

CMI Working Group
Technical Guidance Note

Ecosystem Governance for Carbon Markets Infrastructure: Assessment and Recommendations

Acknowledgments

This technical guidance note is an output of the Carbon Markets Infrastructure Working Group (CMI WG) convened by the World Bank. The CMI WG members are Abaxx Exchange, Air Carbon Exchange, B3—Brazilian Stock Exchange, BeZero Carbon, Climate Action Data Trust (CAD Trust), Climate Impact X, CME Group, EcoRegistry, European Bank for Reconstruction and Development (EBRD), Global Carbon Council (GCC), Global Carbon Market Utility (GCMU), Gold Standard, Indian Energy Exchange (IEX), INFRAS, Integrity Council for the Voluntary Carbon Market (ICVCM), Intercontinental Exchange, International Standards Organization (ISO), International Swaps and Derivatives Association (ISDA), Johannesburg Stock Exchange (JSE), Nasdaq, Philip Lee LLP, Puro.earth, S&P Global Commodity Insights, SustainCERT, Sylvera, Verra, World Bank, and Xpansiv.

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Table of contents

List of tables and figures

Table 1 Composition of the CMI WG

Table 2 Key governance themes in carbon markets infrastructure

Table 3 Selected approaches to revenue structure and role separation in carbon credit programs

Table 4 Safeguard approaches to enable verifier independence and role clarity

Table A1 Key functional stages and processes across the carbon market lifecycle

Table A2 Key entities and their roles in the carbon market infrastructure ecosystem

Figure 1 Key challenges and recommendations of the five CMI WG technical guidance notes

Figure 2 Identified bottlenecks in ecosystem governance within carbon markets infrastructure

Figure 3 Preliminary framework of ecosystem mapping for carbon markets infrastructure

Figure 4 Recommendations across key governance areas

Abbreviations and acronyms

AML	anti-money laundering	ITMO	internationally transferred mitigation outcome
CDM	Clean Development Mechanism	KYC	know your customer
CFTC	Commodity Futures Trading Commission	MRV	monitoring, reporting, and verification
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement	NDC	nationally determined contribution
CMI WG	Carbon Markets Infrastructure Working Group	PDD	project design document
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation	SFWG	Sustainable Finance Working Group
ERC	emissions reduction credit	tCO₂eq	tons of carbon dioxide equivalent
GCC	Global Carbon Council	TSVCM	Taskforce on Scaling Voluntary Carbon Markets
GHG	greenhouse gas	UNFCCC	United Nations Framework Convention on Climate Change
ICAO	International Civil Aviation Organization	UNIDROIT	International Institute for the Unification of Private Law
ICROA	International Carbon Reduction and Offset Alliance	VCM	voluntary carbon market
ICVCM	Integrity Council for the Voluntary Carbon Market	VCMI	Voluntary Carbon Markets Integrity Initiative
IOSCO	International Organization of Securities Commissions	VCS	Verified Carbon Standard
IPCC	Intergovernmental Panel on Climate Change	VVB	validation and verification body
ISDA	International Swaps and Derivatives Association		
ISO	International Organization for Standardization		

Foreword

Carbon markets hold significant potential as a vehicle for channeling climate finance to developing countries, many of which face growing needs that far exceed available funding. When designed with high integrity, these markets not only unlock capital and drive verifiable emissions reductions but also help close investment gaps in critical sectors. Beyond their environmental impact, well-functioning carbon markets support job creation and deliver tangible financial benefits to local communities.

Significant progress is already underway. As highlighted in the [World Bank's 2024 State and Trends Report](#), several key initiatives are advancing the integrity and functionality of carbon markets. The International Organization of Securities Commissions (IOSCO) is advocating for stronger oversight and market integrity; the International Institute for the Unification of Private Law (UNIDROIT) is working to harmonize the legal classification of carbon credits; and the Integrity Council for the Voluntary Carbon Market (ICVCM) is advancing transparency and scale through its Continuous Improvement Work Program. These global efforts lay essential groundwork, but further progress is needed to address persistent gaps—particularly in governance, institutional coordination, and technical integration.

As carbon markets grow in scale and strategic relevance, the need for trusted, connected and scalable infrastructure has become a global policy priority. Market infrastructure is the backbone of credibility, transparency, and efficiency. It supports the issuance, transfer, and retirement of carbon credits, and enables trust among market participants. Under South Africa's 2025 G20 Presidency, the Sustainable Finance Working Group (SFWG), highlights in its [Note on Agenda Priorities](#) that "by focusing on improving the foundational elements of market infrastructure – including data standardization and cross-border connections – the SFWG can help unlock the greater financing potential of these markets." This reflects growing recognition that robust, standardized approaches to data and infrastructure are essential for the credibility and effectiveness of carbon markets.

While carbon market infrastructure is just one part of a broader system that encompasses environmental, financial, and social integrity, it forms the backbone of effective market operations. Addressing infrastructure gaps early is critical to building a solid foundation for growth. The choices made now will shape our ability to scale, unlock climate finance, and achieve meaningful emissions reductions

Advancing a global and decentralized market—such as for carbon credits—presents a unique opportunity to build robust, future-ready systems.

At COP28, the World Bank launched the *Engagement Roadmap for Carbon Markets* outlining how it will support countries in building high-integrity, high impact carbon markets. As part of efforts to operationalize this strategy, the World Bank launched the Carbon Markets Infrastructure Working Group (CMI WG), convening a diverse set of stakeholders to identify infrastructure-related bottlenecks and deliver actionable guidance. At COP29, the CMI WG released its flagship publication, *A Roadmap for a Safe, Efficient, and Interoperable Carbon Markets Infrastructure*, which outlined a vision for addressing foundational gaps and identified key priority areas for action.

Building on these findings and the collaborative efforts of the CMI WG, five targeted technical guidance notes were released in June 2025. These technical guidance notes aim to support countries and market actors in addressing key infrastructure challenges through practical recommendations on ecosystem governance, transaction integrity, information security, data interoperability, and digital MRV.



1

**Ecosystem Governance for Carbon Markets Infrastructure:
Assessment and Recommendations**



2

**Transaction Integrity for Carbon Markets Infrastructure:
Tools and Recommendations**



3

**Information Security for Carbon Markets Infrastructure:
Tools and Recommendations**



4

**Enhancing Data and Systems Interoperability for Carbon Markets:
Current Landscape and Strategic Recommendations**



5

**Standardizing Digital MRV in Carbon Markets:
System Evaluation Criteria and Hotspots Assessment**

Together, these guidance notes are complementary in supporting the scale-up of safe, efficient, and interoperable carbon market infrastructure. Robust governance builds trust by clarifying institutional roles and responsibilities, integrity and security safeguards reduce risks, and interoperability enables scale by facilitating seamless data and system integration. The World Bank will integrate this guidance into ongoing capacity-building efforts to support countries in strengthening their carbon market infrastructure.

Executive summary

The *Technical Guidance Note on Ecosystem Governance for Carbon Markets Infrastructure: Assessment and Recommendations* is one of five guidance notes developed by the Carbon Markets Infrastructure Working Group (CMI WG). This note aims to inform robust governance across carbon market systems. It highlights governance priority areas identified by the CMI WG, including clarification of roles among key actors, the independence of Validation and Verification Bodies (VVBs), and harmonized terminology to support transparency, trust, and interoperability. Through a stocktake of global initiatives, a mapping of ecosystem functions accompanied by a glossary of terms, and strategic recommendations, the note aims to support stakeholders in strengthening institutional safeguards and align with evolving market requirements.

Carbon Markets Infrastructure Working Group

The CMI WG was established to identify key bottlenecks hindering the security, efficiency, and interoperability of carbon market infrastructure and to prioritize actions to address these challenges. As of June 2025, the CMI WG includes entities from across the carbon market ecosystem—ranging from standard setters on both the demand and supply sides, carbon crediting programs, registry operators, trading platforms, marketplaces, financial institutions, data and analytics providers, technology firms, Validation and Verification Bodies, legal and consulting firms, multilateral organizations, and regulatory authorities, among others. This broad and balanced membership brings together diverse perspectives that are essential for addressing infrastructure gaps, fostering interoperability, and supporting the integrity and scalability of global carbon markets (Table 1).

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TABLE 1
Composition of the CMI WG

CMI WG Member Organizations	
Abaxx Exchange	Integrity Council for the Voluntary Carbon Market (ICVCM)
Air Carbon Exchange	Intercontinental Exchange (ICE)
B3—Brazilian Stock Exchange	International Standards Organization (ISO)
BeZero Carbon	International Swaps and Derivatives Association (ISDA)
Climate Action Data Trust (CAD Trust)	Johannesburg Stock Exchange (JSE)
Climate Impact X	Nasdaq
CME Group	Philip Lee LLP
EcoRegistry	Puro.earth
European Bank for Reconstruction and Development (EBRD)	S&P Global Commodity Insights
Global Carbon Council (GCC)	SustainCERT
Global Carbon Market Utility (GCMU)	Sylvera
Gold Standard	Verra
Indian Energy Exchange (IEX)	World Bank
INFRAS	Xpansiv
Observers: International Organization of Securities Commissions (IOSCO) Secretariat Climate Data Steering Committee (CDSC) Secretariat	

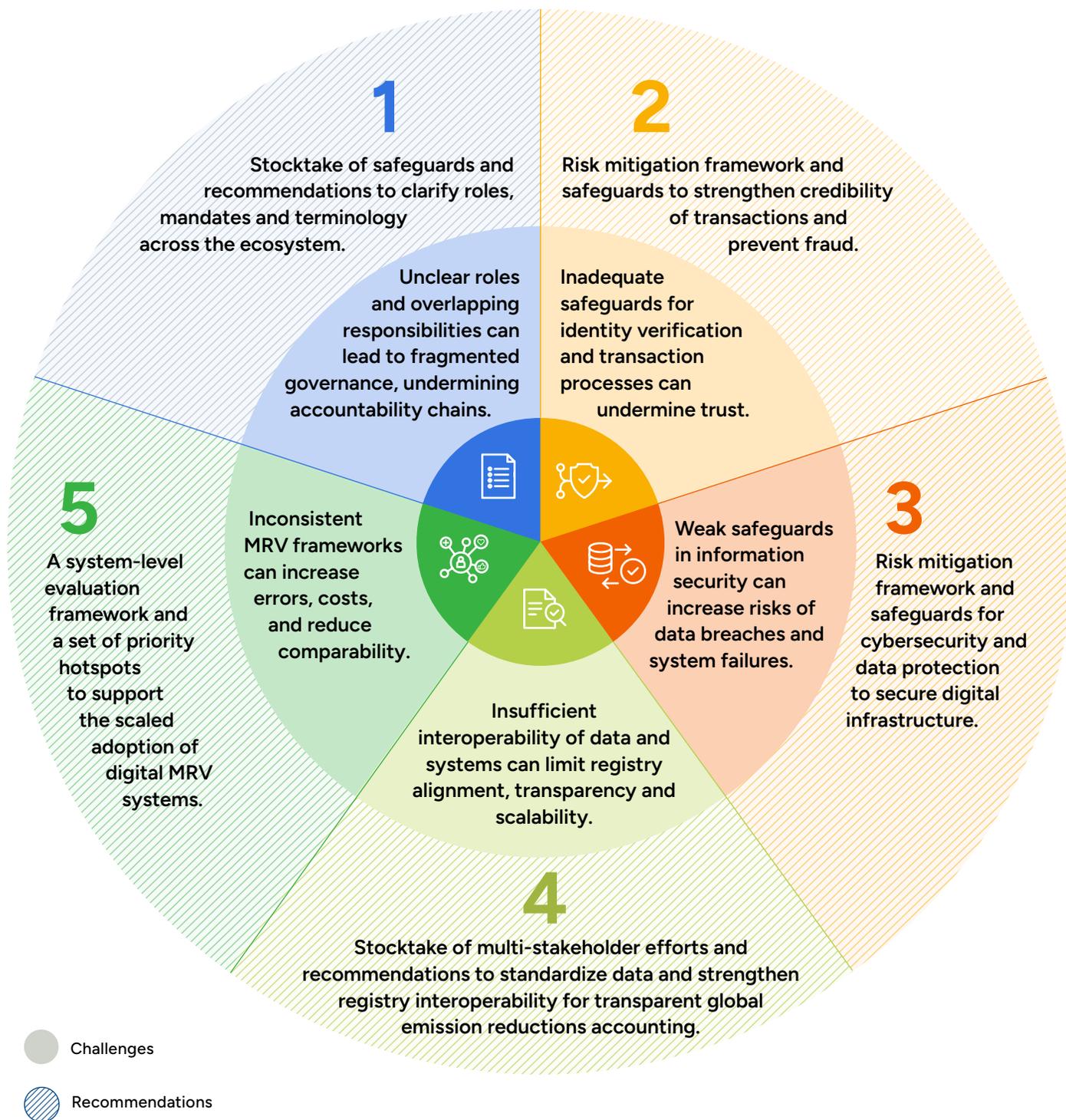
The CMI WG convened a series of meetings and consultations beginning in June 2024, which informed the development of A Roadmap for Safe, Efficient, and Interoperable Carbon Market Infrastructure (2024), released at COP29. The roadmap identified key infrastructure bottlenecks and outlined three priority action areas to strengthen the carbon market ecosystem: (i) ecosystem governance, (ii) information security and transaction integrity, and (iii) data and systems interoperability. It proposed the development of targeted technical guidance notes for each priority area by June 2025, intended to provide deeper analysis of existing barriers as well as practical frameworks, tools, and recommendations to guide coordinated action and system-wide improvements (Figure 1).

