

ABSTRACT

The carbon market faces serious challenges in terms of transparency, efficiency, and accountability. Blockchain technology comes as a transformative approach that offers great potential to strengthen trust and efficiency in carbon trading. However, the use of blockchain in this context has not been supported by a comprehensive taxonomic framework, making it difficult for developers, policymakers, and market participants to understand the carbon tokenization ecosystem as a whole.

This research aims to develop an integrated taxonomy for a blockchain-based credit carbon tokenization system, which is able to map the technical, governance, and regulatory dimensions in digital carbon trading. The research departs from the question: "How is the taxonomy of blockchain-based credit carbon tokenization in the carbon trading industry?" The developed taxonomy is expected to be a conceptual and practical guide for the development of a more structured and trustworthy digital carbon system.

The research approach used the Systematic Literature Review (SLR) method based on the PRISMA 2020 protocol to identify, select, and analyze 35 relevant scientific articles. Next, semi-structured interviews were conducted with four experts from the regulatory sector, market participants, NGOs/standards organizations, and blockchain technology developers. Qualitative data were analyzed using open coding, axial coding, and selective coding methods, and validated through source triangulation to ensure the accuracy and depth of findings.

The results of the study resulted in a taxonomy with four main dimensions: (1) Blockchain Infrastructure, (2) Carbon Asset Lifecycle, (3) Governance and Stakeholders, and (4) Regulatory and Market Context. This taxonomy maps sub-sub-dimensions such as blockchain consensus, carbon issuance and trading models, MRV data integration, hybrid governance models, to legal contexts and market types. In addition, several important frontier areas were identified such as cross-platform interoperability challenges, the need for immutable trail audits, ReFi incentives, and oracle-based automated MRV integration. These dimensions show the interrelationships between the pillars and the complexity of the design of the digital carbon system.

This research provides a theoretical contribution in the form of a taxonomic framework that can be the basis for further research, as well as a practical contribution as a design guide for carbon tokenization systems for policymakers and developers. The study also places the findings in a broader discourse related to blockchain, sustainability, and digital innovation, and recommends further testing through implementing case studies and sandbox policies to test the readiness of technology adoption in Indonesia.

Keywords: Blockchain, Carbon Credit, Regenerative Finance (ReFi), Sustainability, Taxonomy, Tokenization.