.
- **Non-repudiation.** The creator/sender of the information cannot deny at a later stage their intentions in the creation or transmission of the information.
- **Authentication.** The sender and receiver can confirm each other's identity and the origin/destination of the information.

https://www.globalpayments.com/en-ca/insights/2023/03/02/blockchain-technology-is-revolutionizing-payments
Attributes of the Blockchains - Publicity and security

- Traditional Endpoint Protection
- Transaction And Communication Infrastructure Security
- Preventing Distributed Denial of Service Attacks
- Protection from compromised nodes or server failure
- Identity Security
- Preventing Data Manipulation
- Security from malicious insiders

https://cri-lab.net/security-in-blockchain-applications
In a decentralized blockchain network, each participant can join the network. And each validator node (or miner) verifies the data or transaction. This process is handled through a "consensus mechanism" to achieve agreement that the data or transaction is valid. No central authority, like a government or bank, is needed to approve the transaction. The information within a block cannot be changed; it's recorded and becomes permanent as soon as it enters the ledger. That's what an "immutable ledger" is. If there's an error in the blockchain, another block must be added to reverse the error.
Attributes of the Blockchains – Use Cases

Use-Cases: blockchain in real life for carbon credits

- Regenerative Agriculture
- Satellite Remote Sensing Data
- Chainlink Network
- AIRS Hybrid Smart Contract
- Stewards of Regenerative Agriculture

AIRS contract uses satellite data to reward stewards of targeted regenerative agriculture who improve the planet’s climate

https://www.weforum.org/agenda/2021/06/blockchain-can-help-us-beat-climate-change-heres-how/
Blockchain Tokenization of Carbon Credits

Blockchains allow the coordination of large groups of disparate users. Blockchains can guarantee ownership.

- Blockchain is the enabler to facilitate secure, transparent, and efficient transactions for carbon credit trading, leading to increased trust and participation in carbon markets.
- Tokenization is a digital representation of real-world carbon credits on the blockchain.
- Tokenization allows for the creation of a standardized
Why Blockchain?

• **Speed.** Blockchain doesn't require a central authority—or gateway, acquiring bank, card association and issuing bank—to approve and authenticate a payment. Once the validator nodes reach consensus, the information is added to a block in real time.

• **Transparency.** Anyone with the proper credentials can view transactions anytime because they're recorded on an immutable distributed ledger. The entire history of the transaction is unchangeable and traceable.

• **Privacy and security.** Blockchains use public and private keys, which encrypt the data. With no personal information visible, blockchain systems keep data from becoming vulnerable to hackers.
Carbon Credit uses for Blockchain

Cross-border (or international) carbon credit exchange rely on more complex authentication processes because you transact with registries from different countries. And different countries have different centralized authorities operating in accordance with their own regulations. The method of authenticating a cross-border carbon credit registries can take days, weeks, months, years.

Blockchain simplifies this process. Using a decentralized network removes the need for multiple intermediaries to authenticate and process transactions. An exchange of carbon credits is authenticated in real time against data contained in a blockchain. This new transaction is added to a block that is then added to the chain for traceability. What took days...years to process now takes minutes.
Carbon Credit Quantification and Standardization Challenges

Carbon offsets are a unit of measure, certifying that a particular action, project, or thing has removed the same one metric tonne of CO2. One credit = one tonne. The math is simple, but applying it to the real world proves challenging.

**Measurement** – how do you measure how much CO2 a certain set of actions will remove, before it even does so? This can be especially complicated when you add in living organisms, such as trees, as is the case for most nature-based offsets.

**Verification** – even if you can measure things accurately, how do you verify that the set of actions did actually result in a measurable offset?

**Challenge** – Low buyer confidence in voluntary markets leading to decline in capital for Carbon capture projects.
Standardization Principles taken from ISO 14064-2

• Relevance Select the GHG sources, sinks, reservoirs, data, and methodologies appropriate to the needs of the intended user.
• Completeness Include all relevant GHG emissions and removals. Include all relevant information to support criteria and procedures.
• Consistency Enable meaningful comparisons in GHG-related information.
• Accuracy Reduce bias and uncertainties as far as is practical.
• Transparency Disclose sufficient and appropriate GHG-related information to allow intended users to make decisions with reasonable confidence.
• Conservativeness Use conservative assumptions, values, and procedures to ensure that net GHG emission reductions or removals are not overestimated.
Integrity Council – Voluntary Carbon Market (ICVCM) Principles

THE CORE CARBON PRINCIPLES
The CCPs set a global benchmark to ensure integrity in the voluntary carbon market.

