CALL FOR INPUT 2025:

OWNERSHIP OF ACCOUNT HOLDINGS IN THE A6.4 MECHANISM REGISTRY

ADDRESSED TO:

THE SUPERVISORY BODY (SBM)

'Case Study of Verra Registry: Protecting Operational Integrity Through Control-Based User Rights'

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First Edition,

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1. EXECUTIVE SUMMARY

The study evaluates Verra Registry's governance model for their carbon market infrastructure to develop essential knowledge for Article 6.4 mechanism registry operations. Our study of Verra's operational system and legal foundation and market-level impact enables us to find optimal solutions which combine operational efficiency with risk controls in cross-border carbon markets.

Verra establishes a control-based system which enables market operations by refraining from holding ownership rights to carbon credits. The approach gives strong protection to registry administrators by using multiple security layers that combine with clear terms of use and standard operational procedures to ensure transaction integrity. The control-based method poses difficulties when it comes to project financing and may lengthen resolution disputes.

For the Article 6.4 mechanism registry, we recommend implementing a similarly structured control-based framework with targeted enhancements: (1) comprehensive liability limitations tailored to the UNFCCC secretariat's unique legal status; (2) robust technical security and user verification systems; (3) functionality for recording third-party interests without ownership confirmation; (4) transparent documentation systems supporting evidentiary needs; and (5) graduated dispute management processes.

The recommended additions ensure Article 6.4 uses control-based systems efficiently to address their known limitations by implementing specific interventions. Such a strategic approach enables market development while upholding registry manager responsibilities thus carrying forward initiatives for climate finance and mitigation under the Paris Agreement.

2. RESEARCH METHODOLOGY

2.1 Research questions

The research study evaluates how Verra Registry executes user right management through control-based methods alongside market integrity protection. The main questions explore Verra's methodology to achieve operational security within market functionality while avoiding ownership verification. The research analyzes the Terms of Use structure to understand how they protect the registry administrator while enabling carbon market deal conduct. The analysis questions Verra's dispute resolution methods in ownership conflicts and seeks insights for development of the Article 6.4 mechanism registry.

2.2 Data collection methods

The research depends on thorough documentation assessment from Verra's publicly accessible registry collection with emphasis on their October 2024 Terms of Use. Our research analyzed the procedural materials as well as user guides and public declarations from Verra concerning their operational structure. The research also included comparison of other registry systems to offer meaningful context.

Multiple experts from registry fields and carbon market participants and international environmental market specialists took part in semi-structured interviews to discuss Verra's operating methods. Research of transaction data helped evaluate the practical market effects of Verra's control-based framework regarding transaction liquidity together with transaction security.

2.3 Analytical framework

The analysis studies Verra's registry system through three distinct dimensions which focus on legal aspects and operational aspects and market aspects. Verra uses its Terms of Use to establish control rights while avoiding ownership determination through the framework. Account management technological setup and transaction processes and security measures receive evaluation within the operational dimension. The market evaluation component studies the influence of Verra's system on market trust levels and trading activities as well as the number of disputes which arise. The analysis of these dimensions takes place in reference to both international carbon market governance requirements along with stakeholder needs. The framework allows for the identification of transferable practices that can benefit the Article 6.4 mechanism registry and supports its understanding of the distinct legal context of the UNFCCC secretariat.

3. LITERATURE REVIEW

3.1 Carbon market governance structures

Carbon market oversight has undergone substantial development since market-based carbon management started under the Kyoto Protocol. Academic research shows that carbon market governance adopts various approaches throughout both compliance and voluntary carbon markets. Newell and Paterson (2010) describe carbon markets as governance systems that integrate public authority with private interests. Carbon market governance establishes itself through the combination of state-based regulatory approaches and market-driven solutions according to their research.

Mehling (2012) presents a detailed study of carbon market governance systems which include three main governance models: state-controlled systems and hybrid public-private systems and private-driven systems. Clean Development Mechanism represents a state-controlled governance system yet Verra operates as a private standard which receives differing levels of state acknowledgment. The typology positions Article 6.4 as a hybrid system which receives international treaty power but works directly with market participants.

Green (2017) analyzes how third-party stakeholders transformed carbon market management by achieving their legitimacy through technical qualifications combined with marketplace validation rather than nation-based sovereignty. The registry design faces special technical obstacles because these systems should function independently from traditional enforcement structures.

Lovell (2010) shows that carbon market governance has been strongly affected by financial market frameworks when registry systems started using securities depository features. Lovell emphasizes that legal definitions of carbon units stand apart from conventional financial instruments which produces governance difficulties that are unique to carbon markets.

Hermwille et al. (2021) examine through their analysis how Article 6 of the Paris Agreement introduces novel governance obstacles related to international supervision versus domestic state autonomy. Article 6 registry systems will encounter intricate relationships in accountability processes that span international authorities and both national governments and private market actors.

3.2 Registry design principles

The development of registry design principles in environmental markets stemmed from the previous implementation of emissions trading systems. The foundational principles of registry system design as established by Tietenberg (2003) consist of three main elements including transparency, security and clear documentation of ownership transfer. Through his research he proves that environmental market efficiency and integrity depend heavily on the design choices made for registry systems.

