UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

Technical and statistical report

The Role of Voluntary Carbon Markets in Global Climate Action

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Abbreviations

A6.4 ER	Article 6.4 Emission Reduction
AIIB	Asian Infrastructure Investment Bank
AMC	Advanced Market Commitment
ASEAN	Association of Southeast Asian Nations
ACCU	Australia's Australian Carbon Credit Unit
CA	Corresponding Adjustment
CASI	Capacity-building Alliance of Sustainable Investment
CBAM	Carbon Border Adjustment Mechanism
CCER	China Certified Emission Reductions
CCPs	Core Carbon Principles
CDM	Clean Development Mechanism
CDR	Carbon Dioxide Removal
COP	Conference of the Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
DLT	Distributed Ledger Technology
ETS	Emissions Trading System
G20	Group of Twenty
GHG	Greenhouse Gas
HKGFA	Hong Kong Green Finance Association
ICAO	International Civil Aviation Organization
ICAP	International Carbon Action Partnership
ICE	Intercontinental Exchange
ICVCM	Integrity Council for the Voluntary Carbon Market
IETA	International Emissions Trading Association
IMO	International Maritime Organization
IOSCO	International Organization of Securities Commissions
IPCC	Intergovernmental Panel on Climate Change (IPCC)
ISSB	International Sustainability Standards Board
ITMO	Internationally Transferred Mitigation Outcome
LDC	Least Developed Country
MDB	Multilateral Development Bank
MOU	Memorandum of Understanding
MRV	Measurement, Reporting, and Verification
NDC	Nationally Determined Contribution
NGFS	Network for Greening the Financial System
OTC	Over the Counter
PACM	Paris Agreement Crediting Mechanism
RCEP	Regional Comprehensive Economic Partnership
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SBTi	Science Based Targets initiative
SME	Small and Medium-sized Enterprise
tCO_2e	Tons of carbon dioxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market
VCMI	Voluntary Carbon Markets Integrity Initiative

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Executive summary

This study reviews the current state of voluntary carbon markets (VCMs) globally, with particular reference to those in developing countries. Based on a stock-taking analysis, it identifies key barriers to VCM development and explores pathways for enhancing quality and interoperability across markets.

The study identifies the following key challenges facing VCM development:

1. A lack of clear policy signals from governments and limited guidance from international organizations regarding the role of carbon credits as a tool for facilitating sustainable finance and achieving global climate goals;

2. Heightened integrity concerns, reflecting issues related to standard setting, verification practices, double counting, and transparency, which reinforce perceptions of greenwashing;

3. Insufficient consideration given to the interoperability of standards and market connectivity, due in part, to the rapid development and fragmentation of crediting schemes;

4. The disjuncture between most VCMs and compliance emission control regimes, which holds back the growth of both VCMs and compliance markets;

5. Policy ambiguity regarding cross-border transactions of carbon credits; and

6. The high costs associated with the development, measurement, reporting, verification (MRV), and registration of carbon credits that limit the benefits to communities hosting carbon projects in developing countries.

This study proposes several options to address these challenges and enhance the quality, scale, interoperability, and interconnectivity of VCMs. These include: 1) providing policy clarity on the role of VCMs within national and international carbon pricing mechanisms, with international organizations playing a supporting role through technical assistance and global coordination; 2) creating demand for carbon credits by leveraging offset mechanisms that link VCMs with compliance markets or carbon taxes, consistent with Article 6.2 and 6.4 of the Paris Agreement; 3) enhancing the quality and integrity of carbon credits by promoting the adoption of Core-Carbon-Principles by the Integrity Council for the Voluntary Carbon Market (ICVCM); 4) promoting interoperability among VCMs through the establishment of cooperation mechanisms; 5) adopting technological solutions to improve the distribution of benefits to communities in developing economies and moving to an impact based approach beyond CO2 offsetting; 6) developing operational rules for cross-border transactions; and 7) enhancing capacity building for VCM regulators and key participants in developing countries.

Introduction

Recent estimates indicate that approximately US$7.4 trillion in climate-related investment is required annually to meet net-zero targets by 2030. Yet only about US$1.5 trillion is being mobilized each year.[1] G20 members collectively contribute around 75 per cent of current global climate finance and emit approximately 80 per cent of global greenhouse gases (GHG), which invites them to lead efforts in scaling and standardizing the use of carbon markets as tools to mobilize finance for climate actions.

Voluntary carbon markets (VCMs) provide a mechanism for incentivizing and channelling capital into projects aimed at emissions reduction, avoidance or compensation. For developing countries, VCMs can serve as an essential mechanism for mobilizing private finance aligned with national climate and development goals – particularly where concessional or public climate finance is insufficient.[2] In contrast to most compliance carbon markets, they channel investment capital across borders, as most VCM credits are issued for projects in developing countries and sold to buyers in developed countries (primarily European countries and the United States).

Despite increasing interest in carbon credit markets, the lack of globally coordinated standards and practices for VCMs has led to discrepancies in credit quality, pricing, and market trust. In turn, this has undermined the potential for VCM growth.

> Voluntary carbon markets channel private capital to projects that cut, avoid, or offset emissions

[1] Climate Policy Initiative. Global Landscape of Climate Finance 2024: Insights for COP29: https://www.climatepolicyinitiative.org/wp-content/uploads/2024/10/Global-Landscape-of-Climate-Finance-2024.pdf

[2] UNCTAD (2023). *World investment Report: Investing in Sustainable Energy for All.* United Nations: New York and Geneva.

However, recent developments present opportunities for all parties to benefit from greater collaboration around carbon markets. Notably, the agreement at COP29 on cooperative approaches under Article 6 of the Paris Agreement and revised country assessments of their Nationally Determined Contributions (NDCs). Many initiatives, such as the COP, have highlighted the necessity to ensure harmonization and collaboration on VCMs, and this can be further supported by the G20 and the strengthening of global coordination mechanisms.

Based on a stock-taking of the current landscape of VCMs globally, with particular attention given to those in developing countries, this study identifies barriers to scaling up the market. These include, among others: (i) the lack of clear policy signals and regulatory alignment at the international and national levels; (ii) heightened greenwashing risks resulting in a lack of investor confidence and demand for credits; (iii) lack of pricing transparency and data availability; (iv) limited integration between voluntary and compliance markets; (v) policy uncertainty around cross-border transactions and Article 6 implementation; and (vi) excessively high costs of developing, verifying, and registering carbon credits, and financial integrity.

Most of these challenges are common to all VCMs rather than country specific. To avoid duplication and minimize coordination costs, the G20 and other relevant international coordination bodies can take the lead in developing solutions. These could include, but are not limited to: clarifying the role of VCMs in decarbonization efforts; advising countries on creating offset linkages between compliance markets/carbon taxes and VCMs; creating or aligning with a global VCM standard, using clear labelling and benchmarking, including for the co-benefits of credits; clarifying the scenarios for the use of corresponding adjustments[3] for cross-border transactions; developing international data sharing mechanisms; supporting market interoperability through the development of frameworks and registries using a standardized common data model; and providing capacity-building to developing countries on VCM development. These seven suggestions are further elaborated in the final section of this study for consideration by the G20 and other international bodies.

[3] Corresponding adjustments aim to prevent the double counting of carbon emissions: when a mitigation outcome is transferred internationally, this mitigation outcome cannot be counted by the Party that agreed to transfer it towards their climate commitments.

