

The Transportation Sector, Cap-and-Trade and Blockchain: A Carbon Credit Trading Platform

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Introduction

A recent congressional report, dated December 2022, states that the transportation sector is the largest source of carbon dioxide emissions in the United States. Specifically, the report warns that “Emissions from transportation surpassed emissions from the electric power sector five years ago and now constitute two-fifths of domestic emissions from burning fossil fuels.” The report offers a solution that aims to enable the transportation sector to mitigate its role as the largest source of CO₂ emissions. The solution sits at the intersection of cap-and-trade initiative, carbon credit trading, and blockchain technology. The cap-and-trade program is a regulatory compliance system developed to curb carbon emissions by limiting the permitted levels of overall emissions and lowering the cap over years. Fueled by the interest in cryptocurrency, the concept of blockchain has been subject to curiosity, scrutiny, criticism, boosterism, investment, and above all, fast-moving innovation. Blockchain technology removes the need for costly intermediaries in complex systems. More specifically, the technology has demonstrated that value and asset trading can take place securely and meticulously without middlemen such as financial intermediaries and other brokers. In this study, researchers show how a democratized trading system for carbon credit trade can be constructed in which the parties conduct trades directly, with no third-party involvement.

Study Methods

Blockchain technology is a peer-to-peer (P2P) network with no central point of authority or control, meaning information is shared, modified, recorded, and exchanged between all participants. This information is recorded on what is called a Distributed Ledger. Every node on the network maintains its own copy of the transaction data on a sequence of “blocks” that embodies the ledger and updates the blocks in synchrony with others when new transactions

are submitted. Effectively, in lieu of putting the “trust” in a central authority to verify a transaction, the authenticity of each new record is verified by the entire community. One important consequence of this mechanism is transparency because the entire transaction history is available to every node of the network. Another important characteristic is the immutability of records, which prevents any one person from altering the information, since changes are verified through a peer-to-peer consensus.

The proposed blockchain-as-a-platform simplifies the transportation sector’s transactions, specifically those related to energy and the environment. It offers several key characteristics, including the following: programmable, secure, unforgeable, time-stamped, immutable, unanimous, and transparent. The cost associated with blockchain is often compared to the cost and advantage of having a centralized system. The authors have identified how the transmission cost can be reduced significantly if the central authority is removed and peer-to-peer transaction is promoted. They also studied and evaluated whether having a smart contract to enable transactions on the blockchain can be automated, thus reducing the human dependency on verification and completion.

Findings

The development of the system presented herein demonstrates a number of important points. Some of the benefits of the proposed system include the following:

- Removal of intermediaries by allowing the users to interact directly with each other and with data through the use of smart contracts
- Sovereignty and self-regulation by promoting community ownership, organization, voting, and development of governance models for projects
- Immutability, by virtue of all records being permanent and impossible to modify

- Transparency, where all transactions are open and visible, while confidentiality of data such as personal information is maintained
- Promoting collaboration with various collaborative forms enabled by blockchain tools
- Trust and anonymity ensured by blockchain design principles and distributed infrastructure, which provide confidence in its operations and resistance to malicious attacks while allowing user anonymity.

In addition, with no middleman collecting fees, the overall cost of transactions are significantly reduced. The proposed system allows anyone to verify the history of the credit. Overall, it improves the transparency and trustworthiness of the system. The proposed system makes carbon credits accessible worldwide, irrespective of location and regulations, thus increasing the possibility of large-scale adaptation. The proposed framework is devoid of regional politics and regulations, which encourages transportation operators, companies, and people to join voluntarily.

Cap-and-Trade has the potential to make the transportation sector a positive contributor to environmental concerns, and blockchain technology is an enabler for globalizing this initiative.

Policy Recommendations

The cap-and-trade system, which aims to limit the maximum amount of emissions across all industries and reduce the capped amount by some margin each year, empowers various entities to compensate for their excess carbon emissions by acquiring another entity's carbon offset credits. The currently existing cap-and-trade systems exhibit several limitations, including a lack of standardized global adaptation. Many of the limitations can be mitigated using blockchain technology, which, as a Peer-to-Peer system, incorporates decentralization, increased privacy, consensus mechanisms that do not rely on mutual trust, and the ability to incorporate smart contracts. With no centralized authority, which inevitably may cater to a specific region or country, a global peer-to-peer exchange system will help increase universal participation in carbon offset credits trading. This solution is significant because the earth is battling a historical rate of adverse climate conditions and the transportation sector bears some responsibility for one

of the key contributors, namely, greenhouse gas emissions. Even with the great strides that have been taken toward minimizing emissions, simple calculations show that the transportation industry continues to be one of the largest contributors to carbon emissions. The developed system will encourage the sector to take more ownership of their emissions and provide easy facilitation for offsetting.

About the Authors

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To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/2329



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