The objective of these notes is to offer practical tools and actionable recommendations for a broad spectrum of market participants. This includes both those designing and operating key components of carbon market infrastructure, as well as those leveraging these systems to carry out carbon market activities. All stakeholders play a critical role in developing robust, secure, and scalable market systems. The insights presented here are also intended to inform capacity-building and technical assistance efforts tailored to the unique contexts and institutional capacities of each country. This targeted support is designed to promote a cohesive, inclusive, and resilient carbon market infrastructure.

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FIGURE 1

Key challenges and recommendations of the five CMI WG technical guidance notes



Ecosystem governance

Rationale and strategic context

As carbon markets grow in complexity and participation—spurred by Article 6 of the Paris Agreement and increased national-level implementation—clarity, accountability, and coordination among market actors have become essential to uphold trust and scale carbon markets. Governance frameworks and models, long considered a crucial consideration, must now take center stage in the design and operation of carbon markets infrastructure.

The decentralized and evolving nature of global carbon markets has led to a diversity of governance arrangements across countries, standards, and platforms. While this flexibility reflects local priorities and innovation, it has also resulted in varying definitions of roles and responsibilities, which can make coordination and interoperability more challenging. In some cases, the absence of harmonized procedures or clearly defined mandates among registries, validation bodies, standard setters, and regulators has contributed to perceptions of overlapping functions, potential conflicts of interest, and areas where accountability may be unclear.

Against this backdrop, the CMIWG has prioritized ecosystem governance as a technical workstream essential to building transparency, resilience, and long-term credibility in carbon markets. Through the assessment and multi-stakeholder consultations conducted during the development of the [Roadmap for Safe, Efficient, and Interoperable Carbon Markets Infrastructure \(2024\)](#), three key governance challenges were identified: (1) inconsistent terminologies and technical definitions that create ambiguity around core market functions, (2) overlapping roles and responsibilities across institutions leading to inefficiencies and blurred accountability, and (3) potential conflicts of interest and weak incentive structures that can compromise the integrity of project validation and credit issuance. Addressing these challenges through clearer role definitions, harmonized standards, and stronger safeguards is critical for scaling high-integrity carbon markets.

As carbon markets grow in complexity and participation—spurred by Article 6 of the Paris Agreement and increased national-level implementation—clarity, accountability, and coordination among market actors have become essential to uphold trust and scale carbon markets.

FIGURE 2

Identified bottlenecks in ecosystem governance within carbon markets infrastructure



Source Adapted from *A Roadmap for Safe, Efficient, and Interoperable Carbon Markets Infrastructure* (CMI WG 2024).

Building on this foundation, the CMI WG has deepened its work in this priority area through continued stakeholder consultations and targeted assessments. These efforts have aimed to provide practical guidance and foster a shared understanding of key governance challenges across carbon markets infrastructure. Four thematic areas consistently emerged from these discussions:

- Terminology alignment across the carbon asset value chain
- Clarification of roles and safeguards to address potential overlaps or conflicts of interest
- Financial integrity and regulatory coherence
- Environmental integrity through methodological consistency

Terminology alignment across the carbon asset value chain

The use of varied and evolving definitions by different actors—often tailored to specific documentation or programmatic contexts—can limit system interoperability and introduce ambiguity. The absence of a shared, comprehensive repository of key terms and functional definitions across pre- and post-issuance stages has contributed to fragmentation within the carbon market ecosystem. Several international efforts—such as those led by the Taskforce on Scaling Voluntary Carbon Markets (TSVCM), the World Economic Forum, IOSCO, and the ICVCM—have sought to map roles and clarify terminology to address this challenge.¹

Inconsistent use of technical terms and differing interpretations of core market functions create operational misalignment across jurisdictions and actors. For example, the same registry function may be labeled as an “issuance registry,” “transaction registry,” or “carbon credit registry” depending on the program. These discrepancies hinder the harmonization of rules, the alignment of data flows, and, ultimately, interoperability, comparability, and trust. While the use of diverse definitions reflects the varied roles and practices across the voluntary carbon market (VCM), greater alignment—particularly in the context of emerging Article 6 arrangements—can reduce ambiguity around roles, responsibilities, and liability chains, and facilitate more seamless coordination across systems.

Clarification of roles and independence safeguards to address potential overlaps and conflicts of interest

The rapid growth and diversification of market participants—especially as emerging economies establish national carbon markets—introduces new complexity. As actors assume overlapping or evolving roles across the crediting cycle, the absence of clearly defined functions and safeguards can blur accountability, increase the risk of perceived conflicts of interest, and challenge the coherence of market governance. While commercial relationships are not unique to carbon markets, the absence of robust regulatory oversight and heightened public scrutiny calls for enhanced transparency and assurance measures.

A key priority is the clear delineation of responsibilities among entities across the carbon crediting value chain—especially at the interfaces between project developers, project proponents, validation and verification bodies (VVBs), and national or international standard-setting organizations spanning the public, private, and not-for-profit sectors. Relationships such as those between project developers and VVBs—though common in other sectors—can raise concerns about perceived dependence. Proactively enhancing the transparency of these relationships, along with measures to ensure the integrity of verification processes, can strengthen market confidence and respond to civil society concerns, especially those heightened in carbon markets.

¹ TSVCM (Taskforce on Scaling Voluntary Carbon Markets). 2021. *Final Report*. Institute of International Finance. https://www.iif.com/Portals/1/Files/TSVCM_Report.pdf; World Economic Forum and Bain & Company. 2023. “Scaling Voluntary Carbon Markets: A Playbook for Corporate Action.” https://www3.weforum.org/docs/WEF_Scaling_Voluntary_Carbon_Markets_2023.pdf; IOSCO (International Organization of Securities Commissions). 2023. *Voluntary Carbon Markets Consultation Report*. <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD774.pdf>; ICVCM (Integrity Council for the Voluntary Carbon Market). 2024. *Core Carbon Principles, Assessment Framework and Assessment Procedure*. <https://icvcm.org/core-carbon-principles>.

Financial integrity and regulatory coherence

As the VCM scales—from an estimated peak of \$2 billion in 2020 to a projected \$250 billion by 2050—the financial and regulatory dimensions of market governance will become increasingly critical. Entities administering crediting systems may be expected to meet the standards of custodial institutions in traditional financial markets, especially if the financial sector is to play a central role in scaling the market.²

The legal classification of carbon credits continues to vary across jurisdictions, shaping the extent of regulatory oversight applied to market participants and infrastructure. Ongoing initiatives—such as those led by UNIDROIT—seek to clarify the legal nature of verified carbon credits,³ providing important building blocks for more coherent and robust governance frameworks. Similarly, IOSCO has outlined key considerations for preserving financial market integrity within carbon markets, divided by core actor categories, including registry providers, standard-setting bodies, brokers, and rating agencies.⁴ Strategic alignment of future governance arrangements with such emerging guidance can help reinforce financial integrity, enhance operational resilience, and support compliance with evolving regulatory requirements.

Environmental integrity through methodological consistency

Environmental integrity remains a foundational pillar of carbon market credibility. While methodological innovation is important, convergence around high-integrity approaches—paired with ongoing improvements that reflect scientific advances and stakeholder feedback—is essential to delivering consistent outcomes and fostering market-wide trust.

Although the detailed design of methodologies falls outside the direct scope of this guidance note, ongoing efforts by the ICVCM and the United Nations Framework Convention on Climate Change (UNFCCC) under Article 6.4 are highly relevant. These bodies are working to curate and endorse methodologies that align with globally recognized integrity principles, helping to establish a consistent and credible basis for verified carbon credit issuance.⁵

² Blaufelder, C., C. Levy, P. Mannion, and D. Pinner. 2021. “A Blueprint for Scaling Voluntary Carbon Markets to Meet the Climate Challenge.” McKinsey & Company, January 29. <https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge>.

³ UNIDROIT (International Institute for the Unification of Private Law). 2024. “Legal Nature of Voluntary Carbon Credits: Exploratory Study.” <https://www.unidroit.org/wp-content/uploads/2024/04/C.D.-103-11-Legal-nature-of-Voluntary-Carbon-Credits-with-Annexe-1.pdf>.

⁴ OSCO. 2024. “Considerations for Financial Market Integrity of Carbon Credit Markets.” <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD774-note.pdf>.

⁵ ICVCM. 2024. *Core Carbon Principles, Assessment Framework and Assessment Procedure*. Version 2. <https://icvcm.org/wp-content/uploads/2024/02/CCP-Book-V2-FINAL-6Feb24-compressed.pdf>. See also <https://icvcm.org/wp-content/uploads/2024/02/CCP-Section-5-V2-FINAL-6Feb24.pdf> and <https://unfccc.int/process-and-meetings/the-paris-agreement/paris-agreement-crediting-mechanism/methodologies#Development-of-A64-methodologies-and-methodological-tools>

TABLE 2

Key governance themes in carbon markets infrastructure

Theme	Challenges identified	Strategic importance	Emerging solutions/ ongoing efforts
1. Terminology alignment	<ul style="list-style-type: none"> • Inconsistent definitions across programs • Ambiguity in core functions 	<ul style="list-style-type: none"> • Enables interoperability • Enhances comparability and trust 	<ul style="list-style-type: none"> • TSVCM, World Economic Forum, IOSCO, ICVCM mapping efforts • Push for shared repository of functional definitions
2. Clarification of roles and independence safeguards	<ul style="list-style-type: none"> • Overlapping roles across project cycle • Risk of perceived conflicts of interest 	<ul style="list-style-type: none"> • Strengthens accountability • Reduces governance risks 	<ul style="list-style-type: none"> • Separation of functions across VVBs, standards, and registries • Transparency in commercial relationships
3. Financial integrity and regulatory coherence	<ul style="list-style-type: none"> • Varying legal status of credits • Gaps in oversight and custodianship 	<ul style="list-style-type: none"> • Aligns with financial market expectations • Supports market scaling 	<ul style="list-style-type: none"> • IOSCO recommendations • UNIDROIT work on credit classification • Clarification of actor categories
4. Environmental integrity through methodologies	<ul style="list-style-type: none"> • Fragmented or weak methodologies • Misaligned crediting baselines 	<ul style="list-style-type: none"> • Upholds climate credibility • Builds confidence in mitigation outcomes 	<ul style="list-style-type: none"> • ICVCM Core Carbon Principles • Article 6.4 Methodology curation and endorsement

Source: CMI WG

This guidance note focuses on the first two themes— 1) terminology alignment, and 2) role clarification and independence safeguards—as foundational elements of ecosystem governance. These areas are prioritized for immediate action given their direct implications for coordination, accountability, and system interoperability. The subsequent sections present a practical framework to assess and address these challenges, drawing on global insights and implementation experience.

Scope and approach

Drawing from the CMI WG’s ecosystem mapping, technical assessments, and multi-stakeholder consultations, this guidance note offers targeted recommendations to strengthen ecosystem governance in carbon markets. It builds on and complements prior efforts led by TSVCM, ICVCM, IOSCO, and the World Economic Forum, while grounding recommendations in practical insights gathered from CMI WG consultations.

This guidance note focuses exclusively on two areas of cross-cutting strategic relevance—1) terminology alignment, and 2) clarification of roles and independence safeguards—as foundational priorities for ecosystem governance. These were selected based on strong convergence in stakeholder feedback and the feasibility of advancing actionable solutions within the CMI WG’s mandate.

1

Terminology alignment → Ecosystem mapping and glossary of terms

This first area aims to provide foundational guidance to address potential fragmentation caused by varied and evolving definitions across the carbon market value chain, which can hinder interoperability, introduce ambiguity, and complicate data integration. To tackle this, the note draws on the **ecosystem mapping framework** outlined in the CMI roadmap and introduces a **glossary of terms** developed through stakeholder consultations under the CMI WG.

2

Clarification of roles and safeguards → Stocktake of governance models and institutional functions

The second theme highlights the increasing importance of strengthening accountability and impartiality mechanisms as carbon markets expand and diversify. By conducting a **stocktake of safeguards and governance models** across markets, the note explores roles and relationships—particularly between standard-setting bodies and project proponents, and between project proponents and VVBs. These dynamics, while not unique to carbon markets, require enhanced transparency, public disclosure, and clearer functional boundaries to address integrity risks and strengthen market confidence.

1 Ecosystem mapping and glossary of terms

As carbon markets expand under diverse national and voluntary frameworks, the lack of standardized terminology has emerged as a critical barrier to transparency, accountability, and interoperability. To address this, the CMI Working Group developed a preliminary ecosystem governance mapping framework as part of the CMI roadmap, along with a harmonized glossary of terms grounded in leading market references, including guidance from Article 6, ICVCM, TSVCM, and IOSCO. Together, these tools provide a shared foundation for understanding core functions, stages, and institutional roles across the carbon market value chain. By reducing ambiguity and clarifying responsibilities, they support the development of coherent, interoperable, and high-integrity systems—enabling more consistent governance and alignment across jurisdictions and standards.

