CaseStudyAnalysis

In the past, the carbon trading market has been centralised, controlled by a single entity, and has relied on human reporting of emissions. However, blockchain technology has brought transparency, decentralisation, and unchangeability to a number of industries, including the carbon trading market. Incorporating blockchain technology into this market has enhanced transaction costs and data transparency within the context of real carbon trading. Scalability issues and the absence of a standardised legal framework are among the disadvantages. We can assess the impact of blockchain integration on real carbon trading markets by looking at a number of case studies.

1. Shanghai Environment and Energy Exchange

To determine whether the integration of BCT into the carbon trading market would impact the market's transaction prices, a case study analysis was conducted on the Shanghai Environment and Energy Exchange. The first transaction through this integration took place on April 2, 2022. The findings indicate that blockchain has significantly benefited the carbon trading industry. One of the key benefits is the improvement in emission data precision. P2P transactions were made possible by the advent of blockchain, which increased trust and ensured the accuracy of the data. It also permitted cross-regional participation, in contrast to the traditional system that limited participation to organisations within the same area.

The study also demonstrated that the market price of carbon quotas was unaffected prior to the development of blockchain. However, the market price of carbon became bullish after blockchain integration, demonstrating increased stability and more stable pricing. These positive outcomes contributed to the development of increasingly complex policies as the market became more stable. These advantages come with some drawbacks, such as the use of blockchain in the carbon market. One of the biggest challenges is the steep learning curve because BCT requires a lot of technical knowledge, which might keep some users from participating completely. Another issue is scalability, as the limited computer throughput may result in delays as more transactions are made. There are challenges in integrating blockchain with existing systems as well, particularly with regard to complexity. Finally, since there are no established rules to support its widespread use, the lack of a legal framework governing blockchain's application in the carbon trading industry raises serious concerns.

2. China's Carbon Market

A case study analysis of the effects of implementing BCT in China's carbon markets was conducted using Matlab simulation. Three levels of investigation were used in this study: the macroscopic level, which considers policy incentives; the mesoscopic level, which focusses on how BCT promotes developments in China's carbon markets; and the microscopic level, which examines the implications for carbon trading companies. According to this study, China's pilot provincial and municipal carbon markets currently include about 3,000 businesses across more than 20 industries. The findings show that implementing BCT has a major impact on market participants and encourages technological innovation and industrial transformation. For instance, entrepreneurs are growing more motivated to research innovative approaches to emissions, and participants say they feel more trusted when interacting with other market participants.

Real-time transaction capabilities and the ability to clear and settle on-chain transactions, which improves transaction reconciliation accuracy, are two more benefits of integrating blockchain technology with the carbon market. These changes ultimately aid in market stabilisation as adoption rises. The case study also discussed how traditional waterfall transaction processing models could be challenged and altered by BCT. For instance, smart contract-driven processing addresses trust issues while advancing automation and digitalisation in the markets. Nevertheless, some adverse effects were observed, such as the fact that market size affects market participation. Since the market is still small and people are less aware of blockchain's potential on the carbon market, this reduces market participation. emphasising the need for government intervention to pass legislation that will encourage the use of BCT in the carbon market.

3. Shenzhen and Beijing Pilot Programs

Data from China's eight most recent carbon trading pilot programs are used for analysing the effects and development of carbon trading using BCT. The study found that businesses' willingness to embrace BCT determines how long it takes them to understand and successfully apply it. Among the benefits, BCT has been shown to improve market participants' privacy and lower the administrative expenses related to reporting carbon records. One recognised obstacle is the discrepancy between the number of participants and the market's potential capacity, which arises from the slow adoption of technology.

4. Urawa Misono Microgrid Case in Japan

To investigate the impacts and difficulties of BCT in the energy sector, a case study was carried out involving ten consumers, five prosumers, and a shopping mall that were all connected to the main utility grid via an embedded distribution line. The difficulties related to the current phase of technology adoption were the main focus of this explanatory study. According to the study's conclusions, some of the main obstacles keeping BCT from being extensively accepted and utilised in the carbon trading market are scalability problems, throughput limitations, low latency, and inadequate data storage. Furthermore, there is limited interoperability due to the difficulty of integrating systems operating on various blockchain networks and the lack of a legal framework that takes into consideration the unique characteristics of blockchain systems. Although the blockchain network has some inherent security, hackers can still attack it if the code is not run correctly. The study offered recommendations for addressing these problems from a number of perspectives.

From a societal perspective, skill development and wider public acceptance of technology are essential. Environmental experts should address concerns about the lack of a legal framework by developing a robust one to support the appropriate adoption of the technology. Finally, from an institutional perspective, primarily regarding organisations responsible for emissions, setting goals for renewable energy was recommended.