1

The current landscape for voluntary carbon markets

Carbon pricing is vital for achieving a net zero global economy and truly reflecting the environmental and social costs of emissions. Complementary to compliance markets and taxes in the carbon pricing toolbox, VCMs serve as mechanisms through which projects with climate benefits can generate carbon credits and attract private capital participation. While carbon markets can provide climate finance in addition to traditional financing sources, VCMs can help deliver broader sustainable development aims, such as strengthening climate resilience and other co-benefits such as job creation and poverty alleviation.

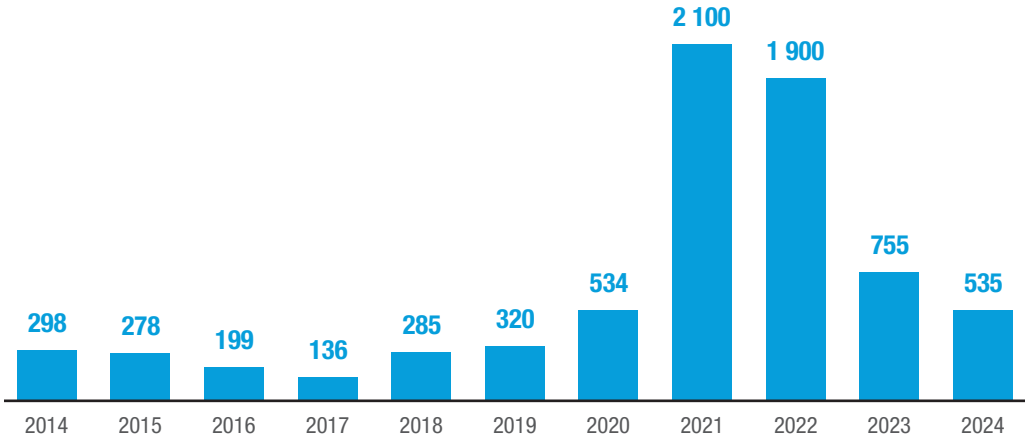
To meaningfully contribute to the green transition and net zero targets and become a significant source of climate finance, VCMs need to be scaled up, with a shift toward high-quality removals alongside continued support for emissions reduction. For example, the net zero scenario developed by the Network for Greening the Financial System (NGFS), which is consistent with an emissions pathway that limits global warming to 1.5° Celsius, indicates that global demand for carbon credits would need to increase by a factor of 15 by 2030. This corresponds to a market value of US$50 billion under a higher carbon price regime.[4] Research by Morgan Stanley estimated that the market size for VCMs could reach US$250 billion by 2050.[5]

> VCMs support sustainable development by boosting climate resilience and creating jobs and other co-benefits

[4] McKinsey (2021). A blueprint for scaling voluntary carbon markets to meet the climate challenge. https://www.mckinsey.com/capabilities/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge

[5] Morgan Stanley (2023). Where the Carbon Offset Market is Poised to Surge. https://www.morganstanley.com/ideas/carbon-offset-market-growth

Figure 1.1.
VCM market size by value of traded carbon credits, 2014 to 2024
(Millions of dollars)



Source: EcoSystem Marketplace, MSCI, 2024.

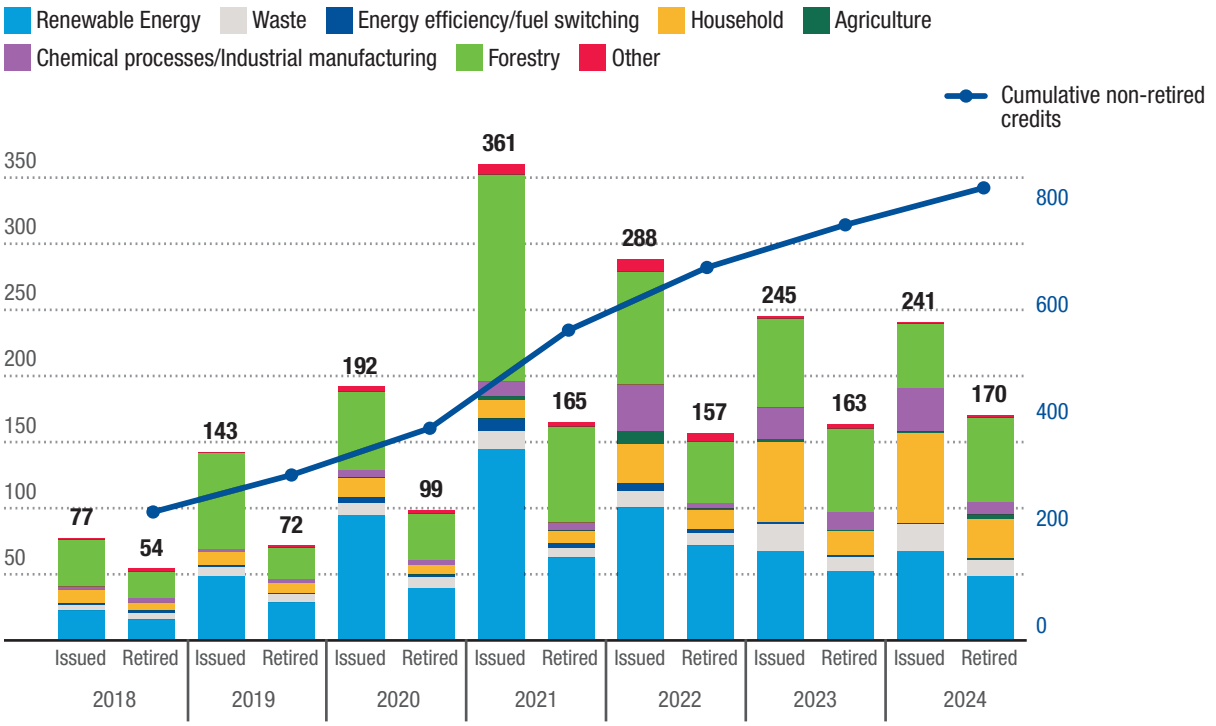
A large surplus of unretired credits, like 2024's 71 Mt, depresses prices and undermines integrity

However, despite a surge in VCMs in 2021 and 2022, their value has faced volatility, with a significant decline in 2023 and 2024, reflecting shifting concerns about credit integrity and quality (figure 1.1). VCM credits are not fungible, and despite being denominated in units of tons of CO_2 equivalent (tCO_2e) they are differentiated by type, deriving from underlying 'assets' whose quality determines the value, and hence price, of the credit. Corporate buyers remain cautious, particularly in REDD+[6] and renewable energy projects, due to concerns over whether projects provide additionality, whether they are permanent, and any consequent reputational risks. Meanwhile, a persistent surplus of issued but unretired credits, such as the 71 million tons of carbon dioxide equivalent (tCO_2e) surplus in 2024, continues to weaken prices and challenge market integrity (figure 1.2). These features highlight the need for robust verification standards, crediting harmonization, and to explore enhanced linkages between voluntary and compliance markets. Such measures are essential for boosting confidence and demand, and for positioning VCMs as a key tool for climate finance and decarbonization efforts.

[6] Reducing Emissions from Deforestation and forest Degradation

Figure 1.2.
Issuances and retirements of carbon credits by project category in independent crediting mechanisms 2018–2024

Credits issued and retired (r/h axis), and cumulative non-retired credits (l/h axis)
(Volume in million tCO_2e)



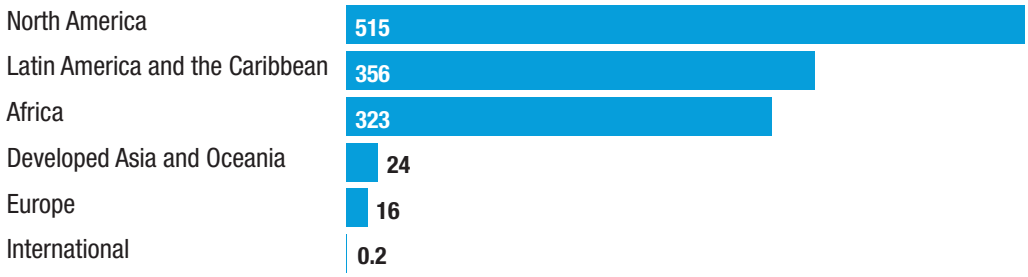
Source: UNCTAD based on Climate Focus and the following crediting mechanisms: American Carbon Registry, Climate Action Reserve, Gold Standard, and Verified Carbon Standard.