Ecosystem governance mapping framework

The decentralized and bottom-up nature of carbon markets under the Paris Agreement has led to a proliferation of diverse policy, regulatory, and operational frameworks. This complexity has contributed to a fragmented ecosystem, where varied terminologies and overlapping roles, responsibilities, and functions can create challenges for clear governance and accountability across the carbon asset life cycle.

To address this, the CMI WG developed a preliminary **ecosystem governance mapping framework (Figure 3, p.22)** as part of the [A Roadmap for Safe, Efficient, and Interoperable Carbon Markets Infrastructure \(2024\)](#), that provides a structured overview of entities, functions, and relationships across the carbon market value chain. This living resource includes:

- A harmonized set of technical definitions and role mappings across entity types
- A sequential outline of core market functions spanning pre-issuance and post-issuance stages
- Classification of entities based on their role (pre-issuance, post-issuance, regulatory/governance) and level of responsibility (direct or indirect)
- A visual representation linking functionalities to entities involved at each stage of the carbon credit lifecycle.

The ecosystem governance mapping framework offers a helpful tool for stakeholders to identify and consider possible inconsistencies, overlaps, gaps, or potential conflicts of interest in how carbon markets infrastructure is designed and implemented. This effort offers a granular mapping of both core functions and institutional actors across the full carbon credit life cycle. It covers 29 market functionalities—including methodology development, digital MRV, registry operations, credit issuance, trading, retirement, and reporting—and maps them to 40 ecosystem actors such as project developers, VVBs, crediting programs, technology providers, regulators, and financial institutions.

This mapping effort adds particular value as carbon markets expand and diversify under frameworks like Article 6 of the Paris Agreement. The growing number of actors, overlapping mandates, and the presence of public, private, and hybrid institutions have heightened the risk of ambiguity and inefficiency. Often, a single function—such as verification or issuance—involves multiple entities with distinct mandates, which can lead to accountability gaps or risks of perceived conflicts of interest. The mapping effort helps illuminate these dynamics by clarifying the distribution of roles and responsibilities across key functions and entity types, aimed at supporting greater transparency and more effective implementation. It also responds to the fragmentation of definitions and role interpretations across programs—challenges that can hinder coordination and slow progress toward interoperable, high-integrity market infrastructure.

This framework is designed to offer practical utility to a wide range of stakeholders by providing a shared vocabulary and a visual reference point. For governments and market actors, it serves as a tool to examine key functions and associated entities across the carbon market lifecycle, and to identify where safeguards or clearer role definitions may be needed. For standard-setting bodies and platform developers, it supports the design of coherent and interoperable systems. Civil society and oversight institutions can use it to better understand market architecture and promote accountability. By mapping functional relationships and institutional responsibilities, the framework aims to help pinpointing potential coordination gaps, clarify role boundaries, and inform the design of more transparent and operationally sound carbon market infrastructure.

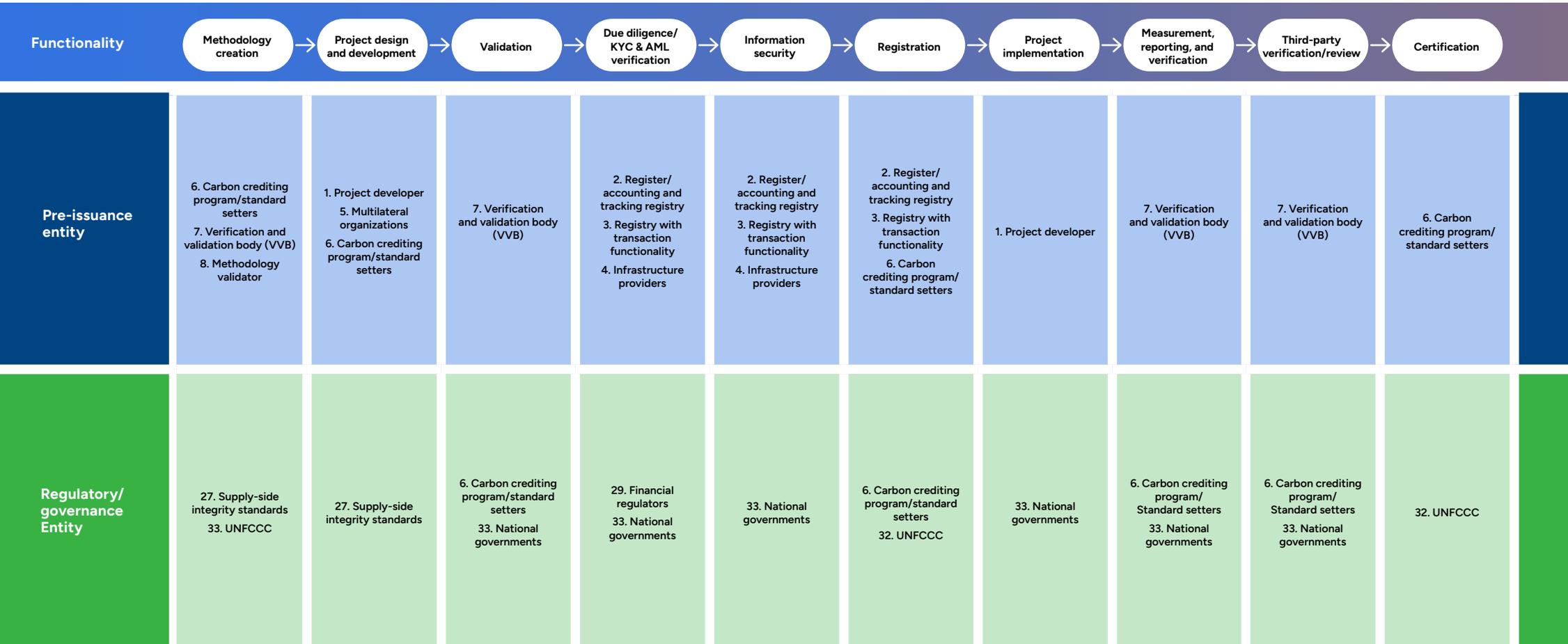
This mapping effort adds particular
value as carbon markets expand and diversify
under frameworks like Article 6 of the
Paris Agreement.

FIGURE 3
Preliminary framework for ecosystem mapping

Pre-issuance

Functionalities: Pre-issuance/primary	Entities: Pre-issuance
Methodology creation	1. Project developer
Project design and development	2. Register/Accounting and tracking registry
Validation	3. Registry with transaction functionality
Due diligence/KYC & AML verification	4. Infrastructure providers
Information security	5. Multilateral organizations
Registration	6. Carbon crediting program/standard setters
Project implementation	7. Verification and validation body/certification bodies/third party auditors
Measurement, reporting, and verification	8. Methodology validator
Third-party verification/review	
Certification	

Mapping Functionalities (Pre-Issuance) to Entities

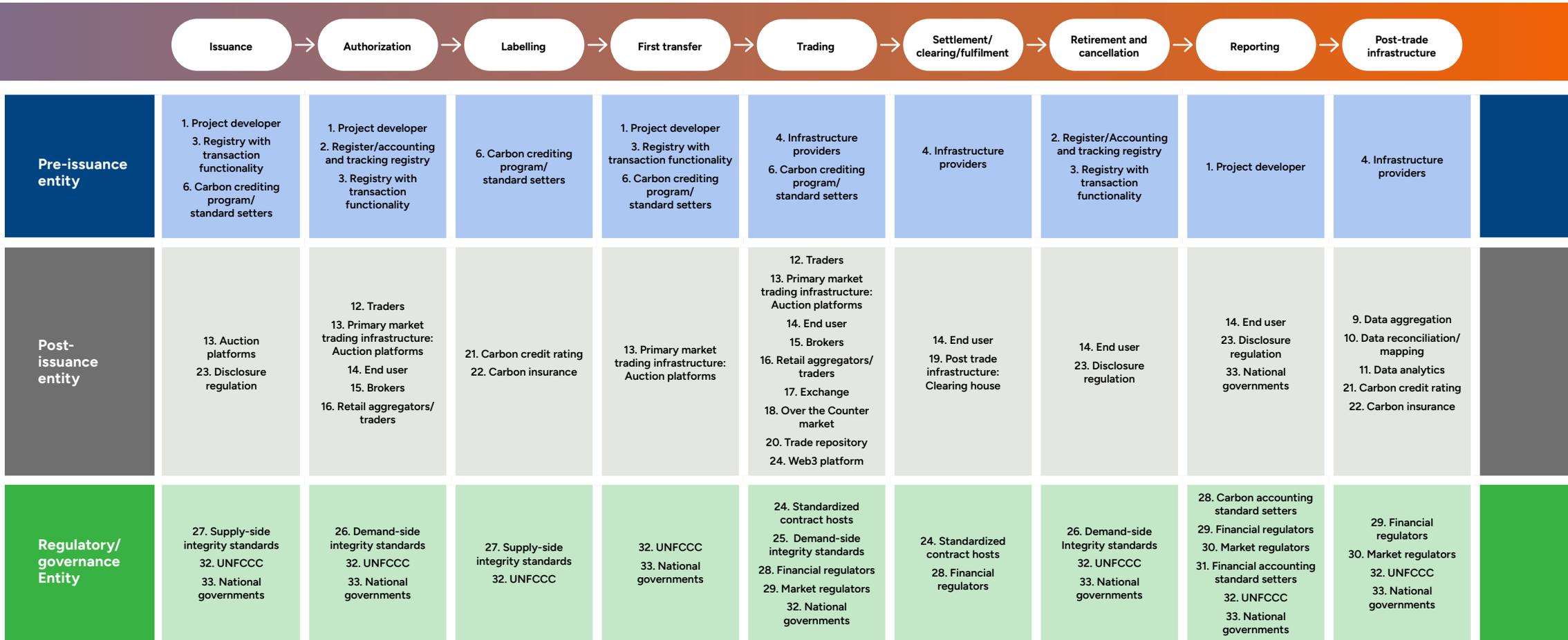


UNFCCC to play a role where applicable. May not have a role to play in case of certification under VCM

Post-issuance

Entities: Post-issuance/post-trade/secondary	Entities: Post-issuance	Entities: Regulatory/governance
Issuance	9. Data aggregation	25. Standardized contract hosts
Authorization	10. Data reconciliation/mapping	26. Demand-side integrity standards
Labeling	11. Data analytics	27. Supply-side integrity standards
First transfer	12. Traders	28. Carbon accounting standard setters
Trading	13. Primary market trading infrastructure: Auction platforms	29. Financial regulators
Settlement/clearing/fulfilment	14. End user	30. Market regulators
Retirement/cancellation	15. Brokers	31. Financial accounting standard setters
Reporting	16. Retail aggregators/traders	32. UNFCCC
Post trade infrastructure	17. Secondary market trading infrastructure: Exchange	33. National governments
	18. Secondary market trading infrastructure: Over the counter market	
	19. Post trade infrastructure: Clearing house	
	20. Trade repository	
	21. Carbon credit rating	
	22. Carbon insurance	
	23. Disclosure regulation	
	24. Web3 platform	

Mapping Functionalities (Post-Issuance) to Entities



Role of actors will change as negotiations around 'first transfer' are finalised. The stage at which the first transfer takes place will affect the entities involved

Glossary of terms

To complement the ecosystem mapping framework and support greater consistency in terminology across jurisdictions and programs, the CMI WG developed a harmonized glossary of technical definitions covering core functions and key entities within the carbon market ecosystem. Grounded in a comprehensive review of leading crediting programs, Article 6 provisions, and voluntary market practices, the glossary seeks to establish a common understanding of the key functions, lifecycle stages, and institutional roles that support the effective operation of carbon markets on both the supply and demand sides (Annex, Glossary of terms - Key entities and functionalities in carbon markets).

The glossary covers two components:

- **Annex Table A1** outlines the full value chain—from methodology creation and project registration to trading, settlement, and retirement of credits—describing 27 key functionalities.
- **Annex Table A2** profiles 40 core market actors, including project proponents, registries, infrastructure providers, regulators, and financial intermediaries.

As the landscape continues to evolve, this glossary aims to offer a practical reference for policymakers, developers, verifiers, and infrastructure providers—supporting clearer coordination, more consistent terminology, and improved role delineation. It also aims to help foster alignment across emerging standards, including Article 6 mechanisms, and contribute to the development of interoperable carbon market infrastructure.

These definitions draw from authoritative references—including the TSVCM,⁶ the World Economic Forum,⁷ ICVCM’s Core Carbon Principles,⁸ and IOSCO’s guidance on market oversight.⁹ This foundational glossary (see Annex) offers a consolidated resource that reflects both legacy systems (for example, the Clean Development Mechanism, CDM) and emerging digital practices. To reinforce alignment, the CMI WG encourages relevant stakeholders—such as the UNFCCC, ICVCM, and the Voluntary Carbon Markets Integrity Initiative (VCMI)—to collaborate in expanding and formalizing a cross-cutting terminology framework that can serve as a global reference for carbon market actors.

This glossary is intended as a living document—it may continue to evolve and be informed by future stakeholder engagement, institutional developments, and market innovation as the carbon market ecosystem matures.