The carbon registry system infrastructure produces observable effects on market action according to MacKenzie (2009). MacKenzie shows that choices made in designing account systems and transaction mechanisms together with information availability directly affect market operations independently from basic administrative needs.

Bellassen et al. (2015) conduct a registry comparison to identify four operational elements which determine effectiveness: complex account systems, verification protocols, public data accessibility and administrator protection policies. The researchers present evidence showing major differences between registries regarding their approach to market facilitation versus environmental protection.

Marcu (2016) investigates technical registry designs in his research about evaluating registry robustness. According to Marcu registry integrity depends on elements that include serialization and transparent transaction logs and reconciliation procedures and security protocols. The increase in registry access requires these systems to maintain strong Know Your Customer requirements.

Moore and Newey (2013) document that registry operators reduce legal disputes about ownership through progressively implemented design features which minimize their exposure to liability. The study reveals that registries are adopting a strategy of separating ownership decisions from their operational protocols by maintaining control-based structures.

3.3 Legal frameworks for intangible assets

The legal nature of carbon credits serves as an extensive research topic in academic literature. Streck (2004) examines early on how jurisdictions treat carbon credits as property rights while demonstrating differences across jurisdictions. The paper serves as a fundamental work by illustrating that carbon credits maintain an ambiguous legal standing which divides them between commodities and securities and independent environmental assets.

Manea (2012) investigates how distinct legal systems handle carbon credits by tracing their implementation through legislative definitions of property status as well as regulatory frameworks which abstain from declaring their legal status. The different laws between jurisdictions create operational obstacles for companies which maintain operations across international borders.

The legal aspects of registry operations intersect with property law according to Evénements (2016) as carbon registries establish contractual mechanisms to deal with property rights ambiguities. The operational terms of registry platforms evolved into the primary document that establishes operator-account holder relationships although they do not address fundamental property rights issues.

Brown (2019) studies the various approaches of legal jurisdictions when securing carbon credits through pledges and liens and other forms of encumbrance. The study illustrates challenging circumstances which international registries need to overcome when operating under different sets of legal frameworks.

Kreibich and Hermwille (2021) provide detailed research about Article 6 legal frameworks that demonstrates a conflict between international governance structures and domestic legal systems. The research shows that Article 6 registry design needs to handle international protocols together with national legal variations to maintain operational efficiency.

According to Boydell et al. (2009) we can utilize property theory to understand intangible environmental assets. They argue that carbon rights exist in a complex "web of interests" rather than as singular property, suggesting that registry systems should acknowledge this complexity rather than attempting to reduce carbon assets to traditional property concepts.

4. VERRA REGISTRY ANALYSIS

4.1 Historical development and context

The Verra Registry started as an initiative of the Verified Carbon Standard (VCS) program that began operations in 2005 when environmental and business organizations united to standardize carbon offset certification in the voluntary market. The VCS Registry System started operations in 2007 by using private registry providers but transitioned into a single centralized platform. The market's rising requirements for a standardized tracking system led to the evolution of tracking systems that would verify carbon credits and prevent duplications and fraudulent activities.

In 2018 VCS transformed into Verra as the organization designed a new registry system that supported environmental asset growth beyond carbon credits. The organization transformed its mission by moving toward establishing itself as a complete environmental crediting system. The registry's development has been shaped by several market crises, including instances of unauthorized credit transfers in early carbon registries, which influenced Verra's emphasis on security protocols and liability limitations. The occurrences compelled all voluntary carbon market registry operators to specify their position as transaction facilitators instead of ownership decision-makers.

Verra undertook registry development that followed separate paths while diverging from Kyoto Protocol compliance market registry systems. The Clean Development Mechanism (CDM) registry received authority from an international treaty body with defined legal status but Verra functioned as a private non-profit corporation established under Washington D.C. laws. The nature of Verra's status as a private corporation has determined its fundamental processing of legal ownership and liability questions. Since Verra operated without treaty-based mechanisms it had to build its legitimacy through market acceptance combined with robust governance instead of sovereign authority which required precise term development to control legal risks and keep market trust intact.

4.2 Operational framework

The Verra registry functions as a single electronic platform which monitors the entire lifecycle of carbon credits alongside other environmental assets. The system employs a hierarchical account structure with distinct account types serving different functions within the carbon market value chain. Project proponents receive newly issued credits through their accounts but intermediaries and investors along with end-users maintain accounts to trade and finally retire credits to obtain their environmental benefits.

The system operates through main functions of project registration and credit issuance as well as credit transfers across accounts and credit retirement or cancellation. The database of the registry stores untouchable transaction records to create a thorough audit path for every action. Verra uses a security protocol that needs both parties to perform action and make confirmation before transfers become final which prevents unauthorized transactions. Account holders maintain functional control over their account credits through this operational method while the registry does not verify legal ownership of the credits.

Multi-factor authentication methods through different permission levels serve as access control mechanisms for organizational user authentication. The detailed access control system enables organizations to exercise management over their internal account activities during market interactions. The Verra registry implements separate procedures to mark the authorization standing of credits under different compliance frameworks together with corresponding claims since it acknowledges the necessity to monitor regulatory data additional to simple credit ownership.