GOVERNANCE
1. Effective governance
2. Tracking
3. Transparency
4. Robust independent third-party validation and verification

EMISSIONS IMPACT
5. Additionality
6. Permanence
7. Robust quantification of emission reductions and removals
8. No double counting

SUSTAINABLE DEVELOPMENT
9. Sustainable development benefits and safeguards
10. Contribution to net zero transition
Considerations in selecting a CC Blockchain


2. Standardization and access to underlying data about projects.

3. Risk of token being deemed a security by regulators.

4. Tokenized Carbon Offsets – the growing global market poses a unique challenge in verifying and offsets. Non-fungible tokens are by their very nature unique (Amazon NFT by Moss; Rimba Raya NFT).

Explaining Different Blockchain Technology

1. Proof of Work – Proof of work is a competitive process that uses publicly available transaction information to attempt to generate a hexadecimal number less than the network target for that mining period. Under PoW consensus, thousands of mining programs work on one block until the hash is solved, then move to the next block. E.g. Bitcoin (BTC) - Energy intensive

2. Proof of Stake – Proof-of-stake protocols are a class of consensus mechanisms for blockchains that work by selecting validators in proportion to their quantity of holdings in the associated cryptocurrency. Currently 70% of the staking controlled by 3 organizations. This could enable a large country or organization to organize a 51% attack by controlling the blockchain validation. E.g. Ethereum (ETH)

3. Proof of Spacetime (POST) - is a means of proving that a network participant has allocated available storage space to a network over a given time period to show financial interest in the network. E.g. CHIA (XCH)

https://ccaf.io/cbeci/index/comparisons
Country Ranking, Annual Electricity Consumption

1. Proof of Work – BTC - Energy intensive
2. Proof of Stake – Currently 70% of the staking controlled by 3 organizations.
3. Proof of Space and Time – Fully distributed

https://ccaf.io/cbeci/index/comparisons
Proof of Work

This is why POW takes so much energy to “win” the block.
Proof of Stake Drawbacks

- Lacks in terms of security when compared to proof-of-work and Proof-of-Space-and-Time.
- Validators with large holdings can influence the verification of transactions.
- Few of the PoS cryptos require locking up staked coins for a certain period of time.

Participants prove to the network that they are storing a certain amount of data through a process called farming. Proofs of space must be generated in a process called plotting.

Plotting is the proof of space generation phase, where a user creates a “plot file” that requires an upfront one-time use of computational resources, so that proofs can be quickly and easily verified later. The plotting process can’t be too easy or the protocol would completely devolve into proof of work, but the key is that it only has to be done once (instead of proof of work, where new hashes need to be found between every block or challenge).

For consensus, Farmers compete to create blocks when a proof of space is found that meets the challenge requirements. The higher amount of storage space a farmer has, or more plot files consuming more actual storage space, measured in bytes (e.g. terabytes, petabytes).

This storage “space” is equivalent to hashing power in the network, and the total space in the Chia network is referred to as Netspace.

Flow of Carbon Credit Trading

Digital MRV (UNFCCC, ISO or Independent Standard)

Program Level MRV
- Equipment
- Sensors
- Meters
- Satellite

Facility Level MRV

Digital Carbon Assets (Tokenization Engine)

Registries
(Independent Standards, Sovereign Registries, UNFCCC Registries) + WB registries

Centralized Database/optionally to National MRV System

verification of units

Services Layer
- Climate Action Data Trust
- Climate Warehouse Digital Ecosystem

Metadata Layer
- Compliance reporting
- Benchmarking
- Due diligence checks
- Certifications
- Conflict resolution
- Ratings
- Forecasting

Exchange A

Exchange X

Reporting for markets, UNFCCC

National Inventory

Digital work-flow
project preparation from document development, approval, validation to registration in applicable standards
Carbon Credit Opportunity Fund

• This new framework that will use new blockchain technologies is an innovative way for capital markets to fully engage in carbon credit trading in a transparent, secure, fair, and beneficial manner. “Paulo de Bolle, Senior Global Director, Financial Institutions Group, IFC.

• Cultivo provides data-driven technologies will identify nature-based projects that recurrently produce high-quality carbon credits.

• Aspiration will advise on the selection of carbon credits projects and Fund investments.

• As the Fund's carbon credits are tokenized, they will be tracked by the World Bank's Climate Warehouse, which was launched on Chia's public blockchain, as the foundational architecture to build market trust by enhancing transparency and securing the integrity of global carbon trading.

• "The Chia technology demonstrates the value of blockchain infrastructure for real-world financial markets instruments, only made possible through a sustainable, secure, and compliant public blockchain network." Gene Hoffman, Chia Network Chief Operating Officer.
Milestones – First tokenization

Carbon Opportunities Fund – Tokenization Trial

- IFC and Cultivo Identify Carbon Credit Project
- Purchase of Carbon Credits from Eco Registry – Columbia
- Tokenize Carbon Credits on Climate Action Data (CAD) Trust
- Sell Tokenized Carbon Credit on Chia Blockchain
- Retire Carbon Credits
The Future

- Implications of Global Risks and Trends on Future Underlying Assumptions
- Commodity or Security
- Global Policy
- Technology Innovation

Image: Vincent Callibaut