⁶ TSVCM. 2021. *Final Report*. https://www.iif.com/Portals/1/Files/TSVCM_Report.pdf.

⁷ World Economic Forum and Bain & Company. 2023. “Scaling Voluntary Carbon Markets: A Playbook for Corporate Action.” https://www3.weforum.org/docs/WEF_Scaling_Voluntary_Carbon_Markets_2023.pdf.

⁸ ICVCM. 2024. *Core Carbon Principles, Assessment Framework and Assessment Procedure*. Version 2. <https://icvcm.org/wp-content/uploads/2024/02/CCP-Book-V2-FINAL-6Feb24-compressed.pdf>; <https://icvcm.org/wp-content/uploads/2024/02/CCP-Section-5-V2-FINAL-6Feb24.pdf>.

⁹ IOSCO. 2024. *Voluntary Carbon Markets Final Report*. <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD774.pdf>.

2 Stocktake of safeguards and governance models

Clarifying roles and relationships—particularly between standard-setting bodies and project proponents, and between project proponents and validation and verification bodies (VVBs)—is essential as carbon markets grow in scale, complexity, and scrutiny. Transparent and credible governance models are increasingly central to maintaining trust. Safeguards that mitigate real or perceived conflicts of interest—especially in financial relationships, verification arrangements, and role assignments—are critical for upholding market integrity and fostering institutional confidence.

This section presents a stocktake of governance approaches and safeguards adopted by key actors across the carbon crediting ecosystem:

1. **Clarification of roles and responsibilities** between standard-setting bodies, project proponents, and VVBs—particularly in cases where financial flows, oversight functions, or service relationships may give rise to real or perceived conflicts of interest.
2. **Independence of verification processes**, particularly in cases where project proponents directly contract and compensate third-party validators or verifiers. Such arrangements may give rise to perceived or actual conflicts of interest, potentially compromising the impartiality of verification outcomes.

Guidance from initiatives such as ICVCM and VCMI are already helping to address these considerations. Continued efforts to enhance transparency, strengthen performance monitoring, and explore oversight models can boost confidence among institutional investors and market participants.¹⁰

Continued efforts to enhance transparency, strengthen performance monitoring, and explore oversight models can boost confidence among institutional investors and market participants.

¹⁰ ICVCM. 2024. *Core Carbon Principles, Assessment Framework and Assessment Procedure*. Version 2. <https://icvcm.org/wp-content/uploads/2024/02/CCP-Book-V2-FINAL-6Feb24-compressed.pdf>; <https://icvcm.org/wp-content/uploads/2024/02/CCP-Section-5-V2-FINAL-6Feb24.pdf>.

These concerns are not unique to carbon markets. Issuer-pays models and pay-for-verification structures are common across financial and commodity markets. However, the absence of formal regulation in most carbon crediting systems—combined with increasing civil society and investor scrutiny—requires more deliberate design of safeguards and transparency protocols. Drawing from both carbon market experience and adjacent sectors, this section outlines emerging practices that can support clarification of roles and independence safeguards.

As carbon markets expand, thoughtful governance that incorporates best practice from both carbon and other markets is essential to ensure credibility, confidence, and scalability. Across the carbon asset value chain, various actors—such as standard-setting bodies and crediting programs—have introduced safeguards that offer valuable models for emerging systems. These measures help strengthen role clarity, mitigate perceived conflicts of interest, and promote system-wide integrity.

This section highlights emerging governance safeguards that have been introduced across carbon market. Drawing on practitioner insights and multi-stakeholder consultations conducted by the CMI Working Group, this section presents a stocktake of practical measures adopted by selected programs—illustrating how diverse governance models have addressed common challenges. These examples offer adaptable approaches that can inform ongoing efforts to strengthen institutional integrity and build market trust.

Across the carbon asset value chain, various actors—such as standard-setting bodies and crediting programs—have introduced safeguards that offer valuable models for emerging systems.

i. Clarification of roles and responsibilities between standard-setting bodies and project proponents

In many carbon crediting systems, standard-setting bodies are responsible for multiple functions—such as certification, issuance, and registry management. Perceptions of bias may arise in cases where the flow of finances is associated with certification and issuance of credits even in the absence of actual conflicts of interest. To strengthen role clarity and safeguard impartiality, several programs have implemented governance measures that aim at:

- Structural separation between registry operations and certification decisions;
- Neutral revenue models that decouple income from issuance volume or market prices.

Examples:

- The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) requires registry administrators to avoid financial, commercial, or fiduciary conflicts of interest, and to establish procedures to address and manage any such conflicts that may arise.¹¹
- The International Carbon Reduction and Offset Alliance (ICROA) mandates that revenue is not based on credit prices.¹²
- Puro.earth and Isometric use neutral fee structures that are decoupled from credit volume or sale timing.¹³

¹¹ “Programs should avoid administrator conflicts of interest and should have policies in place that prevent program registry administrators from having financial, commercial or fiduciary conflicts of interest in the governance or provision of registry services. Where such conflicts arise, and are appropriately declared, programs should have robust procedures in place to address and isolate the conflict.” ICAO (International Civil Aviation Organization). n.d. “Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA): Program Application Form, Appendix A: Supplementary Information for Assessment of Emissions Unit Programs.” https://www.icao.int/environmental-protection/CORSIA/Documents/TAB/Programme_Application_Form_Appendix_A_Supplementary_Information_for_Assessment.pdf; ICAO. 2024. “Clarifications of TAB’s Criteria Interpretations Contained in TAB Reports.” https://www.icao.int/environmental-protection/CORSIA/Documents/TAB/TAB2024/Clarifications_March2024.pdf.

¹² ICROA (International Carbon Reduction and Offset Alliance). 2024. “Carbon Crediting Programme Endorsement Review Criteria.” https://icroa.org/wp-content/uploads/2025/01/Programme-Endorsement-Review-Criteria_V3.3.1_12.2024.pdf.

¹³ Puro.earth. 2025. “Puro.earth Fee Structure.” <https://puro.earth/fees>; ICROA. 2024. “Isometric Assessment Framework.” https://icroa.org/wp-content/uploads/2024/10/Isometric-Application-Report_-ICROA.pdf.

Such measures aim to reinforce trust by minimizing dependencies that could influence certification and issuance outcomes. A comparative overview is provided in Table 3, summarizing how selected programs address revenue structures and role separation. This shows that safeguards can be achieved through various business and revenue models—and while no single model is inherently preferred, it is essential to maintain transparency regarding the implementation of safeguards, particularly in addressing potential or perceived conflicts of interest.

TABLE 3

Selected approaches to revenue structure and role separation in carbon credit programs

Entity/standard	Safeguard focus	Revenue model	Approach to role separation
CORSIA	Registry administrators must maintain independence from financial or commercial interests. ¹⁴	Fees are not explicitly specified in public documentation.	Separation between registry operations and entities with financial interests is required.
ICROA	Neutral revenue structures to avoid undue influence on credit issuance is encouraged. ¹⁵	Fees may only be based on transaction volume—not credit prices.	Standards must not set or influence market prices; revenue models must remain neutral. ¹⁶
Isometric	Financial responsibility is shifted to buyers and decouples credit timing. ¹⁷	Flat fee charged to buyers for MRV, independent of credit issuance volume.	Units require confirmed buyer offtake; verification fees are collected before credit issuance, ensuring upfront cost recovery and reducing the risk of non-payment.
Puro.earth	Scalability and integrity are promoted through a neutral, volume-based fee structure. ¹⁸	Fees are based on the volume of credits issued and the complexity of audits, rather than on market price.	No link to secondary market activity; operational separation between market facilitation and certification.
Verra	Operational independence between registry and certification functions is maintained. ¹⁹	Per-ton issuance fees are based on the reduced or removed carbon dioxide equivalent. ²⁰	Registry staff are structurally and functionally independent from certification activities.

Source: CMI WG

14 ICAO. n.d. "Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA): Program Application Form, Appendix A: Supplementary Information for Assessment of Emissions Unit Programs." https://www.icao.int/environmental-protection/CORSIA/Documents/TAB/TAB2024/DRAFT%20Programme_Re-assessment_Form_Appendix_A_Supplementary_Information_2025.pdf.

15 ICROA. 2025. "Code of Best Practice." https://icroa.org/wp-content/uploads/2025/02/ICROA_Code_Best_Practice_v2.6.1.02.2025.pdf.

16 ICROA. 2025. "Code of Best Practice." https://icroa.org/wp-content/uploads/2025/02/ICROA_Code_Best_Practice_v2.6.1.02.2025.pdf.

17 ICROA. 2024. "Isometric Assessment Framework." <https://icroa.org/wp-content/uploads/2024/10/Isometric-Application-Report-ICROA.pdf>.

18 Puro.earth. 2025. "Puro.earth Fee Structure." <https://puro.earth/fees>.

19 Verra. 2023. "Program Guide." <https://verra.org/wp-content/uploads/2023/08/VCS-Program-Guide-v4.4.pdf>.

20 Verra. 2024. "Program Fees Schedule." <https://verra.org/wp-content/uploads/2024/10/Verra-Program-Fee-Schedule-v1.0.pdf>.

ii. Independence of verification processes

Contractual arrangements in which project proponents engage third-party VVBs are common practice across VCMs and are well established in many physical commodity markets. While these arrangements offer practical advantages, they may also raise concerns about the impartiality and credibility of the verification process. To enhance transparency and support objectivity, various programs and standards have introduced governance measures designed to strengthen assurance processes:

- Strict accreditation and auditor independence rules;
- Performance oversight, quality controls, and the rotation of review teams;
- Conflict disclosure requirements and clear mitigation protocols.

Examples:

- ICVCM, CORSIA, and Gold Standard require International Organization for Standardization (ISO)-compliant accreditation and independent performance checks.²¹
- Puro.earth and Isometric remove direct financial ties by paying VVBs themselves.²²
- The Global Carbon Council (GCC) and others mandate separation between validation and verification activities.²³

These evolving practices demonstrate how safeguards can be adapted to support verifier independence while retaining operational efficiency. Table 4 outlines selected program features for maintaining impartiality in third-party verification.

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- ²¹ ICVCM. 2024. *Core Carbon Principles, Assessment Framework and Assessment Procedure*. Version 2. <https://icvcm.org/wp-content/uploads/2024/02/CCP-Book-V2-FINAL-6Feb24-compressed.pdf>; ICAO. 2021. *CORSIA Eligible Emissions Units*. https://www.icao.int/environmental-protection/CORSIA/Documents/ICAO%20Document%2008%20_%20CORSIA%20Eligible%20Emissions%20Units_March%202021.pdf; Gold Standard. 2025. "New Assurance Model and Management Process for Gold Standard Project Certification." <https://goldstandardhelp.freshdesk.com/support/solutions/articles/44002562276-new-assurance-model-and-management-process-for-gold-standard-project-certification#How-are-VVBs-and-expert-reviewers-selected?-%C2%A0How-is-conflict-of-interest-mitigated%20?%20%20>.
- ²² Puro.earth. 2025. "Puro.earth Fee Structure." <https://puro.earth/fees>; ICROA. 2024. "Isometric Assessment Framework." https://icroa.org/wp-content/uploads/2024/10/Isometric-Assessment-Report_-ICROA.pdf.
- ²³ GCC (Global Carbon Council). 2024. *Procedure for Approval of VVBs*. https://www.globalcarboncouncil.com/wp-content/uploads/2024/09/GCC-2.0-Procedure-for-Approval-of-VVBs_V4.0.pdf.

TABLE 4

Safeguard approaches to enable verifier independence and role clarity

Standard/ program	Accreditation and independence criteria	Oversight and quality assurance mechanisms	Safeguards for objectivity and impartiality
CORSIA	VVBs must be accredited by a national accreditation body to ISO 14065:2020 with CORSIA-specific criteria. ²⁴	Periodic spot checks and limits on verification cycles (six-year cap with three-year pause).	Disclosure of financial links; restrictions on registry ownership by verifiers; conflict isolation protocols.
GCC	Requires VVBs to be independent and separate from those who validate the project, with accreditation aligned to ISO 14065 and ICROA-endorsed standards. ²⁵	Aligns with ICVCM, ICROA, and CORSIA safeguard requirements.	Ensures structural separation of validation and verification stages to support impartiality.
Gold Standard	Accreditation through ISO 14065, UNFCCC-CDM, or Assurance Services International, in line with ICROA-endorsed program requirements. ²⁶	Uses expert reviewer panels, public reporting, and ongoing monitoring.	Conflict of interest assessments; reviewer neutrality checks; mandated training and capacity standards.
ICROA	Requires accreditation under ISO 14065, CDM, or Article 6.4, with specific sectoral limitations. ²⁷	Regular performance checks, rotation of auditors, and public oversight protocols.	Minimum of two reviewers per project; caps on sequential audits; protocols for managing underperformance.

²⁴ ICAO. 2021. *CORSIA Eligible Emissions Units*. https://www.icao.int/environmental-protection/CORSIA/Documents/ICAO%20Document%2008%20-%20CORSIA%20Eligible%20Emissions%20Units_March%202021.pdf.