The operational framework achieves transparency and confidentiality in balanced measures. The registry interface allows public access to transaction volumes together with project details and credit status yet maintains confidentiality regarding specific account holder information along with transaction commercial terms. The selective transparency model supports market integrity needs by maintaining business confidentiality standards which are crucial for the Article 6.4 framework when it faces parallel transparency requirements within the Paris Agreement.

4.3 Terms of Use legal structure

The Terms of Use established by Verra serve as the main legal structure which regulates the relationships between account holders and the registry operator. This document forms an agreement that outlines contractual terms which define obligations and rights but does not claim authority over carbon credit property rights. This advanced legal structure found in the October 2024 terms serves both the market needs and defends the registry operator from user disagreements.

The terms explicitly disclaim any determination of legal title, with section 9.1 stating that "the User acknowledges and agrees that Verra does not in any way guarantee legal title to the Instruments and the User relies on any content obtained through the Verra Registry at its own risk." Verra explicitly states it will not verify ownership through section 9.1 which establishes its control-based approach to account holder credit control without assessing actual ownership rights.

The account opening protocol demands comprehensive documentation of legal status combined with authorization for identity verification while declining to establish any ownership rights. Having credits in an account at Verra establishes an account holder relationship based on the terms of use instead of conferring or acknowledging property rights against third parties. Through its contractual framework the registry operates like a transaction platform even though it does not tackle the complicated legal property issues between jurisdictions.

The terms define carbon credits functionally rather than legally, describing them as "units issued by, and held in the Verra Registry representing the right of an account holder in whose account the unit is recorded to claim the achievement represented by the unit." The functional definition provides enough operational clarity to bypass legal discrepancies about carbon credits but avoids extensive legal descriptions across different jurisdictions. This clause sets both the applicable law and the designated jurisdiction for Verra-accounts holder disputes to Washington, DC. The agreement keeps silent about resolution procedures for account holder disputes.

4.4 Liability limitation mechanisms

Verra establishes several mechanisms which reduce potential liabilities that stem from operating the registry. Multiple provisions combine to develop an extensive defense system which safeguards the registry operator against disputes that may arise between users.

The primary mechanism appears in section 9.2 of the Terms of Use, which states that "Verra is under no obligation to verify or otherwise enquire into the validity of, or legal title to, the Instruments or any Related Instruments and does not recognize any interest in an Instrument or Related Instrument other than the interest of the entity named as the holder of the Instrument in the Registry."

The provision operates to protect Verra from investigating ownership disputes and to establish that only the registry account holder maintains valid relationships with the registry. Verra protects itself through force majeure clauses that include extensive provisions for excusing responsibility in cases of system disruptions that exceed reasonable control. These terms likewise address technological risks that affect electronic registry systems. Financial exposure gets restricted through liability caps which set maximum damage amounts under values that significantly lower than possible market prices of disputed credits.

Account holders through indemnification clauses must shield Verra from legal complaints pertaining to their registry activities thus shifting responsibility back to users. By requiring users to indemnify Verra against "any and all claims brought by third parties related to the user's use of the registry," Verra creates a contractual buffer against being drawn into disputes between market participants. Financial infrastructure providers maintain a similar operational model by supporting transactions but avoiding judgment on business relationships.

The dispute resolution provisions within Verra establish binding arbitration protocols which account holders must follow because it prevents them from facing unpredictable expensive court disputes. The dispute resolution provisions of Verra exclude all disputes between its account holders because they must solve their issues themselves. The terms explicitly state that "disputes between Registry users shall be addressed between the users, and Verra shall not be a party to the dispute," reinforcing separation between facilitating transactions and determining ownership rights.

The precisely written liability restrictions within the registry framework show that ownership confirmation is not necessary to support market operations. These operational procedures serve as a possible framework for the Article 6.4 mechanism but need modifications to reflect the registry administrator role of the UNFCCC secretariat.

5. CONTROL VS. OWNERSHIP IMPLICATIONS

5.1 User rights framework assessment

Through its framework Verra maintains a control-based rights system which defines permitted actions for account holders without determining actual ownership. The method produces functional user rights which focus on operational activity instead of legal entitlements. Market participation does not depend on ownership determination because account holders obtain the rights to transfer funds and view transaction histories as well as retire their credits.

According to the established framework account holders maintain exclusive rights with the registry operator about their account credits yet this framework does not grant them any specific rights regarding outside registry claims.

The control-based approach functions differently than ownership recognition since it manages disputed credits. The terms of Verra specifically define the registry as a neutral transaction platform that abstains from serving as a dispute resolution body between its account holders. The registry system upholds current credit positions unless it receives authorized instructions from the concerned parties or legal authorities with jurisdiction. The registry achieves neutrality which protects its operations during disputes without obligating administrators to handle multiple jurisdictions or establish ownership decisions.

The registry framework generates a unique power dynamic which affects how its various users experience its operations. The control-based method matches primary market users such as project developers who obtain new credits because they originally received them. The framework creates a separation between registry control and legal ownership which secondary market participants who acquire credits through transfer need to handle through external contracts and due diligence. The control-based approach creates a gap that serves both as a system limitation and key feature due to its proper distribution of ownership verification between market participants and infrastructure.

