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Blockchain for the Monitoring and Reporting of Carbon Emission Trading: A Case Study on Its Possible Implementation in the Danish Energy Industry

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Abstract : The use of blockchain to address the issue of climate change is increasingly a discourse among countries, industries, and stakeholders. For a long time, the European Union (EU) has been combating the issue of climate action in industries through sustainability programs. One of such programs is the EU monitoring reporting and verification (MRV) program of the EU ETS. However, the system has some key challenges and areas for improvement, which makes it inefficient. The main objective of the research is to look at how blockchain can be used to improve the inefficiency of the EU ETS program for the Danish energy industry with a focus on its monitoring and reporting framework. Applying empirical data from 13 semi-structured expert interviews, three case studies, and literature reviews, three outcomes are presented in the study. The first is on the current conditions and challenges of monitoring and reporting CO_2 emission trading. The second is putting into consideration if blockchain is the right fit to solve these challenges and how. The third stage looks at the factors that might affect the implementation of such a system and provides recommendations to mitigate these challenges. The first stage of the findings reveals that the monitoring and reporting of CO_2 emissions is a mandatory requirement by law for all energy operators under the EU ETS program. However, most energy operators are non-compliant with the program in reality, which creates a gap and causes challenges in the monitoring and reporting of CO_2 emission trading. Other challenges the study found out are the lack of transparency, lack of standardization in CO_2 accounting, and the issue of double-counting in the current system. The second stage of the research was guided by three case studies and requirement engineering (RE) to explore these identified challenges and if blockchain is the right fit to address them. This stage of the research addressed the main research question: how can blockchain be used for monitoring and reporting CO_2 emission trading in the energy industry. Through analysis of the study data, the researcher developed a conceptual private permissioned Hyperledger blockchain and elucidated on how it can address the identified challenges. Particularly, the smart contract of blockchain was highlighted as a key feature. This is because of its ability to automate, be immutable, and digitally enforce negotiations without a middleman. These characteristics are unique in solving the issue of compliance, transparency, standardization, and double counting identified. The third stage of the research presents technological constraints and a high level of stakeholder collaboration as major factors that might affect the implementation of the proposed system. The proposed conceptual model requires high-level integration with other technologies such as the Internet of Things (IoT) and machine learning. Therefore, the study encourages future research in these areas. This is because blockchain is continually evolving its technology capabilities. As such, it remains a topic of interest in research and development for addressing climate change. Such a study is a good contribution to creating sustainable practices to solve the global climate issue.

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