²⁵ GCC. 2024. *Procedure for Approval of VVBs*. https://www.globalcarboncouncil.com/wp-content/uploads/2024/09/GCC-2.0-Procedure-for-Approval-of-VVBs_V4.0.pdf; ICROA. 2024. "Carbon Crediting Programme Endorsement Review Criteria." https://icroa.org/wp-content/uploads/2025/01/Programme-Endorsement-Review-Criteria_V3.3.1_12.2024.pdf.

²⁶ Gold Standard. 2025. "New Assurance Model and Management Process for Gold Standard Project Certification." <https://goldstandardhelp.freshdesk.com/support/solutions/articles/44002562276-new-assurance-model-and-management-process-for-gold-standard-project-certification#How-are-VVBs-and-expert-reviewers-selected?-%C2%A0How-is-conflict-of-interest-mitigated%20%20%20>; ICROA. 2024. "Carbon Crediting Programme Endorsement Review Criteria." https://icroa.org/wp-content/uploads/2025/01/Programme-Endorsement-Review-Criteria_V3.3.1_12.2024.pdf.

²⁷ ICROA. 2025. *ICROA Code of Best Practice*. https://icroa.org/wp-content/uploads/2025/02/ICROA_Code_Best_Practice_v2.6.1_02.2025.pdf.

Standard/ program	Accreditation and independence criteria	Oversight and quality assurance mechanisms	Safeguards for objectivity and impartiality
ICVCM	Accepts ISO 17029 with ISO 14065/14066 or UNFCCC Article 6.4 accreditation standards. ²⁸	Mandatory performance monitoring with suspension and revocation processes.	Requires underperformance reporting to accreditation bodies; standardized conflict mitigation protocols.
Isometric	VVBs are contracted and compensated by Isometric to ensure independence from the project proponent, with verification fees decoupled from credit volume. ²⁹	Annual verification limits (maximum five of seven years) apply and internal quality reviews are conducted.	Verification fees are decoupled from credit volume; standardized protocols are used to identify and mitigate conflicts.
Puro.earth	VVBs are contracted and compensated directly by Puro.earth, with requirements aligned to ISO 14065 and ICROA-endorsed practices. ³⁰	Conducts witness audits and maintains oversight of newly approved VVBs.	Enforces a five-year VVB rotation policy; has clear protocols for suspensions or revocations.
Verra	Requires ISO 14065 accreditation (scope Verified Carbon Standard, VCS) from an International Accreditation Forum Multilateral Recognition Agreement body, consistent with ICROA-endorsed program standards. ³¹	Implements structured quality reviews and transparent documentation; limits on repeated verifications.	Full separation between registry and certification activities; no registry role in trading or crediting.

Source: CMI WG

²⁸ ICVCM. 2024. Core Carbon Principles, Assessment Framework and Assessment Procedure. Version 2. <https://icvcm.org/wp-content/uploads/2024/02/CCP-Book-V2-FINAL-6Feb24-compressed.pdf>; <https://icvcm.org/wp-content/uploads/2024/02/CCP-Section-5-V2-FINAL-6Feb24.pdf>.

²⁹ ICROA. 2024. "Isometric Assessment Framework." https://icroa.org/wp-content/uploads/2024/10/Isometric-Application-Report_-_ICROA.pdf.

³⁰ Puro.earth. 2025. "Puro.earth Fee Structure." <https://puro.earth/fees>; ICROA. 2024. "Carbon Crediting Programme Endorsement Review Criteria." https://icroa.org/wp-content/uploads/2025/01/Programme-Endorsement-Review-Criteria_V3.3.1_12.2024.pdf.

³¹ Verra. n.d. "Validation and Verification." <https://verra.org/validation-verification/>; ICROA. 2024. "Carbon Crediting Programme Endorsement Review Criteria." https://icroa.org/wp-content/uploads/2025/01/Programme-Endorsement-Review-Criteria_V3.3.1_12.2024.pdf.

Recommendations

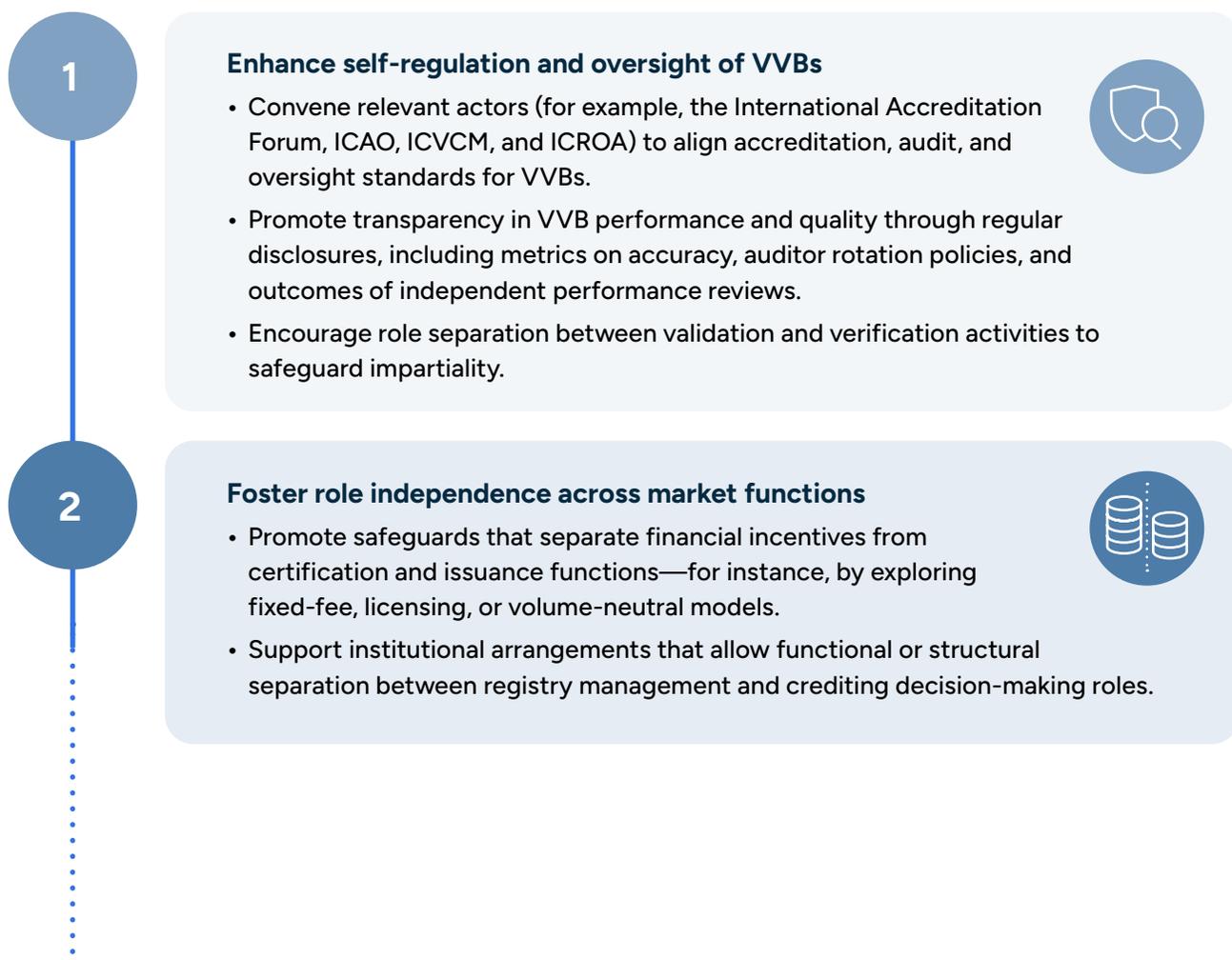
A range of existing safeguards—developed through initiatives such as CORSIA, ICVCM, and ICROA—already contribute to strengthening the integrity of carbon markets infrastructure. These frameworks provide credible benchmarks for eligibility, oversight, and verification. However, implementation practices vary, and in some areas—such as role delineation—consensus among stakeholders has yet to emerge. The carbon market landscape continues to evolve, and there is potential for greater alignment over time—while recognizing that certain commercial differences will remain, given the competitive nature of financial markets.

To support countries, standard-setting bodies, and infrastructure providers to advance high-integrity systems, the CMI WG proposes a focused set of forward-looking measures. These recommendations are built on existing practices, help close identified gaps, and promote convergence on transparent and resilient governance.

Drawing on the insights, stakeholder consultations, and stocktakes presented in this guidance note, the CMI WG outlines the following strategic priorities to guide near-term governance improvements.

FIGURE 4

Recommendations across key governance areas



3

Build accountability across the carbon asset life cycle



- Encourage the development of governance principles and legal frameworks that clarify the fiduciary and operational responsibilities of key actors such as VVBs, registries, standard setters, and program administrators.
- Leverage and align with emerging international guidance from entities such as UNIDROIT, ISO, IOSCO, and ICVCM to support coherence and enforceability of governance arrangements.

4

Clarify institutional functions and harmonize terminologies



- Adopt and promote use of harmonized definitions and standardized terminology across the carbon market value chain to support interoperability and reduce ambiguity.
- Encourage governments and standard-setting bodies to use ecosystem mapping tools to identify overlaps, gaps, and coordination needs.
- Facilitate convergence on functional definitions and role mappings to support cross-border interoperability and alignment with Article 6 implementation.

5

Enable ongoing dialogue and capacity building



- Strengthen international coordination and convergence through participation in global initiatives (for example, Article 6.4 mechanism, ICVCM, and VCMI).
- Promote South-South cooperation and multi-stakeholder dialogues to enable shared learning and the adaptation of governance practices to country contexts.
- Leverage the CMI WG tools—such as the glossary of terms, ecosystem mapping framework, and technical guidance notes—as global public goods to support training and institutional development.

Way forward

This technical guidance note aims to inform robust governance practices across the carbon market ecosystem. It emphasizes the need for clearly defined roles among key actors including crediting programs, VVBs, registry providers, national authorities, and project proponents. It also highlights the importance of consistent terminology and institutional safeguards to ensure systems are transparent, accountable, and interoperable at scale.

The scope of the note includes:

- **Stocktaking of selected governance challenges and safeguards**, with a focus on clarifying roles and independence of validation and verification bodies (VVBs)—two important areas identified through stakeholder consultations and market assessments.
- **A mapping of ecosystem entities and functionalities, along with a glossary of terms**, aimed at reducing ambiguity, fostering a shared understanding of key market actors and their roles, and contributing to ongoing efforts to harmonize terminology.
- **Strategic recommendations** grounded in best practices and international guidance, offering actionable measures to strengthen institutional integrity, reduce perceived conflicts of interest, and align governance approaches across the carbon crediting lifecycle.

This guidance is relevant to a wide range of stakeholders—including standard-setters, registry operators, national authorities, carbon crediting programs, project developers, and multilateral organizations. Whether designing new systems or enhancing legacy processes, users can draw on this note to:

- Leverage the ecosystem mapping framework to assess institutional functions and identify areas where role clarification may be needed;
- Apply international safeguard approaches to address potential governance and integrity risks;
- Align with evolving regulatory, legal, and financial requirements.

As carbon markets grow in complexity and converge across voluntary and compliance systems, robust ecosystem governance must evolve from serving as a background consideration into a central design principle. Embedding clarification of roles, independence safeguards, and harmonized terminology into carbon markets infrastructure will be critical to ensuring transparency, fostering trust, and enabling the scalable delivery of climate finance.

Following extensive discussions and consultations, the CMI WG subgroup identified several priority actions to strengthen ecosystem governance and recognized the value of continued collaboration through potential technical workshops or multi-stakeholder initiatives. These efforts will help reinforce consensus on key governance issues and support the implementation of coordinated solutions across the carbon market ecosystem.