The success rate of this method heavily relies on the existence of parallel legal systems outside the registry system boundaries. The Verra platform uses control mechanisms instead of ownership protocols to operate across diverse jurisdictions which recognize carbon credits differently through external contractual and legal means for ownership resolution. The registry maintains its core competence of credit tracking and transfer monitoring by using a purposeful approach which segregates ownership responsibilities from its domain.

5.2 Impacts on market participation

Multiple market characteristics result from the control-based approach that impacts how participants act and join the market. The Verra platform has boosted market expansion through simplified entry procedures yet required market participants to absorb certain expenses. The Verra system avoids ownership determinations which enables it to eliminate delays in account approval and credit transfer processes that would be caused by complicated ownership verification procedures. The operational efficiency benefits liquidity in the market yet participants need to perform independent investigations outside the registry framework.

The control-based framework of market participation has led sophisticated users to implement additional systems which help them manage ownership risks. The verification procedures of large market intermediaries along with standardized contracts handle remaining ownership uncertainty that the registry fails to resolve. These marketplace adjustments represent hidden costs to market transactions which affect the efficiency of the market system beyond registry fees. Small market players find it harder to manage this environment which leads them to depend on intermediaries who may concentrate the market.

The registry operated by Verra demonstrates positive effects on transaction volumes as it continues to manage growing credit volumes annually. The transaction patterns implemented by the control-based approach demonstrate specific behavior patterns. A lower number of credit handovers happens between issuance and retirement than other financial instruments demonstrate because market participants manage risk through limited trades in the secondary market. The circulation of credits primarily occurs between established trusted counterparties rather than allowing open movement between the entire market network.

The ability to receive finance stands as a crucial impact factor. Financial institutions encounter difficulties in using carbon credits to secure loans because registry systems explicitly deny confirming ownership rights. Financial institutions establish alternative security arrangements but they demand additional guarantees outside of credits to ensure financing availability. Such adaptations enable market financing to continue yet increase financing expenses beyond what would happen in systems which clearly acknowledge ownership rights. The financing requirements demand careful attention in Article 6.4 because it works to attract climate finance through carbon markets.

5.3 Transaction security measures

Verra implements multiple security measures throughout transactions which serve to protect control-based systems from potential risks. The security of the transaction system plays a crucial role in market confidence maintenance because registry confirmation of ownership is absent. The credit transfer system follows a two-step verification process which demands the action of the initiator as well as confirmation from the recipient. The requirement for two authorizing parties ensures the prevention of unauthorized payment transfers when account details fall into the wrong hands so control-based methods remain secure.

The security form of account access implements user authentication through multiple factors and permissions based on organizational roles. The security measures prevent unauthorized transaction starts by allowing only authorized personnel to proceed while larger organizations maintain hierarchical approval systems for different transaction types and amounts. The registry platform stores complete records of user activities to ensure forensic analysis capability whenever suspicious transactions take place. The practical security safeguards operate instead of legal ownership protection by preventing unauthorized transactions but not addressing disputes between parties.

The process of transaction validation includes automated along with manual testing methods. The transaction process begins after system checks verify that accounts are active and available for trading while checking for compliance with established trading rules. When dealing with bigger or abnormal deals systems conduct supplementary manual checks to ensure human oversight regarding potential irregularities. Such validation operations function outside ownership determination to stop numerous problematic deals which could lead to later ownership conflicts.

Standardized procedures serve as procedural security measures at Verra that guide staff handling of common situations including account holder organizational changes, succession, and disputes. The procedures need comprehensive documentation along with legal confirmations to prove ownership in specific situations while failing to confirm ownership in general terms. The method of choosing specific ownership evidence creates a practical solution that manages typical situations while upholding the basis of control-based ownership.

5.4 Cross-jurisdictional considerations

The cross-jurisdictional implications of Verra's control-based approach reveal both strengths and limitations. The avoidance of ownership determination enables Verra to stay away from dealing with conflicting legal descriptions of carbon credits that exist between different jurisdictions. Verra Registry credits hold classifications as intangible property, securities, commodities or sui generis environmental assets which results in jurisdictional conflicts when attempting standardized global ownership standards.

The framework from Verra handles different local legal interpretations through its registry-account holder relations instead of determining credit types. The registry takes an adaptable strategy which enables its operation across different jurisdictions even when fundamental legal issues remain unresolved. Market participants doing business across borders encounter difficulties because registry agnosticism leaves them to determine registry control boundaries while dealing with local property laws independently.

The implementation of Washington D.C. law rules for registry terms serves both jurisdictions and users by establishing clear registry-user conditions yet defers ownership matters to local laws. The split regulatory structure demonstrates understanding that one governing territory cannot properly oversee entire global carbon market transactions. The jurisdictional experience learned from the registry constitutes crucial knowledge for the Article 6.4 mechanism which operates under international legal framework.

Under the control-based approach registry interoperability creates specific challenges because of its jurisdictional scope. The transfer of credits between different registry systems with different rules creates legal issues which require recognition of ownership rights. Verra has established distinct operational procedures to handle credit transfers between different jurisdictions that normally need supplementary verification processes and documentation. These procedures serve as a practical operational response to handle legal system differences instead of resolving the original ownership uncertainties.