Developing economies play a pivotal role in VCMs as the source of most carbon reduction projects and credit issuance. Countries in Asia lead global credit issuance, with other countries such as Brazil, Peru, and Rwanda ranking among the top ten issuers, in 2024 (figure 1.3). As more developing economies implement policy measures to strengthen carbon crediting frameworks, their market share is set to expand, further positioning them as drivers of global climate finance and emissions reduction.[7] At the same time, it is important that policy frameworks around carbon crediting are also aligned with broader sustainable development goals.

Asia leads global credit issuance, with Brazil, Peru and Rwanda also among 2024's top issuers

[7] UNCTAD *World Investment Report 2025* https://unctad.org/publication/world-investment-report-2025

Figure 1.3.
Developing regions account for 75 per cent of VCM credit volume
Volume of credit traded in VCMs, 2004-2024
(millions of credits)



Source: Berkeley Carbon Trading Project's Voluntary Registry Offsets Database based on: American Carbon Registry (ACR), Climate Action Reserve (CAR), Gold Standard, and Verra (VCS).

VCMs operate in a fragmented landscape of overlapping, inconsistent private and government frameworks

The recent expansion of some VCMs has been driven by a range of use cases for carbon credits, including corporate voluntary purchases, linkages with compliance markets, linkages with international offsetting initiatives, and governments seeking to meet their NDCs. These diverse channels of demand are shaping the evolution of VCMs and influencing both the volume and quality of credit transactions. Currently, VCMs in different jurisdictions operate under a fragmented landscape involving many overlapping but inconsistent frameworks comprising both private and government-driven mechanisms. Three parallel carbon market structures now exist:

1. Independent mechanisms managed by specialized non-governmental organizations, such as Verra, the Gold Standard, American Carbon Registry, and Climate Action Reserve;
2. National mechanisms led by governments such as Australia's Australian Carbon Credit Unit (ACCU) market, China's CCER, Japan's J-Credit, and various REDD+ initiatives; and
3. International mechanisms, such as the Clean Development Mechanism and the Paris Agreement Crediting Mechanism (PACM)

As businesses seek to offset their residual emissions and meet climate-related commitments, corporate voluntary purchases remain the dominant source of demand.[8] However, offsetting can be biased towards over-crediting with wide ranging credit types of varying quality and credibility.[9] This issue cannot be resolved by standardisation alone but also requires fundamental reforms to market incentives, the adoption of high-transparency technologies for verification, and a shift toward larger-scale (jurisdictional) crediting. While corporates should prioritise emissions reductions based on science-based GHG reduction targets,[10] many corporations, especially those in hard-to-abate sectors such as aviation, shipping, and heavy industry, include voluntary carbon credits that target emission reductions, removal or sequestration in their green transition strategies.

[8] World Bank. *State and Trends of Carbon Pricing 2024.* https://openknowledge.worldbank.org/server/api/core/bitstreams/253e6cdd-9631-4db2-8cc5-1d013956de15/content

[9] Haya et al., (2023). Quality Assessment of REDD+ Carbon Credit Projects https://gspp.berkeley.edu/assets/uploads/page/Quality-Assessment-of-REDD+-Carbon-Crediting.pdf

[10] The Science Based Targets Initiative (SBTi) reports that, as of January 2025, over 10,000 businesses have committed to setting science-based GHG reduction targets. *Science Based Targets (2025): Target Dashboard.* https://sciencebasedtargets.org/target-dashboard

Integrating carbon credits into compliance markets, where a limited percentage of high-quality offsets are allowed for regulatory compliance, can play a role in driving the expansion of VCMs. This linkage provides an additional channel of demand, increasing liquidity and price stability while reinforcing the credibility of voluntary credits by adhering to compliance-grade requirements. Several national Emissions Trading Systems (ETSs) allow limited credit use as a compliance option (table 1.1). For example, the Republic of Korea's ETS permits eligible international offsets, while China's national ETS is piloting the reintroduction of China Certified Emission Reductions (CCERs) for compliance. In Singapore, the carbon tax regime is linked to international high-quality carbon credits. In Latin America, Colombia also allows companies to use voluntary credits to offset carbon tax obligations.[11] Moreover, the linkages between legally governed compliance schemes and VCMs, driven by private standards, can act as a stepping-stone for broader market integration, where voluntary credits that meet high integrity standards could gain recognition in emerging compliance markets or future international trading under Article 6 of the Paris Agreement. At the same time, several jurisdictions, such as the EU ETS, do not currently allow voluntary carbon credits to be used for regulatory compliance. [12]

Allowing limited high-quality offsets in compliance markets can help expand voluntary carbon markets

Table 1.1.
Examples of use of offsets in compliance carbon markets[13]

No offset allowed	Domestic offset allowed	International offset allowed
EU ETS	Australia National ETS	Korea ETS
German National ETS	China National ETS	California Cap-and-trade System
New Zealand ETS	British Columbia Output-Based System	Kyoto Cap-and-trade System
Switzerland ETS	Kazakhstan ETS	Singapore Carbon Tax Regime
UK ETS	Mexican ETS	
	Regional Greenhouse Gas Initiative	
	Québec Cap-and-Trade System	
	Colombia Carbon Tax (in development)	

Source: UNCTAD based on ICAP.

Note: Domestic offsets include, for example, national reforestation or methane reduction projects. International offsets include through the CDM or Article 6 of the Paris Agreement.

[11] Clear Blue Markets (2025). https://www.clearbluemarkets.com/knowledge-base/colombian-government-proposes-changes-to-carbon-tax-mechanism

[12] See regulation .-2021/1119 ('European Climate Law')

[13] International Carbon Action Partnership (2023). *Offset Use Across Emissions Trading Systems.* https://icapcarbonaction.com/system/files/document/ICAP%20offsets%20paper_vfin.pdf

At the international level, several sector-specific mechanisms further drive demand for voluntary carbon credits. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), implemented by the International Civil Aviation Organization (ICAO), requires airlines to offset emissions exceeding 2019 levels by purchasing eligible carbon credits.[14] This initiative has generated substantial demand for high-integrity credits, particularly from nature-based solutions and carbon removal projects. The International Maritime Organization (IMO) is exploring market-based mechanisms in the maritime sector, including a potential carbon pricing system for shipping emissions.[15] If implemented, such a framework could establish a structured demand for carbon credits like CORSIA.