Annex: Glossary of terms - Key entities and functionalities in carbon markets

Table A1: Key functional stages and processes across the carbon market lifecycle

#	Functionality	Description
1	Methodology creation	<p>Parties to the Paris Agreement and several independent standards may develop and adopt their own methodologies and standardized baselines for use in voluntary carbon markets (VCMs) and under Article 6.2, or adopt those developed by the Supervisory Body of the United Nations Framework Convention on Climate Change (UNFCCC) under Article 6.4. Most methodologies used in current carbon market schemes base their approach of accounting for greenhouse gases (GHGs) from the Intergovernmental Panel on Climate Change (IPCC) Guidelines for national GHG inventories. The main programs serving VCMs have historically recognized Clean Development Mechanism (CDM) methodologies as an acceptable standard, while also developing additional scheme-specific methodologies. Additionally, VCM schemes can stipulate additional criteria that must be met.¹</p> <p>Under Article 6.2 guidance adopted at COP26, where a mitigation outcome is measured and transferred into tonnes of carbon dioxide equivalent (the GHG metric tCO₂eq), the measurement must adhere to the methodologies and metrics assessed by the IPCC and adopted by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA).²</p> <p>A rich repository of approved methodologies that may be used for transitioning to the Paris regime has been created. Under the rules, modalities, and procedures for the new mechanism established under Article 6.4, the new supervisory body is tasked with reviewing the baseline and monitoring methodologies used for the CDM with a view to appropriately revising them under the Article 6.4 mechanism.³</p> <p>New technologies can provide more accurate and frequent data. Therefore, modular and more adaptable methodologies can help enhance efficiency in the market.</p>
2	Project design and development	<p>The project design stage includes developing a project concept, choosing or developing a baseline, proving additionality, monitoring methodology, and consulting stakeholders.⁴</p> <p>The project design document (PDD) contains a description of the chosen technology and explains the methodology used to define the baseline scenario, demonstrate additionality, and calculate emission reductions. It also contains information on the monitoring of all relevant technical parameters, including how monitoring procedures will be established, measurements made, quality controlled, and records stored and accessed. It contains an estimate of the volume of emission reductions that will be achieved by the project. Finally, it documents how the project contributes to sustainable development. The PDD is used throughout the implementation phase to ensure compliance with the parameters outlined in the document.⁵</p> <p>During the project design stage, the project owner prepares the project documentation as required by the standards body or the relevant host country's Article 6.2 policy framework.⁶</p>

Table A1: Key functional stages and processes across the carbon market lifecycle

#	Functionality	Description
3	Validation	<p>The developer submits the PDD to an accredited validation and verification body (VVB) approved by the carbon offset program.⁷ Validation refers to the ex-ante⁸ independent assessment of a project's design and implementation against the requirements of a particular GHG program or standard. The purpose of validation is to ensure that a project can deliver the expected GHG emissions reductions or removals, that it complies with the relevant standards and rules, and that it has the necessary systems and procedures in place to monitor and report on its performance.⁹</p> <p>At a country level, especially under Article 6.4, existing guidance states that the designated operational entity will select a competent team to perform the validation or verification for the Article 6.4 project in accordance with the "Article 6.4 accreditation standard."¹⁰</p>
4	Due diligence/ know your customer and anti-money laundering verification	<p>Know your customer (KYC) is the regulatory process whereby a financial institution verifies a customer's identity by assessing their credentials before allowing them to use a service. KYC policies allow companies to better understand their customers and their financial dealings, which helps to mitigate and manage risks.¹¹ Effective KYC policies protect companies from doing business with organizations or individuals involved in illegal activity, such as money laundering, terrorist financing, or corruption. It also enables financial institutions to gain a better understanding of their customers' businesses, which can provide valuable insights for financial institutions.¹²</p> <p>Anti-money laundering (AML) is a broader and more holistic practice than KYC. AML compliance is the comprehensive set of policies that a company uses to protect against criminal infiltration, money laundering, terrorism financing, human trafficking, and more. KYC is an important part of AML for corporations, banks, financial technology companies, and other financial institutions.¹³</p> <p>The development and implementation of AML and KYC guidelines for VCMs will help minimize the risk of fraud or money laundering as the market develops.¹⁴ It is argued that the implementation of AML and KYC guidelines and processes used within regulated markets should be extended to VCMs to guard against fraudulent actors who may take advantage of the maturing market.¹⁵</p>
5	Information security	<p>Information security is the protection of important information against unauthorized access, disclosure, use, alteration, or disruption. It helps ensure that sensitive organizational data are available to authorized users, remain confidential, and maintain their integrity. Information assets, which might include financial, confidential, personal, or sensitive data, need to be protected. These assets can take the form of digital files and data, paper documents, physical media, and even human speech.¹⁶</p> <p>Throughout the data life cycle, information security oversees functions such as infrastructure, software testing, auditing, and archiving.¹⁷ It prevents unauthorized access to and use or destruction of information or systems. It includes measures to protect electronic information and computer systems from theft or damage to hardware, software, or information. Examples include multi-factor authorization, which requires more than one piece of information to verify an individual's identity.¹⁸</p>
6	Registration	<p>Registration occurs when a credit-issuing standard determines that a prospective project meets the necessary criteria established in a published methodology, including third-party validation and assurance, and gives official approval to list the project in that standard's registry. Once registered, a project can submit requests for credit issuances.¹⁹ The purpose of registration is to ensure that the project meets the basic requirements set by the carbon standard (such as the CDM, Verified Carbon Standard (VCS), and Gold Standard) and is eligible to generate carbon credits.</p>

Table A1: Key functional stages and processes across the carbon market lifecycle

#	Functionality	Description
7	Project implementation	Executing the project requires the coordination of multiple activities, which may include technology deployment; ensuring that monitoring systems are calibrated and meet quality assurance/quality control requirements as per the protocol; conducting the required monitoring, data collection, analysis, and reporting; computing GHG emission reductions based on a comparison of baseline and project emissions in line with the quantification methodology in the applicable protocol; and identifying any data gaps or other issues that could affect the project outcomes. ²⁰
8	Monitoring, reporting, and verification	<p>Measurement, reporting, and verification (MRV) refers to the multi-step process used to measure GHG reductions by a specific mitigation activity over time, such as the reduction of emissions from deforestation and forest degradation, and report these findings to an accredited third party. MRV seeks to prove that an activity has actually avoided or removed harmful GHG emissions additional to the established baseline so that actions can be converted into credits with monetary value. The third party then verifies the report so that the results can be certified and carbon credits can be issued.^{21, 22}</p> <p>Project owners should record the emission reductions or removals in a monitoring report based on the MRV protocol defined in the PDD as per the requirements of the relevant standard. An independent entity should then be contracted to verify the reductions or removals recorded in the monitoring report.²³ Most standards have a list of designated VVBs, which must go through a process of accreditation under that standard.</p> <p>MRV processes can be digitized as well. (Digital) MRV infrastructure includes developing data aggregation platforms and/or dashboards and data quality checks, including import, statistical, and cross-checks. It entails digitally monitoring data parameters to achieve a reduction or removal of GHG emissions according to the rules and requirements of a standard-setting program. Digital monitoring happens when the registered carbon project activity involves retrieving data from a sensor, meter, and/or aggregate platform.²⁴ Standardizing data requirements and consolidating existing methodologies into a set of standardized, modular components can help increase cost efficiency and expedite the MRV process.</p>
9	Third-party verification/review	<p>Verification is the periodic independent review and ex-post determination of the monitored emission reductions or removals by a qualified accredited entity.²⁵ The verification process is intended to confirm: (1) emission reductions or removals per the validated project documents, (2) correct use of the applicable methodologies and tools, and (3) that the project activity continues to meet the applicable rules and requirements of the standard/mechanism.²⁶</p> <p>The project owner must follow a monitoring plan that details how to track and report on carbon assets and other data relevant to the project as specified in the applied methodology and independent standard, as applicable.²⁷</p> <p>Two models currently support digital verification. Digital verification occurs via a project-type-specific digital verification platform developed by the project participant, or a third-party service provider hired by the project participant. Verification is conducted by an independent third-party auditor. In the integrated quantification and verification approach, a platform is developed and hosted by an independent entity that simultaneously conducts both the quantification and verification of data capture and the quality audit.²⁸</p>

Table A1: Key functional stages and processes across the carbon market lifecycle

#	Functionality	Description
10	Certification	<p>To receive carbon credits, climate change mitigation projects need to receive certification through a carbon crediting program. Certification is the verification and formal recognition of the emission reductions achieved by a registered carbon offset project, and it is essential for the issuance of carbon credits.</p> <p>In VCMs, carbon crediting programs set standards for carbon credit quality, certify projects, issue carbon credits, and have a registry to track certified projects, issuance, and retirement of carbon credits.²⁹</p> <p>Under the CDM, project certification was defined as an assurance from the designated operational entity that the stated/estimated emissions reduction/removal had been achieved.³⁰ The purpose of certification is to confirm that the emission reductions claimed by a project have been achieved, are additional (would not have happened without the project), and are accurately measured.</p>
11	Issuance	<p>Issuance is a specified quantity of serialized units of emission reductions issued to project participants' accounts in accordance with the rules and requirements of a mechanism/standard.³¹ It is the total volume of generated offsets that are issued following verification by a VVB (such as VCS). Each offset receives a unique serial number that enables traceability and auditing³² to avoid double-counting and is listed in a registry.³³ Offset credits are typically deposited into the project developer's account in a registry system administered by the offset program.³⁴ Any ownership transfers or retirements must be reported to the issuing standard's registry.³⁵</p>
<p>Under the VCM, once carbon credits have been verified, they are eligible for issuance and are available for trading. This means they enter the market and can be sold directly to companies that will retire them, or they enter the secondary market, where they will continue to be traded until they are retired to offset carbon emissions.³⁶</p>		
12	Authorization/endorsement	<p>(Undertaken at the country level)</p> <p>Authorization refers to the written authorization (via a letter of authorization) of units or activities subject to the regulatory requirements of the Paris Agreement, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), or other specified uses. The mitigation activities or units receive a letter of authorization from the host country and provide a commitment by the host country to carry out corresponding adjustments as needed.³⁷</p> <p>Endorsement/acknowledgement: If applicable, a host country may issue an optional letter of endorsement/acknowledgement to indicate the recognition of a mitigation activity and its link to the host country's nationally determined contribution (NDC). This optional letter is expected to endorse the claim that the mitigation activity or units contribute to the financing or implementation of the host country's NDC. For avoidance of doubt, an endorsement does not commit the host country to a corresponding adjustment.³⁸</p>

Table A1: Key functional stages and processes across the carbon market lifecycle

#	Functionality	Description
13	Labeling	<p>(Undertaken at the country or standard level)</p> <p>Standards/mechanisms may choose to label units to indicate their compliance with the Paris Agreement, CORSIA, or other uses, and to highlight key attributes,³⁹ such as the application of a corresponding adjustment and a letter of endorsement/authorization. These labels are intended to allow different use cases by transparently listing the characteristics of units.⁴⁰ For example, letter of approval; carbon credit label; certified emission reduction label; climate, community, and biodiversity label; and verified carbon unit label.</p>
<p>Under the Compliance Carbon Market (CCM), the country's registry should publish information transparently, and as needed, on how carbon assets are used for different purposes (toward its own NDCs, for other countries' NDCs, or for other programs) once carbon assets have been issued, authorized for specific use (if required), and transferred to another participating party. Based on this information, the host country should record the need to carry out a corresponding adjustment every year in the country's accounting system.⁴¹</p>		
14	First transfer (relevant only for ITMOs)	<p>The definition of "first transfer" varies depending on whether internationally transferred mitigation outcomes (ITMOs) are transferred between countries and contribute to a receiving country's NDC or are transferred to international-market-based schemes such as CORSIA.</p> <p>Specifically, "first transfer" in the first case refers to "the first international transfer of the mitigation outcome," whereas in the second case it refers to a transfer that can occur at "(1) the authorization, (2) the issuance, or (3) the use or cancellation of the mitigation outcome, as specified by the participating party."⁴² This is still under negotiation.</p> <p>This definition refers to a specific UNFCCC agreement—any amendments thereto supersede what is written here.</p>
15	Trading	<p>Carbon credit trading is a process where carbon credits that have been issued and added to a registry may be purchased, traded, or sold, either over the counter through brokers or through exchanges on secondary markets, both spot and derivatives. Many purchasers of carbon credits are motivated to offset their own emissions or to contribute to climate change mitigation. Some purchasers of carbon credits are investors hoping to achieve a return through their subsequent resale at a higher price. Other purchasers buy carbon credits to retire them and claim an emissions reduction or to contribute to climate change mitigation efforts. After a carbon credit has been retired, it cannot be traded again.⁴³</p>

Table A1: Key functional stages and processes across the carbon market lifecycle

#	Functionality	Description
16	Primary market trading	<p>Primary market trading refers to the initial transfer of offsets from a project developer to the first buyer in line—this can be an offset retailer or broker (that is, the “secondary market”) or a buyer of offsets for “end use” (that is, the end user or end buyer) in the voluntary or compliance carbon offset markets.⁴⁴ Project owners can engage in transactions in the marketplace in several ways:</p> <p>Direct sales—that is, offtake agreements with an end user.⁴⁵</p> <p>Selling to a retailer, who purchases the offsets with the intention of finding a match with an end user.⁴⁶</p> <p>Decentralized peer-to-peer trading—the use of blockchain and other decentralized technologies to facilitate the buying, selling, and trading of carbon credits without relying on a central authority or traditional intermediaries.⁴⁷</p> <p>Credits in compliance markets are often auctioned or sold through open market exchanges, whereas transactions in voluntary carbon markets (VCMs) are primarily exchange-traded or occur over the counter.⁴⁸</p> <p>Auctions can help scale the market by enhancing price transparency, enabling value discovery, and improving access to high-quality credits.⁴⁹</p>
17	Secondary market trading	<p>Once carbon credits have been issued and added to a registry, they may be purchased, traded, or sold, either over the counter through brokers or through exchanges on secondary markets, including spot and derivative markets.⁵⁰ Secondary markets include all subsequent trading of emission allowances and offset credits. Market participants can trade both spot and derivatives contracts based on emissions allowances and offsets (in the case of derivatives, primarily through standardized contracts like futures and options).⁵¹ This takes place over exchanges and over-the-counter markets.</p>
18	Post-trade infrastructure: Settlement	<p>Any post-trade settlement infrastructure has two critical elements. First, it is essential that the buyer receives the relevant asset and the seller receives payment. Second, it is essential that each party receives good legal title, and legal and beneficial ownership of the relevant asset or payment amount.⁵²</p>
19	Money settlement	<p>This refers to a process by which obligations of buyers and sellers to a trade are discharged; an act between two or more parties to fulfill monetary obligations.⁵³ The traded instrument is delivered to the new owner and cash is transferred.⁵⁴</p>