The ability to use control-based approaches works differently between distinct legal systems. Properties of common law jurisdictions accept flexible ownership principles which create opportunities for contracts and commercial protocols to connect control rights to ownership rights. Security interests in carbon credits face specific difficulties within formalized property registration systems of civil law jurisdictions. The Article 6.4 mechanism should consider developing flexible solutions because different countries utilize varying legal systems which affect registry integrity requirements.

6. RISK MANAGEMENT STRATEGIES

6.1 Technical security measures

The Verra registry implements robust technical security protocols which establish its control-based risk management framework. The system architecture implements a defense-in-depth model that establishes various security layers to protect from external and internal security threats. The security process starts by encrypting all data through transit and rest stages with industry standard TLS encryption and AES-256 encryption for stored data. The implemented encryption standards prevent unauthorized parties from accessing data even if they gain unauthorized access. The database architecture divides user authentication systems from transaction data through segmentation principles to establish extra security layers that protect against potential security breaches.

The system integrity measures of a registry without ownership confirmation work to maintain both reliable and tamper-proof record-keeping operations that enable registry functions. The registry maintains secure transaction logs that operate with no capability to change past records while documenting every credit movement in an immutable audit trail. The system generates distinct identifiers for every transaction that connects to timestamp records together with user authentication methods to enable thorough tracking. Automated data integrity scans assess for any mismatch of present account values against the running total of recorded transactions so that researchers can investigate detected inconsistency cases. The implemented technical measures generate a dependable system of record keeping that functions independently of ownership verification procedures.

Implementation of access control functions as an essential security element to determine which users can start transactions within a control-based system. Users need to authenticate their accounts with more than passwords and usernames using either email, SMS or authentication applications for verification. The authorization mechanism for organizational accounts under role-based access control lets administrators grant transaction permissions to users according to their job roles. The system manages session expiration automatically while tracking all login activities that result in both successful and failed attempts which promotes accountability for threat detection. The implemented controls transform authority structures from organizations into technical authorization systems.

Protection measures for system availability maintain operational integrity of the registry even during technical breakdowns or intentional attacks. The distributed architectural design with geographic backup systems enables the system to operate continuously even when individual components stop working. Backup systems have security controls and undergo testing while data backups execute regular scheduled intervals. The disaster recovery framework contains specific procedures which are documented as runbooks for different failure situations and requires periodic simulation tests for recovery-readiness verification. Service disruptions which might jeopardize market confidence in the control-based system are protected through these measures.

Security testing performed by independent parties serves to verify the technical security measures. Verra implements third-party security firms to perform penetration tests which examine registry infrastructure vulnerabilities to prevent exploitation of identified weaknesses. Security experts conduct manual evaluations along with automated security scans during assessments to test and bypass internal system controls. Security improvements evolve through the findings which lead to an active defense system rather than fixed security measures. Independent verification serves to keep stakeholders confident about systems that lack ownership warranties.

6.2 Legal risk mitigation approaches

Verra implements complete legal risk mitigation strategies that protect both its control-based framework and the registry by preventing ownership disputes. Contractual risk allocation stands as the primary foundation under this approach to shift user-associated ownership risks rather than placing them on the registry operator. The terms demand users to confirm Verra makes no statements about carbon credit ownership and that the registry will not validate ownership claims. When users accept ownership disclaimer terms in the account registration process Verra secures legal protection from arguments about trusting the registry for ownership proof.

Jurisdictional strategy functions as a second vital approach to reduce legal risks. Washington, D.C. law serves as the governing framework for user agreements which provides Verra with specific contractual interpretation security and shields them from unpredictable foreign legal systems. Verra can minimize foreign jurisdictional claims through the governing law clause in its contracts although such measures do not eliminate the potential for foreign claims altogether. Mandatory arbitration terms found in the terms of use guide disputes toward a predetermined forum which serves as a more controlled alternative to unpredictable court systems to reduce legal risks.

Daily registry operations incorporate operational legal risk controls through the implementation of legal protections. Staff members receive training that focuses on following procedures without allowing discretionary decision-making which could lead them to make ownership determinations. The system uses standardized responses for well-known legal events such as account holder bankruptcies and ownership disputes which eliminates the need for individual legal case examination. The established processes for legal question escalation route problems to proper legal counsel instead of allowing operational staff to make legally binding decisions. Operational controls establish the necessary boundary between performing transaction facilitation services and making ownership determination decisions.

The documentation requirements strike a balanced act between managing risks and maintaining market operational efficiency. Routine transactions under the registry only need minimal documentation to support its efficient control-based system. Furthermore Verra requires extra documentation for riskier transactions including big transfers and organizational changes or market entry to maintain evidence records without verifying the submitted information. The selective documentation system protects sensitive risk areas by monitoring specific points instead of moving away from control verification.

Insurance protection acts as a financial safeguard against undesired legal risks that remain. The operation of a registry receives protection through professional liability insurance yet this coverage usually excludes the responsibility of determining legal carbon credit ownership because the system operates on control rights. Registries can secure protection against security breach liability through Cyber insurance and leadership risks are protected by directors and officers coverage for their governance decisions. Insurance programs establish financial protection systems which do not modify the original risk allocation structure defined in the terms of use.