There is further convergence between voluntary and compliance markets as voluntary standards frameworks adopt safeguards (corresponding adjustments, host country authorization) aligning credits with Article 6 of the Paris Agreement. Under the Paris Agreement, Article 6.2 enables countries to trade Internationally Transferred Mitigation Outcomes (ITMOs) through bilateral or multilateral agreements, in pursuit of their NDC targets as long as a corresponding adjustment is made to ensure it is not counted twice. Under this mechanism, there is a risk that countries might water down the ambition of their NDCs in favour of trading credits, requiring further international coordination to avoid this scenario. As of February 2025, more than 59 countries have signed 97 bilateral agreements under Article 6.2, although these agreements vary in structure, scope, and environmental integrity requirements.[16]

As of February 2025, more than 59 countries have signed 97 bilateral agreements under Article 6.2

Meanwhile, Article 6.4 establishes a centralized crediting mechanism to replace the Clean Development Mechanism (CDM), which may further enhance demand for voluntary credits by creating a standardized framework for international carbon trading.[17] Although the general rules have been adopted, the operationalization of Article 6.4 is still under development, meaning its eventual integration with existing government-led and voluntary programs remains uncertain. In future, integration between Article 6 mechanisms and VCMs will likely hinge on clarifying the rules regarding the use of corresponding adjustments, especially on the relationship between cross-border transactions for voluntary claims and those affecting host countries' NDCs. The clarity of rules on double counting and the potential eligibility of voluntary credits for Article 6-compliant transactions will be crucial in shaping both corporate and government procurement strategies.

A collaborative approach that makes better use of VCMs has substantial economic and mitigation potential. According to studies by the International Emissions Trading Association (IETA), implementing Article 6 could generate up to US$1 trillion in international financial flows towards emissions reduction and removal activities per year by 2050.[18] The role of international organizations is critical to provide the coordination mechanisms and the necessary policy, institutional, and market infrastructure to enhance the transparency, integrity, and scalability of VCMs.

[14] https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet-corsia/
[15] https://www.imo.org/en/mediacentre/meetingsummaries/pages/mepc-83rd-session.aspx
[16] United Nation Environmental Programme (2025). Article 6 Pipeline. unepccc.org/article-6-pipeline
[17] https://unfccc.int/process-and-meetings/the-paris-agreement/paris-agreement-crediting-mechanism/CDM_transition#tab_home
[18] IETA. Modelling the economic benefits of Article 6. https://www.ieta.org/initiatives/modelling-the-economic-benefits-of-article-6/#:~:text=The%20potential%20benefits%20to%20cooperation,5%20GtCO2/year%20in%202030

2

Challenges facing voluntary carbon markets

The current lack of comparability, interoperability, and consistency among VCM standards and practices has led to investor concerns about integrity risks. It has also hindered cross-border trading and limited overall market scalability. The absence of standardized approaches to credit issuance, certification, and trading infrastructure results in higher transaction costs, reducing market efficiency and discouraging buyer and seller participation. Incompatible registries and trading platforms further exacerbate these inefficiencies by making it difficult to track and verify credits, increasing the risk of double counting and undermining market credibility. The fragmentation of standards and systems also presents obstacles to innovation in market infrastructure. Without a harmonized framework, new technologies and trading platforms struggle to achieve economies of scale, particularly in smaller, less liquid markets.

2.1 Lack of clear policy signals and regulatory alignment

Recognizing the potential of VCMs as a vital mechanism to channel climate finance to developing economies, the UN was tasked at COP29 with operationalizing a supervised crediting mechanism, and its relationship with VCMs, under Article 6.4

A clear discussion of the roles of host and home countries is critical to understanding the broader development implications of VCMs

of the Paris Agreement.[19] However, various international organizations, initiatives and national authorities have issued conflicting signals about their expectations for VCMs. These include discouraging the use of carbon credits for corporate emission reduction targets or to offset regulatory obligations, as well as bans or taxes on cross-border carbon credit transactions. While many of these policy signals and measures stem from legitimate concerns regarding the quality, transparency, and accountability of current VCM practices, they also reflect differing perspectives between host countries: host countries may prioritize retaining mitigation outcomes to meet their own NDCs or capture domestic development benefits, and home countries or multinational corporations seek flexibility in using VCMs to achieve corporate climate commitments.

A clear discussion of the roles of host and home countries is critical to understanding the broader development implications of VCMs. Host countries, particularly developing countries and LDCs, may view VCMs as an opportunity to attract climate finance, technology transfer, and capacity building. At the same time, they face challenges, such as ensuring real emission reductions and meaningful benefits for local communities. Home countries and corporate buyers should take these wider development impacts into consideration to ensure the credibility of their offsets when meeting their voluntary climate goals.

Transparency concerns also extend to pricing and to the integrity of carbon credit issuance itself

2.2 Integrity concerns and confidence in the market

Recent stories about the integrity of carbon credits have sparked public criticism of VCMs. They have also cast doubt over the transparency of corporate claims of using carbon credits as offsets in their decarbonization strategies.[20]

Transparency concerns also extend to pricing and to the integrity of carbon credit issuance itself. Controversies, such as the exposure of "phantom credits" where claimed emission reductions were not fully realized, have heightened scrutiny over the reliability of carbon credit data.[21] The lack of robust tracking mechanisms across the full lifecycle of carbon credits has led to concerns about double counting and the misallocation of carbon credits.[22] This further undermines confidence in the market and has led to corporations scaling back carbon credit purchases due to reputational risks and even the threat of litigation.

There is therefore a clear need for additional scrutiny for assessing risks related to additionality, double counting, and permanence:

- *Additionality.* Weak verification mechanisms and loose standards have led to the issuance of credits for projects that may not represent genuine emission reductions. Assessing additionality usually involves modelling based on assumptions about what would have occurred in the absence of a project. However, this baseline is difficult to verify, and it varies across different cases.
- *Double counting.* The absence of harmonized registries and data tracking mechanisms, particularly in cross-border transactions, risks credits being claimed by multiple entities.
- *Permanence*. The durability of emission reductions is an issue, as nature-based solutions like reforestation are vulnerable to reversal risks from wildfires, deforestation, or climate-related events.

Two notable examples illustrate these integrity risks. A study published in *Science* by West et al. (2023) evaluated 27 voluntary REDD+ projects across six countries and found that only 7 per cent of the expected

[19] https://icvcm.org/article-6-of-the-paris-agreement-and-the-integrity-councils-work/
[20] ScienceNews (2025) https://www.sciencenews.org/article/carbon-credits-climate-change-emissions
[21] Financial Times (2024) https://www.ft.com/content/93938a1b-dc36-4ea6-9308-170189be0cb0
[22] Gold Standard (2023) https://www.goldstandard.org/publications/our-new-double-counting-guidelines

forest carbon offsets were associated with actual emission reductions, indicating that the environmental integrity of the carbon credits issued by most projects under the study was questionable.[23] Another meta-analysis published in *Nature Communications* by Probs et al. (2024) reviewed 65 studies covering 2,346 carbon crediting projects, which estimated that over 80 per cent of issued carbon credits had a lower climate impact than claimed, with only 16 per cent likely to report their climate impact accurately.[24]

2.3 Lack of pricing transparency and data availability

A persistent challenge in VCMs is the lack of pricing transparency and data availability. Carbon credit prices vary widely and can be highly volatile depending on project type, location, and verification standard, with prices ranging from less than US$1 to US$167 per ton of CO_2e for older/conventional credits.[25] In contrast, high-durability carbon dioxide removal (CDR) credits, which include direct air capture technologies or enhanced weathering are more expensive and can range from US$100 to US$600 per ton of CO_2e.[26] In part, this reflects the differences in credit quality but also a degree of inconsistency in market valuations. Complicating the situation further, many transactions take place over the counter (OTC) with undisclosed pricing. This can limit price discovery and undermine market confidence. While exchange platforms like Xpansiv CBL, AirCarbon Exchange, and CME Group provide some market prices, most deals remain private. The absence of standard benchmarks or price discovery mechanisms makes it difficult for investors and corporate buyers to assess fair market value, reducing market efficiency and predictability.