Table A1: Key functional stages and processes across the carbon market lifecycle

#	Functionality	Description
20	Physical settlement/delivery	An asset or credit, such as an instrument or commodity, is delivered or transferred in physical form. ⁵⁵ Unlike commodities, which can be sampled or measured on delivery, a credit buyer cannot consistently or easily ascertain quality by examining delivered emissions reductions or removals. While the credits themselves can be delivered to the buyer, the underlying asset (emissions reduction or removal) does not typically transfer to the buyer's possession and use. ⁵⁶ Regulatory/licensing requirements are in effect in some jurisdictions for these functions. In some cases, however, the credit is treated as a physically delivered product, whereby contracts held to expiry result in physical delivery. ⁵⁷
21	Post-trade infrastructure: Clearing	This is the process of transmitting, reconciling, and, in some cases, confirming transactions prior to settlement, potentially including the netting of transactions and the establishment of final positions for settlement. This term is also sometimes used (imprecisely) to cover settlement. For the clearing of futures and options, this term also refers to the daily balancing of profits and losses and the daily calculation of collateral requirements. ⁵⁸
22	Post-trade infrastructure: Carbon credit insurance	Carbon insurance protects the purchase of carbon credits. Carbon credits are purchased from carbon projects, which can be directly affected by various external factors. These risks can contribute to the reversal, invalidation, or non-delivery of carbon credits, leaving the carbon credit buyer exposed. Consequences include reputational harm if a buyer is associated with a project that is deemed to be inefficient, unethical, or fraudulent, while those in industries where offsetting is a regulated activity (for example, airlines buying CORSIA-eligible credits) may face compliance repercussions. Carbon insurance protects against all these exposures. ⁵⁹
23	Post-trade infrastructure: Carbon credit rating	Carbon credit ratings are an evaluation of a particular claim and can be produced for different aspects of carbon credits. Carbon credit ratings are most commonly assigned to evaluate the risk that a carbon credit is not delivering the GHG mitigation it claims. ⁶⁰
24	Post-trade infrastructure: Data aggregation and analytics	Available data on carbon markets is leveraged and combined with modeling to generate insights into trends in carbon markets. ⁶¹

Table A1: Key functional stages and processes across the carbon market lifecycle

#	Functionality	Description
25	Retirement	To retire or offset a carbon credit refers to the actions performed in a registry to formally and transparently remove a credit from circulation so that it cannot be further transferred or otherwise transacted. ⁶² Retirement ensures that carbon credits representing real and verifiable emissions reductions or removals are not double-counted or used to offset emissions more than once. ⁶³ It is the total volume of offsets for which the impact has been claimed by the end buyer; once an offset has been retired, it can no longer be traded. ⁶⁴
26	Cancellation	Cancellation refers to the process of permanently removing a carbon credit from circulation for purposes other than offsetting—for example, due to overissuance or expiry. ⁶⁵ It may also be used when a unit is “cancelled” or removed from one standard/program and “recognized” in another standard/program.
27	Reporting	Under the Paris Agreement, parties participating in cooperative approaches are required to report relevant information for the purpose of transparency and robust accounting, and to ensure consistency with Article 6.2 guidance. ⁶⁶ In post-trade reporting, trades are reported to the applicable regulators or trade repositories. ⁶⁷

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
Primary market entities			
1	Project developer	<p>A project developer is the person or organization that intends to develop a crediting project. This could be the project owner, a consultant, or a specialized service provider.⁶⁸ These are entities that manage and operate a project (a private company, nonprofit, or other nongovernmental organization⁶⁹) that reduces or removes GHG emissions. They select the methodology or protocol and draft a PDD.⁷⁰ Project developers design projects, obtain funding, and physically create the project.⁷¹ Prior to any project launch, the project developer should identify the source of funds for executing the project. Advance financing can come directly from prospective buyers of the offsets. In other cases, the developer may have a business model and enough reserves for self-financing. A more common approach is an Emission Reduction Purchase Agreement that contracts for future delivery (see 1.17) of offset credits (or in some cases, options⁷²) as they are issued.⁷³</p> <p>After developing the PDD and other technical documents, the project developer also registers the project with the standards body, manages project validation and verification processes, and manages periodic monitoring and reporting as per the methodology. They frequently liaise with the standards bodies and are responsible for contracting the VVBs.⁷⁴</p>	ReNew Power, Honeywell, Klik, Wildlife Works ⁷⁵
2	Project owner	The project owner is the operator and owner of the physical project site where the crediting project takes place. An owner can be any private person, company, or organization. ⁷⁶	
3	Project proponent	<p>The project proponent obtains the rights to the carbon credits from the owners of the physical carbon. They hold the legal rights to the carbon credits and conduct transactions in the market. They are responsible for distributing the benefits equitably to the other project participants according to pre-agreed terms. They are also responsible for overseeing or facilitating implementation, development, and the required carbon project reporting, and mitigating any non-conformance with the protocol or contracts. They are responsible for ensuring successful implementation, long-term maintenance of the carbon project, and conformance with the carbon program standards and methodologies.⁷⁷</p> <p>The project developer and project proponent can be (and often are) the same entity.⁷⁸ The two basic functionalities of project registration and credit inventory management are relevant to project developers and project proponents.⁷⁹</p> <p>Project developers and project proponents are not always the same entity. While the project developer oversees project implementation, the project proponent is the legal entity requesting the registration of a mitigation activity and issuance of carbon credits under a carbon crediting program. The project proponent may be a public or private entity.⁸⁰</p>	

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
4	Non-transactional registry (informational registry)	<p>A register is a database that records unit-level information as required by the market mechanism. This could include the vintage of the carbon unit, the serial number and location of the project for which the carbon unit was issued, the project funder, and/or carbon credit verification details.⁸¹ It tracks and records the issuance, ownership, transfer, and retirement of carbon credits and associated project information and documentation.⁸²</p> <p>These can also be understood to be non-transactional registries that enable information from underlying cooperative approach registries to be retrieved and viewed.⁸³ They may include information from other registries as well as information from designated authorities and others. A registry recording a detailed plan for an NDC is an example of this.</p>	S&P Global Commodity Insights, Xpansiv, EcoRegistry, UNFCCC Article 6.4 Mechanism (Paris Agreement Crediting Mechanism) Registry
5	Transactional registry (with transfer capability)	<p>These are registries that enable carbon credits to be transferred between registry accounts.⁸⁴ More broadly, a transaction registry is a database with all the features of a register, and has the capability to transact carbon units between multiple account holders on the transaction registry (internal transfer). It also has the capability to transfer carbon units to another transaction registry (external transfer). The more complex the market mechanism, the more features the transaction registry will require.⁸⁵</p>	Verra, Gold Standard, American Carbon Registry, Plan Vivo, BioCarbon, Climate Action Reserve, ⁸⁶ UNFCCC Article 6.4 Mechanism (Paris Agreement Crediting Mechanism) Registry
6	Infrastructure providers/operators	<p>A carbon markets infrastructure provider is an entity that offers the necessary systems, platforms, and services to facilitate the trading of carbon credits. These providers ensure that the carbon market operates smoothly, transparently, and efficiently. This includes developing registries, designing MRV mechanisms, establishing secondary markets, and providing post-trade infrastructure. They also provide services like registries, exchanges, financial intermediaries, and credit rating agencies.⁸⁷</p>	S&P Global Commodity Insights, Xpansiv, Puro.earth, Climate Impact X, B3

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
7	Multilateral organizations	Multilateral organizations such as the World Bank, African Development Bank, and United Nations bodies support countries in building technical capacity to develop and implement policy frameworks and carbon markets infrastructure. Leveraging their collective convening power, these entities also provide guidance on standardization, promote widespread adoption of good international practices, and provide capacity and technical support to developing countries. ⁸⁸	Multilateral development banks—World Bank, European Bank for Reconstruction and Development; United Nations—United Nations Development Programme, UNFCCC, United Nations Environment Programme; Climate Action Platform for Africa; Africa Carbon Markets Initiative
8	Carbon crediting program/standard-setting body/certification body	<p>A carbon crediting program (also known as a standard setter or certification body) is a standard-setting program that registers mitigation activities and issues carbon credits.⁸⁹ It sets standards for carbon credit quality, registers validated projects, identifies or directly accredits eligible VVBs, issues carbon credits for verified emissions reductions or removals, and has or designates a registry to track projects and the issuance and retirement of carbon credits.⁹⁰</p> <p>It issues the rules and requirements for GHG crediting programs, reviews and runs public consultations for these rules and methodologies, and ultimately approves them. It also reviews initial project design documents and reviews and approves the verification of carbon credits.⁹¹ In some cases, however, the “standard” or “methodology” is legislatively driven and the issuance is done by a separate body.⁹²</p> <p>Such entities have also set up guidelines on methodology, validation, registration, issuance, and accreditation procedures.</p>	VCS; Gold Standard; American Carbon Registry; Climate Action Reserve; Architecture for REDD+ Transactions; Plan Vivo; Climate, Community and Biodiversity Standards (CCB Standards); Puro.earth; UNFCCC Article 6.4 Supervisory Body ⁹³

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
9	Validation and verification bodies/certification bodies/third-party auditors	<p>It is an independent third-party entity accredited to perform validation and/or verification audits. VVBs are often also referred to as auditors.⁹⁴ They validate the PDD, assessing whether the project design meets the standard's criteria and is designed according to the methodology.⁹⁵</p> <p>VVBs are critical to ensuring the integrity of the projects registered with a standard's program. After a project has implemented its activities and is monitoring progress—documented in monitoring reports—a VVB undertakes verification, confirming that all emission reductions or removals are quantified according to the standard's requirements. The emission reductions and removals are then issued as carbon credits and are released for trading. Each credit is assigned a serial number in a registry.⁹⁶</p> <p>Additionally, VVBs evaluate specific projects to determine whether they fulfill the standard's methodology protocol and the requirements to be tagged with additional attributes.⁹⁷</p>	GS, ⁹⁸ TÜV SÜD, DNV, European Union Carbon Removals and Carbon Farming Regulation, UNFCCC ⁹⁹
10	Methodology validator	<p>A methodology validator reviews and approves proposed methodologies—that is, the protocols that define how emission reductions or removals are quantified, monitored, and verified.¹⁰⁰ This is distinct from project-level validation (Entry 9), which evaluates whether an individual project conforms to an existing approved methodology.</p> <p>Methodology validation is the process of evaluating a proposed new methodology and the reasonableness of assumption, limitation, and method included with its application.¹⁰¹ Validators conduct a technical review to determine whether the methodology will achieve the carbon sequestration it claims.¹⁰²</p>	UNFCCC, International Organization for Standardization (ISO), national governments, crediting programs (Verra, Gold Standard, American Carbon Registry)

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
11	Verification accreditation agency	<p>Accrediting verification bodies certify that emission reductions or removals comply with a specified standard¹⁰³ (for example, ISO 14065).¹⁰⁴</p> <p>A system for accreditation already exists, with national accreditation bodies accrediting VVBs to ISO 14065. This process is reinforced by a system of peer assessment undertaken by accreditation bodies to evaluate the effectiveness of other accreditation bodies acting within their geographic regions.¹⁰⁵ The International Accreditation Forum provides guidance on the application of the ISO standards used in accreditation.¹⁰⁶</p> <p>Accreditation is a pivotal process within the framework of the Article 6.4 mechanism (known as the <u>Paris Agreement Crediting Mechanism</u>) under the UNFCCC. It is a formal recognition by the mechanism's <u>Supervisory Body</u> to an organization, confirming they have the institutional capacity, competence, and impartiality needed to perform validation or verification/certification functions in accordance with <u>Article 6.4 rules and regulations</u>.</p> <p>Once accredited, the designated operational entity plays two important roles:</p> <p>It validates and seeks registration for new activities or renews existing ones under the Article 6.4 mechanism.</p> <p>It verifies and certifies the emissions reductions of registered activities.¹⁰⁷</p> <p>National governments and crediting programs also set up their own guidelines on the accreditation of VVBs.</p>	International Accreditation Forum, CDM Executive Board, carbon crediting standards, UNFCCC, national governments ¹⁰⁸
12	Data aggregation	This refers to the aggregation of data from external data generators in a single, open location. ¹⁰⁹	Climate Policy Initiative Net Zero Finance Tracker, Climate Action Data Trust ¹¹⁰
13	Data reconciliation/mapping	<p>In a data transfer or data migration process, data reconciliation verifies whether the migration of data from the source database to the target database has occurred correctly. The data in the target database are compared with the data in the source database to detect errors.¹¹¹</p> <p>Data mapping is the mapping of data from multiple providers or direct upload to sustainability/climate-related frameworks to allow for facilitated disclosure.¹¹²</p>	Hong Kong Stock Exchange, Green and Sustainable Finance Data Repository, Climate Action Data Trust ¹¹³