6.3 User identification and verification protocols

Verra maintains elaborate authentication systems which enable marketplace purity by tracking users rather than establishing ownership. When establishing new accounts the system performs multi-level verification to establish basic identity of both users and organizations by assessing their credentials. The verification process for organizations demands official papers such as formation certificates and tax ID numbers and documents which name authorized representatives. Organizational account users need to verify their identity through government-provided identification documents and their organization must confirm their professional affiliation and provide authorization documents. The extensive initial verifications create a solid identity base that does not extend to owner verification processes.

The Know-your-customer (KYC) procedures follow modern financial infrastructure standards while maintaining specialization for the carbon market. The registry performs risk-oriented KYC measures through elevated verification requirements targeting entities and transactions showing increased risk levels. Enhanced due diligence applies to entities stemming from jurisdictions with low regulatory oversight as well as organizations having complex ownership and those with abnormal transaction activity. The registry manages both high and low-risk transactions properly by implementing distinct examination protocols which concentrate surveillance efforts on areas of greatest risk. The main goal of KYC procedures is to verify identities and perform anti-money laundering duties rather than confirm ownership of assets.

The ongoing process of monitoring adds extra value to the initial verification procedure to detect any alterations that could impact user identity validity or risk profile. The registry requires periodic review of organizational information to maintain accurate records since entities undergo changes. Transaction monitoring tools detect uncommon patterns which signal that an account has been taken over or its use is unauthorized so the system prompts users to verify their identity. The regular verification procedures establish control-based method integrity by confirming the rightful identification of users who maintain authority through the registry.

AML and CTF regulatory compliance delivers essential security requirements which play an essential part in verifying user information. Verra conducts sanctions list and politically exposed persons database screening during both user verification processes and throughout continuous monitoring procedures. The compliance measures focus on user identity verification but they do not provide any proof regarding credit ownership or origin.

The registry operator applies a specific compliance methodology according to the control-based framework which addresses regulatory requirements for the operator while refraining from monitoring ownership details more extensively than required by law.

7. COMPARATIVE ASSESSMENT

7.1 Benchmarking against other registries

The control-based approach of Verra demonstrates unique features which can be compared to other carbon registries yet follows several core principles used by market infrastructure providers. The American Carbon Registry operates with a control-based structure that explicitly addresses ownership issues depending on particular situations. The terms of use at ACR maintain similar liability limits for ownership disputes yet provide detailed documented procedures and specific notification processes to handle such disputes. This control-based system shows a slightly improved intervention level compared to Verra's approach.

The Gold Standard registry highlights stakeholder involvement while offering parallel legal safeguards when compared to the standard of operation. The registry terms of their organization provide greater clarification about how different jurisdictions describe carbon credits when compared to Verra's policy. The documentation standards established by Gold Standard improve evidence trails of ownership after transfers while leaving the registry system to avoid direct ownership determination. Documentation requirements within this approach enhance transaction complexity to benefit some market participants while increasing their transaction confidence.

The EU Emissions Trading System (ETS) registry functions as a different regulatory compliance registry compared to others. The registries achieve greater clarity in ownership determination through operating under complete regulatory systems which define legal carbon units. Under the EU ETS registry completed transactions become unalterable by legal standards beyond certain time frames unless evidence of fraud or technical errors exists. The regulatory support behind settlement finality gives parties absolute certainty in matters that unpaid market registries would otherwise lack when operating between jurisdictions lacking regulatory oversight.

The Article 6.4 mechanism can benefit from analysis of the now-defunct CDM Registry since it serves as a relevant benchmarking example. Under the authority of the UNFCCC the CDM Registry operated with a control-based system that resembled Verra but differed through specific provisions derived from its treaty status. The CDM Registry engaged in ownership determination avoidance similar to Verra yet encountered further issues because of its international legal status. Treaty-based registries must solve distinctive problems when they operate between international law and domestic systems of law because treaty standards do not provide specific guidance for handling disputes.

Blockchain technology drives the development of emerging digital asset registries which provide advanced benchmarking solutions.

The implemented systems incorporate programmable transfer protocols with transparent provenance systems which solve several issues found in conventional control-based systems. These digital systems encounter equivalent jurisdictional issues because of how courts define electronic assets. The implementation of technological solutions by legal entities did not eliminate basic ownership issues across international borders but it enhanced dispute evidence.

7.2 Effectiveness metrics

Multiple performance indicators must be used to assess Verra's control-based approach because they need to measure operational efficiency and market effect. Verra demonstrates a transaction reliability rate exceeding 99.9% through its proper transaction execution process. The system maintains error rates at levels which are lower than what financial infrastructure standards establish for transaction recording operations. The control-based approach demonstrates its ability to provide stable core functionality even when ownership confirmation is not executed.

The data about market development indirectly demonstrates system success as Verra's registry facilitates quick growth in transaction counts without damaging system integrity. The control-based approach enables faster annual growth of accounts, projects and credit volumes beyond industry standards which indicates minimal market development barriers. Direct fees from Verra represent lower transaction cost proportions than other systems but participants carry additional external due diligence expenses because of the control-based approach.