Establishing standardized data-sharing frameworks and improving registry transparency will be essential for strengthening market credibility. Cross-border collaboration on data integrity measures, similar to the EU-Switzerland linkage model, could provide a foundation for more interoperable voluntary carbon markets while allowing for jurisdictional flexibility. However, at present, no such mechanism exists on a global scale. Proposals for a common carbon data model could help resolve this problem.

2.4 Fragmented market structures including limited integration between voluntary and compliance mechanisms

The fragmented nature of VCM market structures, including independent mechanisms, national and international initiatives, hold back the scaling of the market. Standards for the various mechanisms/initiatives are designed and governed by independent boards without sufficient consideration for market interoperability. This has led to variations and inconsistencies in credit generation, monitoring, certification, and other key attributes of carbon credits.

A further critical factor in scaling VCMs is their integration with compliance-based carbon pricing mechanisms, such as emission trading systems and carbon taxes. While some jurisdictions, such as China, Colombia, Republic of Korea, and Singapore, have allowed the use of carbon credits to offset a portion of compliance market obligations or carbon

> High-durability CDR credits, like direct air capture, cost $100–$600 per ton of CO_2e

[23] Thales A. P. West et al. Action needed to make carbon offsets from forest conservation work for climate change mitigation. Science 381,873-877(202 3). DOI:10.1126/science.ade3535

[24] Probst, B.S., Toetzke, M., Kontoleon, A. et al. Systematic assessment of the achieved emission reductions of carbon crediting projects. *Nat Commun* 15, 9562 (2024). https://doi.org/10.1038/s41467-024-53645-z

[25] World Bank (2025) https://carbonpricingdashboard.worldbank.org/compliance/price

[26] Carbon Credits (2024) carboncredits.com

tax liabilities, such linkages between VCMs and compliance carbon pricing mechanisms remain rare. Expanding the use of compliance markets remains the most effective way to achieve real emissions reductions. However, facilitating the greater use of credible voluntary credits helps expand both compliance markets and voluntary credit use, as well as strengthening credit quality.

Without clear regulatory pathways to bridge voluntary and compliance pricing mechanisms, demand for voluntary carbon credits will likely remain constrained, especially in developing countries where voluntary corporate purchases of carbon credits are very limited as only a small number of companies have made net zero commitments. -

2.5 Uncertainty around cross-border transactions and Article 6 implementation

Unclear regulations and inconsistent policies create uncertainty, hindering cross-border voluntary carbon market growth

The uncertainty surrounding cross-border carbon credit transactions, stemming from unclear regulatory frameworks, inconsistent national policies and ambiguous interpretation of international rules, is another barrier to the growth of VCMs. One key challenge concerns the different interpretations and implementation of Article 6 of the Paris Agreement, governing international carbon trading through two key approaches. Article 6.2 enables bilateral or multilateral transfers of mitigation outcomes (so-called "Internationally Transferred Mitigation Outcomes" or ITMOs) between countries, subject to corresponding adjustments to avoid double counting.[27] Article 6.4 establishes a centralized crediting mechanism under UNFCCC oversight. Under Article 6.4, certified Emission Reductions (A6.4 ERs) can also be used for the host country NDC or for other international mitigation purposes and can be transferred or used internationally.[28]

As countries revisit their NDCs, some are exploring the use of VCMs to help achieve these goals. This creates uncertainty around how such credits should be accounted for internationally, and requires the use of corresponding adjustments to avoid double counting. Without clear rules and alignment between voluntary and compliance frameworks, market actors face barriers to engaging in cross-border transactions.

From the perspective of international buyers, a critical issue is whether host countries will permit the export of voluntary credits with or without corresponding adjustments. Some governments are considering restrictions or levies on cross-border transactions to retain mitigation outcomes that contribute to their own national climate targets and take account of historical "suppressed demand".[29] It is understandable that developing countries would seek to retain the right to apply mitigation outcomes toward their own national targets. Such policies could limit capital flows to voluntary carbon projects, particularly in developing countries.

Regional carbon market integration under Article 6 presents a possible pathway forward. By aligning NDCs within regional trading blocs, such as the Regional Comprehensive Economic Partnership (RCEP) that involves 15 member states in the Asia Pacific region, countries can facilitate cross-border transactions of ITMOs under Article 6.2 and transferrable A6.4ERs under Article 6.4. Such regional cooperation could promote market stability, reduce transaction uncertainty, and serve as a steppingstone toward greater alignment and integration of carbon markets globally.

[27] https://unfccc.int/sites/default/files/resource/Article_6.2_Reference_Manual.pdf
[28] https://unfccc.int/process-and-meetings/the-paris-agreement/article-6/article-64-pacm/registry
[29] See A6.4-SBM014-A05 https://unfccc.int/sites/default/files/resource/A6.4-SBM014-A05.pdf

2.6 Barriers to participation and financial integrity of the market

The cost of developing, verifying, and registering carbon credits is often prohibitively high, particularly for project developers in developing countries. These expenses often include complex monitoring and validation procedures, as well as third-party certification fees, which can be a significant burden for smaller entities such as local communities, farmers, and small-scale renewable energy developers. The lack of accessible financing mechanisms exacerbates these challenges, particularly in developing countries where support structures and financing options are often limited, restricting the participation of under-resourced stakeholders and reducing the diversity of projects entering the market.

Additionally, the absence of standardized risk-mitigation tools, such as insurance for carbon project underperformance, and the lack of hedging mechanisms further discourage smaller actors from participating, reinforcing the dominance of well-capitalized players. In addition to the high upfront costs, structural weaknesses in financial market infrastructure present a growing barrier to participation and trust in VCMs. IOSCO has drawn attention to the absence of standardized financial safeguards, including reliable systems for custody (secure ownership), trading, and settlement of carbon credits. This absence limits market confidence.[30]

> High development, verification, and registration costs often limit carbon credit projects in developing countries

[30] IOSCO (2024) https://www.iosco.org/library/pubdocs/pdf/IOSCOPD774.pdf

3

Recent efforts to improve the integrity and interconnectivity of VCMs

Effective carbon markets require a common foundation, where carbon credits are consistently defined, quality standards are harmonized, and transaction tracking ensures transparency over additionality, double counting and permanence. In response to the challenges facing VCMs, several international organizations and networks and industry-led initiatives have made efforts to improve market integrity, enhance price stability, standardize disclosure, and facilitate cross-border credit recognition. These initiatives aim to build confidence in VCMs and solidify their role in financing climate mitigation efforts.

3.1 Enhancing and harmonizing standards for VCM integrity

Ensuring the environmental integrity of carbon credits and preventing greenwashing are key to increasing investor confidence. Several initiatives have been introduced to establish high-integrity standards and promote international usage of such standards (table 3.1).

Table 3.1.
Credit integrity initiatives

Initiative	Objective	Key Features	Progress
Integrity Council for the Voluntary Carbon Market (ICVCM)	Establish global quality benchmarks for carbon credits	Core Carbon Principles (CCP) defining programme and project category level criteria	Assessment framework launched in 2023; vetting of crediting programs underway
Voluntary Carbon Markets Integrity Initiative (VCMI)	Provide guidelines for corporate use of offsets	VCMI Claims Code of Practice setting criteria for companies making carbon neutrality claims	Guidelines published in 2023; adoption by corporates growing
Science-Based Targets initiative (SBTi)	Define a framework and a set of criteria to ensure offsets and emission targets are credible, science-based and consistent with net-zero pathways.	Limits on offset use for near-term reduction targets; recognition of beyond-value-chain mitigation, but not counting towards company net zero targets.	10,000+ companies committed; potential updates under discussion
Carbon credit rating agencies (e.g., BeZero, Sylvera, CCQI)	Enhance transparency in credit quality assessment	Independent risk and quality assessments of carbon projects	Reports gaining traction among buyers & investors

Source: UNCTAD based on publicly available information.