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
14	Data analytics	Data analytics entities undertake carbon market analysis, combining data collection with data science, geospatial data, artificial intelligence/machine learning, and modeling to generate insights into carbon pricing and trends in the carbon market. ¹¹⁴	Trove Research, Berkeley Carbon Trading Project, AlliedOffsets, ClearBlue Markets
15	Traders	Individuals or entities can purchase offsets for their own internal use or for resale to an intermediary (another buyer). Intermediaries such as retail traders purchase offsets with the intention of reselling.	
16	Primary market trading infrastructure: Auction platforms	<p>In an auction, the seller provides its emissions reduction credits (ERCs) to an auction provider, who holds the ERCs in trust in the seller's account and puts them up for auction under conditions agreed with the seller (for example, auction duration and floor price per auctioned ERC). Other information required from the seller may include proof of carbon credit issuance from an accredited carbon standard, information on significant co-benefits, and third-party ratings of project leakage and permanence risks.</p> <p>During the auction process, multiple potential buyers compete to outbid each other. The ERCs are awarded by the auction provider to the highest bidder, which requires a contract with the auction provider. Auctions do not require the signing of Emission Reduction Purchase Agreements with individual buyers but offer multiple potential buyers the opportunity to purchase carbon credits through a sealed bid process. Sellers are obliged to sell when they list their credits on an auction platform, whereas they can opt out if they list the credits on an exchange.</p>	<p>Provided by auction platforms or big exchanges such as CME Group, Intercontinental Exchange, and Xpansiv CBL</p> <p>World Bank Pilot Auction Facility</p> <p>Climate Impact X (marketplace, auction house, and exchange for carbon credits)</p>
17	End user	<p>An end user is an entity (such as an individual, company, or organization) that purchases carbon credits, either directly from the project developer or from an intermediary, with the intention of retiring the credits to claim them as offsets against emissions.¹¹⁵ End users purchase offsets to count against their emissions and typically retire them to signal that those offsets are no longer available for sale.¹¹⁶</p> <p>End buyers that need to purchase credits to offset their emissions tend to prefer non-standardized products, which allow them to examine the characteristics of each underlying project, ensure the quality of the credit being purchased, and thus protect themselves from any accusations of greenwashing.¹¹⁷</p> <p>The downstream market is made up of end buyers: companies—or even individual consumers—that have committed to offset part of or all their GHG emissions.¹¹⁸</p>	

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
Secondary market entities			
18	Brokers	<p>Brokers buy carbon credits from a retail trader and market them to an end buyer, usually earning a commission.¹¹⁹ Professional emission reduction traders buy and sell emission reductions by taking advantage of market price distortions and arbitrage possibilities.¹²⁰</p> <p>In the offset credit wholesale market, the transactions of emission offset buyers and sellers can be facilitated by brokers or exchanges. Exchanges are usually preferred for frequent trades or large volumes with standardized contracts or products, while brokers typically arrange transactions for non-standardized products, occasional trades, and small volumes.¹²¹</p>	South Pole, Cool Effect ¹²²
19	Retail aggregators/traders	Retail aggregators/traders purchase large numbers of credits directly from the supplier, bundle those credits into portfolios ranging from hundreds to thousands of tCO ₂ e, and sell those bundles to the end buyers, typically with a commission. ¹²³	

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
20	Secondary market trading infrastructure: Exchange	<p>Trading platforms (such as exchanges) enable carbon credit holders to buy and sell carbon assets in environmental markets. Key benefits of an exchange include a centralized pool of liquidity, electronic clearing and settlement, same-day settlement of products and funds, real-time price transparency, anonymous trading, and a transparent web-based marketplace.¹²⁴</p> <p>Exchanges promote more liquidity, provide price transparency, and act as financial intermediaries for trade. An exchange also reduces counterparty risk through its clearing mechanism, serving as the buyer for every seller and as the seller for every buyer.¹²⁵</p> <p>In contrast to over-the-counter transactions, exchanges provide a central meeting place where buyers and sellers can buy and sell. Market participants' identities are confirmed before they become members of and trade on an exchange; transactions are cleared; and price and volume information is regularly reported to make the market transparent.¹²⁶</p> <p>A spot exchange may become a venue where contract terms become standardized, information can be shared equally among all market participants, and counterparty risks can be managed in a cost- and time-efficient manner. Several carbon exchanges have emerged to optimize the price discovery process and the management of counterparty risks.¹²⁷</p> <p>A <i>spot trade</i> is a transaction where commodities are traded for immediate delivery; settlement for these usually happens within two working days.¹²⁸</p> <p>A <i>futures trade</i> is a transaction where the participants agree on a sale at a predetermined price, with delivery happening at a specified time in the future.¹²⁹</p> <p>In a futures contract, counterparties agree to trade allowances/offsets at a certain price on a certain date in the future (the contract's expiration date). The price is locked in on the date at which the futures contract is traded, but the change in ownership of the allowance only occurs after the contract's expiration date.¹³⁰</p>	Xpansiv, Climate Impact X in Singapore, Carbon Trade Exchange in London and Sydney, AirCarbon Exchange in Singapore
21	Secondary market trading infrastructure: Over-the-counter market	<p>In over-the-counter markets, participants do not use an exchange but trade directly with each other.¹³¹ Over-the-counter trading is more suitable for buyers with complex needs not covered by standardized additional attributes (for example, specific project locations, methodology types, and point-of-sale claims), or for players who do not have access to an exchange.¹³² This encompasses trade outside of, for example, "trading platforms" and "exchanges."</p>	Pachama ¹³³

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
22	Post-trade infrastructure: Clearing house	A clearing house is a financial institution that stands between two firms to facilitate the exchange of payments, securities, or derivatives transactions. Its aim is to reduce the risk that one party to a trade fails to honor its settlement obligations. ¹³⁴ Clearing houses are needed to enable a futures market and provide counterparty default protection. ¹³⁵ It interposes itself between the counterparties to the trade, becoming the buyer to the seller and the seller to the buyer. Therefore, it reduces the counterparty risks for trading participants on the markets. These include non-payment or late delivery of emission credits. ¹³⁶	ACX Clearing Corporation
23	Post-trade infrastructure: Securities settlement system	Securities settlement systems enable securities to be transferred and settled by book entry according to a set of predetermined multilateral rules. Such systems allow transfers of securities either free of payment or against payment. ¹³⁷	
24	Post-trade infrastructure: Central securities depository	A central securities depository provides securities accounts, central safekeeping services, and asset services (which may include the administration of corporate actions and redemptions), and plays an important role in helping to ensure the integrity of securities issues (that is, ensure that securities are not accidentally or fraudulently created or destroyed or that their details changed). ¹³⁸ Central securities depositories can manage the counterparty risk involved in the transfer of ownership of financial asset risk by offering settlement services to ensure that the exchange of assets and cash happens simultaneously and efficiently (through a process known as delivery versus payment). ¹³⁹	
25	Post-trade infrastructure: Payment system	This is a system comprising a set of instruments, procedures, and rules for the transfer of funds between or among participants; it includes the participants and the entity operating the arrangement. ¹⁴⁰	
26	Trade repository	A centralized electronic record (database) of transaction data is provided by an entity that is authorized by its regulators. ¹⁴¹ The centralization and quality of the data that a trade repository maintains can improve market transparency. The data can be shared with relevant authorities and the public in line with their respective information needs. Timely and reliable access to data stored in a trade repository can significantly improve the ability of relevant authorities and the public to identify and evaluate potential risks posed to the broader financial system. ¹⁴²	World Bank, EDF, International Emissions Trading Association, Ecosystem Marketplace ¹⁴³

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
27	Settlement bank	This entity maintains accounts with the settlement agent to settle payment obligations arising from securities transfers, both on its own behalf and for other market participants. ¹⁴⁴ A central bank or commercial bank can be used to effect fund settlements. A financial market infrastructure provider typically maintains an account at one or more settlement banks to conduct fund settlements between or among its participants. ¹⁴⁵	
28	Standardized contract hosts	They host standard contract templates for exchanges and over-the-counter trades. ¹⁴⁶	International Swaps and Derivatives Association (ISDA), International Emissions Trading Association, European Federation of Energy Traders ¹⁴⁷
29	Demand-side integrity standards	These entities define how carbon credits are recognized for corporate claims. ¹⁴⁸	Science Based Targets Initiative, ISO, Voluntary Carbon Markets Integrity Initiative ¹⁴⁹
30	Supply-side integrity standards	Independent governance bodies set standards and rules for better oversight of the supply and quality of credits (for example, the Integrity Council for the Voluntary Carbon Market, ICVCM) ¹⁵⁰ and evaluate certification standards. ¹⁵¹ Companies and buyers define criteria for carbon credit portfolios based on these standards and guidance.	ICVCM, ¹⁵² Carbon Credit Quality Initiative, International Carbon Reduction and Offset Alliance, ¹⁵³ UNFCCC Article 6.4 Supervisory Body
31	Carbon credit rating	The lack of a universally accepted and in-depth definition of carbon credit quality is a fundamental issue for the carbon market, as market actors increasingly treat carbon credits with caution. ¹⁵⁴ Carbon credit rating agencies aim to address the lack of standardization by distinguishing between robust carbon credits and those not delivering on their promises. The agencies claim to increase transparency, mitigate reputational risk, and enable fair pricing. ¹⁵⁵	BeZero Carbon, Calyx, Renoster, Sylvera ¹⁵⁶
32	Carbon insurance	Carbon insurance companies offer carbon credit insurance to de-risk carbon credits, protecting against loss of carbon credits due to risks such as natural catastrophes, fraud and negligence, insolvency and abandonment, political risks, and changing carbon standards. ¹⁵⁷	Oka, CFC, Howden, Swiss Re, Goodcarbon, Kita ^{158, 159}

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
33	Disclosure regulation	This refers to the regulation of public disclosures made on carbon credit usage. These define legal requirements for disclosures by buyers, especially corporations. ¹⁶⁰	Advertising Standards Authority, European Commission ¹⁶¹
34	Carbon accounting standard setters	These standard setters develop rules on how offsets enter corporate emissions accounting. ¹⁶²	GHG Protocol, ISO, Partnership for Carbon Accounting Financials, International Sustainability Standards Board ^{163, 164}
35	Web3 platform	Web3 is an envisioned decentralized internet platform built on blockchains, which are distributed ledgers controlled communally by participants. ¹⁶⁵ Web3 platforms can facilitate the tracking and verification of carbon credits, helping to ensure integrity and accountability throughout the supply chain. These high-quality carbon credits and business cases can be monetized. ¹⁶⁶	
36	Financial regulators	Financial regulation concerns rule setting, that is, establishing the legal framework governing market entry and market activities in the financial sector. The main objectives of financial regulation are to safeguard systemic stability, to maintain the safety and soundness of financial institutions, to protect consumers, and to promote competition and efficiency. For example, in the context of carbon markets, financial regulators may issue guidance regarding the listing of voluntary carbon credit derivative contracts, ¹⁶⁷ with the overarching objective of preventing potential systemic problems related to negative externalities and correcting market imperfections and failures. ¹⁶⁸	Commodity Futures Trading Commission (CFTC), ¹⁶⁹ Financial Conduct Authority ¹⁷⁰
37	Market regulators	These entities include financial jurisdictional regulators, given that they regulate and create standards for trading on carbon credit markets. ¹⁷¹ They enhance investor protection and promote investor confidence in the integrity of financial markets by strengthening information exchange and cooperation in enforcement against misconduct and in the supervision of markets and market intermediaries. ¹⁷²	CFTC, International Organization of Securities Commissions (IOSCO), ¹⁷³ ISDA

Table A2: Key entities and their roles in the carbon market infrastructure ecosystem

#	Key entity/market player	Description	Indicative examples
38	Financial accounting standard setters	These entities provide standardized guidance on financial reporting.	International Financial Reporting Standards (parent company of International Sustainability Standards Board), Generally Accepted Accounting Principles ¹⁷⁴
39	UNFCCC	<p>Some infrastructure requirements under Article 6 of the Paris Agreement include the development of a centralized accounting and reporting platform, as well as supporting databases to track international carbon credit transfers and ensure transparency.</p> <p>The text from Decision 4/CMA.6 stipulates that the UNFCCC secretariat will implement a centralized accounting and reporting platform on which to publish information submitted by the participating parties on cooperative approaches. This platform will include public information on ITMOs, link to publicly available data submitted by participating parties on cooperative approaches, and provide annual reports to the CMA. The UNFCCC secretariat will develop and maintain an international registry that participants can use instead of developing their own. However, participants are not obliged to use the UNFCCC registry or formally link their own registry to it. Under the same platform, the secretariat will also manage an Article 6 database to ensure transparency in the cooperative approaches of the participating parties.¹⁷⁵</p>	
40	National governments	<p>In accordance with Article 6 requirements, countries should have access to a registry. They may choose to use the UNFCCC international registry platform, create their own national registry, or use the registry of an existing independent or international crediting program. The host country should report these arrangements to the UNFCCC.</p> <p>Host countries are also required to establish institutional arrangements and processes for authorizing mitigation outcomes for use as ITMOs. Under these processes, the host country defines which body or institution, official, or position would have the final decision to authorize and transfer ITMOs. These arrangements must be reported to the UNFCCC.¹⁷⁶</p> <p>Under Article 6.4, parties are required to assign a designated national authority to be responsible for approving activities by the host party, authorizing activity participants, and authorizing A6.4ERs (Emission Reduction).¹⁷⁷</p> <p>Parties may set their own guidelines for issuance procedures.</p>	

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