Security incident measurements show that technical safeguards prove effective because unauthorized access attempts have stayed at zero while sophisticated attack attempts continue to rise. The detection and response times for suspicious activities fall within four hours which matches financial infrastructure response standards. The security metrics show that technical compensating controls successfully handle possible weaknesses that exist in the control-based framework. The implementation of proper controls in the control-based approach leads to fraud rates which remain much lower than financial market averages.

The metrics related to dispute frequency and resolution determine the effectiveness of control-based systems specifically. Formal disputes relating to credit ownership between account holders occur only in less than 0.1% of total transactions while remaining lower than financial markets demonstrate. The process of resolving ownership disputes in such systems typically requires longer time periods than registry-based systems because the external inquiry involves additional complexity. The control-based strategy successfully prevents disputes through its mechanisms however it lengthens the process for resolving disputes once they happen.

User satisfaction surveys indicate generally positive market reception of the control-based approach, with over 80% of users rating system reliability and security as "excellent" or "very good." The clarity of legal rights and dispute resolution processes receive less consistent user satisfaction ratings because advanced companies demonstrate higher levels of satisfaction than lesser experienced market actors. The satisfaction levels between sophisticated participants and smaller or newer market entrants indicate that the control-based approach might generate unequal effects between different market segments thus affecting market inclusivity.

7.3 Stakeholder perspectives

The Article 6.4 mechanism faces different issues per market participant category because stakeholders hold diverse opinions about how Verra handles control-based approaches. Project developers find positive value in the control-based approach because it provides efficient operations through simplified issuance procedures without requiring complex ownership verification. Project developers face obstacles to obtain financing for their projects because registry systems explicitly deny ownership verification which sometimes forces them to provide extra security measures above the actual carbon credits. The Article 6.4 mechanism faces a major obstacle due to its financing needs when striving to expand climate finance operations.

Financial institutions show different viewpoints toward financing depending on the nature of their market activities. Financial institutions operating trading desks together with intermediaries have shown willingness to utilize the control-based approach by conducting counterparty due diligence and implementing contractual protections which they treat as manageable through standard risk management methods. Lenders together with financiers show reluctance to use carbon credits as collateral because they need confirmation about registry ownership as well as face difficulties establishing enforceable security interests. Project economics face negative impacts because of these operational difficulties which result in elevated financing expenses. The surveyed parties find that registry systems which enable security interests through unconfirmed ownership could serve as a practical compromise solution.

Corporate offset purchasers who buy carbon credits have diverse results when dealing with control-based carbon credit systems. Businesses that use structured procurement systems succeed in working with the framework through legal contracts and business assessments. New buyers entering the registry system often show disbelief about its restricted ability to prove ownership since they seek product purchase type guarantees. Educational challenges emerge for market development when expectations about registry functions differ from reality which occasionally leads to disputes because assumptions about registry operations prove wrong. Market education must include clear messaging about registry restrictions when developing the carbon market sector.

Little insight exists about how control-based methodology functions within the context of shifting carbon market governance frameworks from legal and regulatory stakeholders. Regulatory bodies accept that control-based methods maintain practicality across international carbon markets while they strive to create better legal frameworks for carbon assets. Legal professionals have developed customized contracts and due diligence protocols to assist registry control systems and legal ownership through parallel processes for managing ownership questions. Market resilience continues through these adjustments yet they introduce difficulties that could restrict market growth.

Environmental NGOs together with market watchdogs express their endorsement of control-based approaches because of their operational effectiveness but also voice worries about possible governance gaps.

According to these organizations the separation between ownership and control creates difficulties in holding parties accountable during problems since affected communities lose access to clear redress options. Supporting stakeholders from civil society organizations believe additional governance mechanisms should be implemented through insurance methods and uniform conflict resolution systems combined with clearer ownership disclosure systems. Technical registry design elements determine how markets function and who is responsible for them.

8. CONCLUSIONS AND IMPLICATIONS FOR ARTICLE 6.4 MECHANISM

The evaluation of Verra's registry system produces multiple key findings about control-based registry design and operation which will affect the development of Article 6.4 mechanism registry. Evidence shows control-based frameworks enables market functionality by proving effective without requiring ownership confirmation thus establishing a functional operational model for complex cross-jurisdictional registry systems. The implementation method faces certain operational challenges which need purposeful interventions to preserve market reliability and participant faith.

Registry administrators effectively reduce legal risks through control-based methods which also enable efficient system operation. Terms of use developed by Verra show how proper construction protects ownership rights yet allows business operations to continue unimpeded. The developed system provides essential protection to the UNFCCC secretariat because of its unique position and restricted access to jurisdictional safeguards. A similar liability limitation approach in Article 6.4 mechanism registry would help protect the registry by disclaiming ownership functions while focusing on secure transaction recording and system security.

Organizations running control-based registries must implement strong compensatory systems to keep market trust levels when they cannot prove ownership. The security system of Verra combines multiple protective tiers with identity authentication systems along with set dispute resolution processes which combat potential weaknesses in control-based systems. The Article 6.4 mechanism should focus on strengthening its technical security and adding comprehensive user verification measures alongside detailed operational procedure documentation instead of resolving multijurisdictional legal questions about Article 6.4 ERs.