The most prominent initiatives include the Integrity Council for the Voluntary Carbon Market (ICVCM) and the Voluntary Carbon Markets Integrity Initiative (VCMI). ICVCM has developed the Core Carbon Principles (CCPs) and frameworks for assessing the integrity of VCM standards and processes to ensure a high-quality supply of CCP "labelled", high-integrity carbon credits.[31] At the same time, VCMI has provided guidelines on the corporate use of carbon credits to ensure a credible demand for them.[32] Since 2024, ICVCM's CCPs have been adopted by private-sector led crediting programs (such as Verra Carbon Standard and Gold Standard), and its assessment framework has been used to endorse methodologies under these CCP-aligned programs.[33] Several governments also refer to, or aim to align their national frameworks with, the CCPs to ensure the quality and integrity of carbon credits.

Despite early success of ICVCM in enhancing quality and driving interoperability among private-led programs, global harmonization of VCM standards remains elusive, especially when it comes to discussion with government-led crediting programs and international programs, as the latter sometimes do not see the NGO-led CCPs as "official". In contrast, established international organizations have not launched any CCP-like standard-setting initiative. One solution could be for the G20 or other international coordination bodies to endorse the CCPs, promote their adoption by government-led programs, and integrate the CCPs into international programs.

[31] See ICVCM: https://icvcm.org/core-carbon-principles/
[32] See ICVCM: https://vcmintegrity.org/new-vcmi-guidance-opens-door-for-corporate-carbon-credit-claims/
[33] See: ICVCM: https://icvcm.org/integrity-council-announces-first-high-integrity-ccp-labelled-carbon-credits-as-assessments-continue/

3.2 Improving price stability, market functionality and financial credibility

VCMs remain fragmented, with inconsistent prices across standards and trading platforms despite new benchmarks

VCMs have experienced significant price volatility and while the market still lacks a widely accepted pricing benchmark, the following initiatives have been introduced to address these challenges and improve price discovery, enhance liquidity, and provide greater predictability in transactions.

- Futures contracts for voluntary carbon credits: The Intercontinental Exchange (ICE), for example, has launched standardized futures contracts linked to nature-based and other credit categories.[34] Though trading volumes remain limited, these contracts aim to improve price discovery and offer risk management tools.
- Auction and floor price mechanisms: The World Bank's Climate Warehouse has explored auction-based pricing models to ensure minimum price levels for carbon credits, thereby improving investment certainty and long-term market stability.[35]
- Corporate Advanced Market Commitments (AMCs): Initiatives such as Frontier Climate have committed billions to future purchases of high-quality carbon credits.[36] These AMCs provide demand signals and financing for emerging credit categories, particularly in carbon removal.

Despite efforts to introduce pricing benchmarks and risk management tools, VCMs remain fragmented, with price inconsistencies across different standards and trading platforms. Financial instruments like futures contracts and auction mechanisms provide partial solutions, but their effectiveness is constrained by the lack of broader market integration and common trading infrastructure. The absence of a unified framework for price discovery, combined with liquidity challenges and varying credit quality has limited the development of a stable and scalable market. Recent efforts to provide a set of principles for financial market integrity offer a path forward (see Box 1) but addressing these challenges requires further coordination among registries, exchanges, financial institutions, and standard-setting bodies to improve market depth, transparency, and cross-border credit comparability.

[34] See: ICE. https https://www.ice.com/products/Futures-Options/Energy/Emissions
[35] See: Climate Warehouse. https://www.theclimatewarehouse.org/work/climate-warehouse
[36] See: Frontier Climate. https://frontierclimate.com/

Box 1.
Financial market integrity in VCMs: World Bank Group & IOSCO Policy Note (2024)

At COP29 in 2024, the World Bank Group and IOSCO released a joint policy note to complement IOSCO's report on VCMs. While previous efforts have focused largely on environmental integrity, the note highlights the growing importance of addressing financial risks and regulatory blind spots. It presents a foundational framework for strengthening financial market integrity in carbon credit markets, emphasizing that investor confidence depends on transparency, accountability, operational resilience, and effective oversight.

To operationalize these goals, five core pillars of financial market integrity are outlined which are crucial for the orderly functioning of carbon credit markets. These pillars include:

1. **Transparency** to ensure open and timely disclosure of credit-level and trade-level data, enabling informed decision-making and accurate price information
2. **Accountability** to establish clear governance, manage conflicts of interest (e.g., between certifiers and project developers), and enforce ethical conduct
3. **Market integrity, fairness and resilience** to build secure and auditable infrastructure for custody, trading, and settlement, supported by risk management and operational continuity
4. **Efficiency** to promote standardized contracts and credit definitions, improving liquidity and lowering transaction costs across fragmented platforms
5. **Oversight** to provide legal clarity on the treatment of carbon credits and extend regulatory supervision to registries, platforms, intermediaries, and rating agencies

These elements are mutually reinforcing mechanisms that support market development and build investor trust, particularly in developing economies where institutional safeguards are still evolving. It is necessary to proactively address risks such as fraud, double counting, insider trading, and weak custodial practices.

Source: IOSCO & World Bank Group (2024). Considerations for financial market integrity of carbon credit markets. https://www.iosco.org/library/pubdocs/pdf/IOSCOPD774-note.pdf

3.3 Establishing mechanisms for cross-border transactions

Limited cross-border transactions present a particular challenge for low-income developing countries which are seeking international capital to support their domestic climate initiatives by launching carbon credit-generating projects which, moreover, contribute to local development. Several efforts are being made to help increase interoperability and cross-market transactions:

- The World Bank's Climate Warehouse is developing a global meta-registry to track cross-market transactions, ensuring transparency and reducing the risk of double counting known as the Climate Action Data (CAD).[37]
- The Voluntary Carbon Market Taskforce (VCM Taskforce) has introduced Core Carbon Reference Contracts, which facilitate trading on ICE and CME and improve credit comparability across different standards.[38]
- Singapore has developed a regional registry that is intended to consolidate carbon credit trading information among Asian countries.[39]
- The Hong Kong Green Finance Association (HKGFA) and the Capacity-building Alliance of Sustainable Investment (CASI) have convened Asian VCM operators to explore mechanisms to enhance interconnectivity of VCMs and support cross-border transactions in the region.[40] The Asian Infrastructure Investment Bank (AIIB) is looking into the possibility of hosting a working group on Asian VCM connectivity based on the HKGFA and CASI initiatives.[41]

Despite these initiatives, significant challenges remain due to the absence of higher-level global coordination mechanisms and data infrastructure to analyse and address barriers to cross-border transactions, especially in integrating registries, data tracking, and verification processes. To support and accelerate these efforts, G20 leadership is crucial in fostering collaboration on a global scale, especially in coordinating the efforts of various international and regional initiatives, to avoid duplicated and uncoordinated initiatives that may complicate the future harmonization of VCM practices across jurisdictions.

37 https://climateactiondata.org/about/
38 https://www.iif.com/Portals/1/Files/TSVCM_Report.pdf
39 https://www.ieta.org/initiatives/cad-trust
40 https://www.hkgreenfinance.org/hong-kong-hosts-dialogue-on-connectivity-of-asian-voluntary-carbon-markets/
41 https://www.hkgreenfinance.org/wp-content/uploads/2025/01/Keynote-summary-International-Seminar-on-Asia-VCM.pdf

4

The way forward

Based on the stock-taking exercise and analyses presented in previous sections and drawing from recent global and regional discussions, the following suggestions try to address the challenges facing VCMs globally, as well as specifically in developing countries. They aim to enhance the quality, scale, interoperability, and interconnectivity of VCMs and to support their role in advancing global climate action.

4.1 Clarify VCMs' role in decarbonization efforts

In light of the current policy uncertainty, it is essential for leading international bodies such as the G20 and the UNFCCC to issue clear statements reaffirming the critical role of voluntary carbon markets (VCMs) in global climate efforts and as a key channel for directing international capital toward climate projects. These statements should recognize the current shortcomings in VCM practices, particularly regarding quality, transparency, and accountability. They should also reaffirm the global commitment to enhancing the integrity, scale, and interoperability of VCMs. This will support VCMs to play a significantly greater role in incentivizing and financing climate action.

Furthermore, these statements should urge national governments to design supportive rules and policies, including those related to the implementation of corresponding adjustments (CA), to foster the growth of the VCM market and facilitate cross-border transactions. Clear and consistent messaging of this kind can boost investor confidence and stimulate demand for high-quality carbon credits.

> More clarity on the role of carbon credits in addressing Scope 3 emissions is also needed

More clarity on the role of carbon credits in addressing Scope 3 emissions is also needed. Towards this end, VCMI's Action Code of Practice on using high-quality carbon credits to address Scope 3 and hard to abate emissions is a welcome development.[42] The International Sustainability Standards Board (ISSB) could also expand IFRS S2 standard to address Scope 3 emissions and hard-to-abate sectors.[43] Such initiatives help companies and investors to effectively leverage VCMs to achieve their corporate climate commitments while supporting climate projects in developing countries.

4.2 Boost demand for carbon credits by leveraging offset mechanisms that link VCMs with compliance mechanisms

Based on examples from Canada, China, Singapore, South Africa and California, which have developed offset mechanisms to boost demand for voluntary credits by establishing linkages between VCMs and compliance markets or carbon taxes, other countries could also consider similar strategies.

UNCTAD calls for coherent policies to boost regulatory certainty and align voluntary and compliance markets

Specifically, for countries that have developed or are developing compliance carbon markets, authorities could consider recognizing voluntary credits in compliance markets, allowing companies to use them to meet regulatory obligations, and increase demand for voluntary credits. Countries that have opted to develop carbon taxes could consider introducing policies that allow companies to use voluntary carbon credits to offset part of their carbon tax liabilities. This would incentivize the purchase of voluntary credits to reduce tax burdens.

Currently, EU Carbon Border Adjustment Mechanism (CBAM) does not include an offset mechanism. However, policymakers could explore potential interactions between CBAM and VCMs in the future, for example by allowing high-quality credits to partially offset CBAM liabilities or by designing complementary mechanisms that recognize high-quality project-based credits.

However, as emphasized earlier, compliance markets should play a key role in achieving emission reductions. The use of carbon offsetting for compliance markets should not undermine national commitments and efforts to reduce emissions. Meanwhile, the greater use of credible voluntary credits may be necessary for hard-to-abate industries. This, in turn, could help expand both compliance and voluntary market, and incentivize investment in low-carbon projects.

To enhance the effectiveness of both compliance and voluntary markets, UNCTAD advocates a coherent policy framework to strengthen regulatory certainty in cross-border transactions and ensure complementarity between voluntary and compliance markets. Multilateral mechanisms, including the G20 and the United Nations, could take the lead in developing clear governance structures to leverage both VCMs and CCMs to unlock private investment for meaningful emissions reduction and project co-benefits that go beyond a focus on offsetting.

4.3 Enhance the quality and integrity of carbon credits by promoting the adoption of international standards

Key to addressing the main challenges on the supply side of VCMs, including the quality and transparency of credits, is the adoption of a set of internationally recognized standards and procedures. ICVCM has developed the CCPs, based on best practices, which have been applied to

[42] VCMI (2025). Scope 3 Action Code of Practice. https://vcmintegrity.org/scope-3-action/
[43] ISSB (2023). IFRS S2 Climate-related Disclosure. https://www.ifrs.org/content/

several private sector-led voluntary carbon crediting programs, such as Verra and Gold Standard.[44] However, many government-led VCMs, either in operation or under development, have not yet adopted the CCPs, partly due to the lack of official endorsement from international bodies such as the G20. Multilateral mechanisms, such as the G20, and the United Nations, could endorse international frameworks, such as the CCPs, and encourage country authorities to utilize them as the basis for drafting or revising their local VCM rules.

4.4 Promote interoperability among VCMs through cooperation mechanisms

Addressing the lack of interoperability in VCMs requires a multi-faceted approach that involves both technical and regulatory solutions. The following strategies could help enhance interoperability:

- Align standards: Authorities could adopt the CCPs as the international baseline for the development of local VCM standards, with the flexibility to add additional requirements to reflect local needs. This arrangement is analogous to ISSB S1 and S2 being endorsed as the global baseline for sustainability disclosure standards.
- Unify certification: Promote the use of high-quality independent certification bodies and standardized certification processes, which can be streamlined and aligned with the CCPs, to ensure that credits meet consistent quality criteria and reduce time to market. In addition to certification from independent bodies, another layer of certification could come from the registries. Already the PACM is intended to provide independent, universal certification and create a level of verification and alignment with major registries.
- Create and maintain a global credit registry network: The G20 should encourage the creation of a global carbon registry, with each individual country's national carbon registry as a member of the network and all members' registries interconnected.
- Adopt existing Article 6 elements: Encourage countries to engage with Article 6 of the Paris Agreement, which among others, facilitates the international transfer of mitigation outcomes (ITMOs) and promotes interoperability. Recognizing that adoption depends on national priorities and institutional readiness, countries could increase the use of bilateral or multilateral agreements with each other to enable transfer of credits (see Box 2). Countries interested in doing so should establish national frameworks that align with Article 6 requirements, ensuring that their carbon market systems can integrate with international mechanisms.

The Common Carbon Credit Data Model prepared in the context of the G20 Sustainable Finance Working Group (Priority 3) is a valuable contribution to addressing the above issues and could be actively explored by G20 members and other stakeholders. Ensuring these systems are inclusive and accessible can help unlock broader socioeconomic gains in host countries, contributing to resilient local economies and long-term development impact.

[44] CVCM (2024). Core Carbon Principles, Assessment Framework and Assessment Procedure. https://icvcm.org/wp-content/

Box 2.
Singapore's bilateral agreements on the transfer of carbon credits

Singapore was an early leader in adopting Article 6.2 elements. At present, it has signed Memoranda of Understanding (MOU) with countries such as Cambodia, Chile, Mongolia, and Rwanda on carbon credits collaboration aligned with Article 6 of the Paris Agreement. Under these MOUs, Singapore and partner countries will work towards a legally binding Implementation Agreement that sets out a bilateral framework for the international transfer of correspondingly adjusted mitigation outcomes and identifies potential Article 6-compliant mitigation activities which can support both countries to achieve their respective NDCs. Singapore has since substantively concluded the negotiation of the Implementation Agreement with Bhutan, Ghana, Paraguay, and Vietnam. At COP-28 in December 2023, Singapore signed its first Implementation Agreement with Papua New Guinea.