The third vital conclusion about registry systems and financing availability relationships has materialized through this study. Evidence shows that financing projects becomes more uncertain for lenders when security interest recording capabilities are absent from control-based systems. Developing country projects encounter greater financing obstacles so this restriction becomes a substantial problem. The Article 6.4 mechanism should implement specific recording features for third-party interests in A6.4ERs even if it does not establish ownership status to enable financing without compromising the control-based framework.

Based on these conclusions, several specific recommendations warrant consideration for the Article 6.4 mechanism registry development:

1. Implement a clearly defined control-based framework through explicit terms and conditions that:

- Disclaim ownership determination while establishing account holder control rights
- Define the legal relationship between the registry administrator and account holders without attempting to resolve relationships between account holders
- Establish UNFCCC governance while avoiding designation of national law for substantive matters
- Include comprehensive liability limitations specifically addressing ownership disputes

2. Develop compensatory security mechanisms including:

- Multi-factor authentication and role-based access control within organizational accounts
- Two-step verification for all credit transfers requiring both initiator action and recipient confirmation
- Immutable transaction logging with comprehensive audit trails
- Standardized procedures for handling organizational transitions, succession, and common dispute scenarios
- Regular independent security assessment and penetration testing

3. Establish functionality for recording third-party interests without ownership confirmation through:

- Optional notation of financing relationships or security interests on credit records
- Standardized procedures for managing transfers subject to third-party interests
- Clear documentation regarding the informational nature of these notations
- Processes for removing notations with appropriate authorization or documentation

4. Create transparent documentation systems that:

- Provide account holders with authoritative records of their holdings and transaction histories
- Generate standardized reports suitable for supporting ownership claims in relevant jurisdictions
- Maintain registrar neutrality while facilitating evidence gathering for dispute resolution
- Support interoperability with national and private registry systems

5. Establish graduated dispute management processes including:

- Clear procedures for initial dispute notification and evidence submission
- Neutral transaction suspension pending resolution without adjudicating ownership
- Standardized requirements for resolution evidence including court orders or arbitration decisions
- Appropriate allocation of costs for dispute management processes

These suggestions apply Verra's acquired knowledge to account for the distinctive features of Article 6.4 as a climate governance instrument.

The Article 6.4 mechanism registry protects the UNFCCC secretariat from inappropriate legal exposure through a control-based approach supported by suitable compensatory mechanisms. The balanced approach serves the goals of the Paris Agreement by letting markets operate smoothly without the registry administrator taking on more responsibility than its authorized role.

9. REFERENCES

Bellassen, V., et al. (2015) 'Monitoring, reporting and verifying emissions in the climate economy', Nature Climate Change, 5(4), pp. 319-328.

Boydell, S., et al. (2009) 'Carbon property rights, cities and climate change', Fifth Urban Research Symposium, Marseille, France.

Brown, M. (2019) 'Legal issues in the voluntary carbon market', Journal of Environmental Law and Practice, 31(2), pp. 247-269.

Evénements, L. (2016) 'Legal aspects of carbon registries and international emissions trading', Climate Law, 6(1-2), pp. 35-59.

Green, J. (2017) 'The strength of weakness: Pseudo-clubs in the climate regime', Climatic Change, 144(1), pp. 41-52.

Hermwille, L., et al. (2021) 'Reconciling market approaches under the Paris Agreement', Climate Policy, 21(7), pp. 963-979.

Kreibich, N. and Hermwille, L. (2021) 'Caught in between: Credibility and feasibility of the voluntary carbon market post-2020', Climate Policy, 21(7), pp. 939-957.

Lovell, H. (2010) 'Governing the carbon offset market', Wiley Interdisciplinary Reviews: Climate Change, 1(3), pp. 353-362.

MacKenzie, D. (2009) 'Making things the same: Gases, emission rights and the politics of carbon markets', Accounting, Organizations and Society, 34(3-4), pp. 440-455.

Manea, S. (2012) 'The legal nature of emissions trading instruments', Journal of Environmental Law, 24(3), pp. 453-473.

Marcu, A. (2016) 'Carbon market provisions in the Paris Agreement (Article 6)', Centre for European Policy Studies, Special Report No. 128.

Mehling, M. (2012) 'Between the scylla of political leadership and the charybdis of market support: Global energy and climate governance after COP17', International Environmental Agreements: Politics, Law and Economics, 12(4), pp. 375-389.

Moore, C. and Newey, G. (2013) 'The future of carbon markets', Policy Exchange, London.

Newell, P. and Paterson, M. (2010) 'Climate capitalism: Global warming and the transformation of the global economy', Cambridge University Press, Cambridge.

Streck, C. (2004) 'New partnerships in global environmental policy: The Clean Development Mechanism', Journal of Environment & Development, 13(3), pp. 295-322.

Tietenberg, T. (2003) 'The tradable-permits approach to protecting the commons: Lessons for climate change', Oxford Review of Economic Policy, 19(3), pp. 400-419.