Key benefits through these bilateral agreements include:

- Leverage existing carbon market mechanisms: Integrate eligible carbon crediting approaches from recognized programs (e.g., Verra, Gold Standard, American Carbon Registry).
- Ensure alignment with Article 6 of the Paris Agreement: Facilitate authorization of correspondingly adjusted credits for both national NDC fulfilment under UN guidelines and corporate voluntary climate commitments.
- Support climate adaptation: Require projects under Implementation Agreements to allocate 5 per cent of proceeds or equivalent value to host countries' adaptation needs and/or the UNFCCC Adaptation Fund.
- Contribute to global decarbonization: Mandate cancellation of 2 per cent of correspondingly adjusted credits to ensure that these carbon credits will not be used towards the country's NDC, compliance requirements, or voluntary targets, thereby serving the sole purpose of contributing to global climate mitigation.

Source: UNCTAD, 2025.

Digital templates for project documents can streamline preparation and ensure consistency under Article 6

4.5 Adopt technology solutions to improve the distribution of benefits towards communities in developing economies

The primary beneficiaries of carbon credit projects are often project developers and intermediaries (such as validation and verification service providers and data providers) based in developed countries rather than local communities in developing countries.

This is mainly due to the complexity and costs of VCM project development and verification processes and the lack of low-cost data collection, monitoring, and verification technologies. Reducing these costs and thereby directing VCM benefits to local communities that host carbon credit projects could involve several strategies:

- Standardization of project development and verification processes. Encourage the use of standardized methodologies, for example in the form of digital templates, for project development and verification. The provision of digital

templates for project documentation could significantly streamline the preparation of project documents and ensure consistency across projects, as envisaged under Article 6. Close coordination with UNFCCC would be useful in this regard.

- Creating a carbon project monitoring mechanism. Independent certification bodies should be encouraged to develop a digital platform whereby all the stakeholders can provide feedback and comments over the life of the carbon project. This is especially useful to local communities who are supposed to share the benefits of local carbon credit projects, e.g., proceeds from the sale of carbon credits, education, and infrastructure improvements.
- Leveraging technology for measurement, reporting, and verification (MRV). Implement digital tools and technologies like blockchain, AI, and satellite imagery to automate real-time data collection and improve verification processes. Carbon project developers should be encouraged to use digital platforms that ensure data integrity, transparency, and immutability.
- A concrete example of leveraging digital technology for carbon market transparency and investment facilitation is the development of a national online carbon emissions registry in Colombia, led by UNCTAD in collaboration with the Ministry of Environment (see Box 3). This initiative enhances compliance, prepares the country for international carbon pricing mechanisms, and sets a precedent for other nations looking to digitize carbon credit reporting and certification.
- Leveraging distributed ledger technology (DLT) for a global credit registry. Connecting each member country's national credit registry through DLT, with all members to jointly maintain the integrity of the system. This prevents any single country becoming the centre of carbon registration and trading as centralizing the control could raise concerns about data sovereignty and compatibility with NDCs. An effective option is a hybrid system in which a national registry is established in each member country and a distributed ledger is used among them.

An effective option is a hybrid system in which a national registry is established in each member country and a distributed ledger is used among them

Box 3.
Digital Carbon Emissions Registry Platform in Colombia

Colombia's Ministry of Environment partnered with UNCTAD to develop a national online carbon emissions registry to enhance carbon market transparency and investment readiness. The registry enables companies to report annual greenhouse gas (GHG) emissions and obtain certification. The registry adheres to Intergovernmental Panel on Climate Change (IPCC) methodologies and strengthens Colombia's ability to participate in voluntary and compliant carbon markets, and comply with the European Union's Carbon Border Adjustment Mechanism (CBAM).

The digital registry supports the expansion of carbon pricing policies while improving data accuracy and market integrity. To ensure widespread adoption and effectiveness, UNCTAD and the Colombian government have introduced additional digital tools:

- Capacity Building and Training – Targeted programs to help businesses, including SMEs, transition to digital emissions reporting.
- Public Private Partnerships – Engaging key stakeholders in sustainable finance and carbon credit generation.
- Environmental Impact & Green Business Certification – Digitalizing permitting and certification to enhance climate-related investments.

Colombia's digitization of environmental governance offers a scalable solution for other economies. It supports policy priorities on sustainable finance, digital transformation, and climate governance while strengthening developing countries' participation in global carbon markets.

Source: UNCTAD, 2025.

4.6 Develop operational rules for cross-border transactions

To promote demand for voluntary carbon credits and facilitate cross-border transactions, governments should clarify the rules governing carbon credit trades, particularly under the Paris Agreement's Article 6.4 (PACM). It is essential to distinguish between transactions that require corresponding adjustments (CA) and those that do not.

This differentiation is crucial because most VCM transactions are driven by corporates' voluntary offsetting efforts to achieve net-zero goals, rather than by the "planning" of government agencies managing NDC statistics. If all voluntary transactions were subject to mandatory government approval due to stringent CA requirements for every cross-border trade, the limited capacity of many governments and the complexity of data demands would effectively halt most such transactions. This would pose a significant barrier to developing an integrated global VCM.

Several approaches can clarify this distinction. For example, Singapore allows cross-border trading of carbon credits without CA if the credits are not used to offset domestic carbon tax obligations. Other options could include permitting cross-border trading without CA when credits are not applied to compliance market obligations or when used to meet

international agreements such as CORSIA, or that refer to specific credit types or labels, such as carbon removal credits.

In summary, policymakers should recognize that the design and implementation of CA requirements should not intentionally restrict cross-border VCM trading. Overly stringent CA rules risk limiting developing countries' access to climate finance through market mechanisms, discouraging corporate voluntary action. They may also reduce incentives for green technology adoption. An interpretation of Article 6, including the CA requirement, should prioritize promoting VCMs as effective tools for climate action, in addition to ensuring the accuracy of NDC accounting.

4.7 Scale up capacity building

There is a significant need for capacity-building services for VCM regulators and key participants in developing countries to assist them in developing and implementing standards and operational procedures. These capacity-building initiatives should educate policymakers, regulators, and market participants on the importance of high-quality carbon credits, ways to align with international standards and best practices, and options for improving market connectivity and reducing MRV and transaction costs via digital solutions.

The involvement of established international organizations and initiatives is key to this effort. The G20 should encourage ICVCM, VCMI, and IETA to work with other NGOs and regional organizations to enhance the design and implementation of high-quality VCMs alongside UNFCCC implementation efforts and its partners. Regional MDBs can also take a lead in organizing capacity-building-programs, in collaboration with capacity-building platforms such as the Capacity-building Alliance of Sustainable Investment (CASI) which has already offered training courses on carbon markets and carbon asset management for emerging markets and developing countries.[45] Capital market actors, such as stock exchanges, are also important sources of information and training to issuers and investors, and they provide increased visibility through public disclosure.[46]

Some regions, such as ASEAN, have made early progress in establishing enabling frameworks for voluntary carbon markets, such as Singapore's Climate Action Data Trust or Indonesia's Carbon Exchange Initiative. These experiences can serve as valuable examples, but future capacity building efforts should also prioritize underserved regions, such as parts of Sub-Saharan Africa, and sectors to ensure fair and inclusive participation. Support should be tailored to each country's context, including their regulatory environment and level of technical readiness. Sharing the experiences of early adopters, including information on regulatory and legal changes and MRV infrastructure development, can help to scale up effective practices and build trust, enabling carbon markets to contribute meaningfully to climate goals and sustainable development.

[45] See: Capacity-building Alliance of Sustainable Investment. https://www.casi.net/about

[46] See Sustainable Stock Exchanges Initiative: How exchanges can maximize the opportunities of carbon markets - An action framework to guide exchanges. https://sseinitiative.org/publication/how-exchanges-can-maximize-the-opportunities-of-carbon-markets-an-action-framework-to-guidance-exchanges

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