International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-84, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

Utilization of Blockchain and the Roles of Banks in Indonesia in Tackling Environmental Challenges: A Qualitative Research

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ABSTRACT: This dissertation investigates the readiness of the blockchain technology to be utilized in the upcoming Indonesia's Emissions Trading Scheme, also the roles of banks and digital banks in the ETS using PESTEL analysis. The study found that Indonesia still lacks the infrastructure to implement the blockchain technology, while banks in Indonesia has huge roles in the scheme including preparing the infrastructure. With a large and growing population, Indonesia has the potential to develop the human resources necessary for blockchain development. However, finding skilled programmers remains difficult. The relationship between blockchain and the environment is also examined, with experts debating its potential benefits and drawbacks. In addition, the thesis analyzes Indonesia's efforts to mitigate and adapt to climate change, including its participation in international agreements and infrastructure improvements. Finally, the thesis considers the role of financial institutions in promoting emissions trading and the challenges they face in doing so. Overall, the thesis highlights the complex and interconnected factors that influence the adoption and development of blockchain technology in Indonesia.

KEYWORDS: Blockchain, banks, Carbon market, Carbon trading, Climate change, Digital banks, Indonesia, fintech.

INTRODUCTION

Since the beginning of the twenty-first century, global greenhouse gas (GHG) emissions have grown relative to the preceding decades, mostly due to the growth in carbon dioxide emissions from rising economies, according to Crippa, et al. (2020). As a result, the quantities of greenhouse gases in the atmosphere grew dramatically, amplification of the global warming potential that severely impacts life on Earth. CO2 emissions, the primary greenhouse gas responsible for global warming, continue to rise globally despite climate change mitigation agreements. According to Olivier and Peters (2019), the 2018 GHG emissions was 55,6 GtCO2 equivalent. Current GHG emissions are approximately 57% greater than they were in 1990 and 43% higher than they were in 2000. At the 21st Conference of Parties (COP21) to the UN Framework Convention on Climate Change (UNFCCC) in Paris in 2015, it was agreed to pursue the aim of limiting global warming caused by human emissions of greenhouse gases (GHG) to 1.5°C.

While the global emission constantly arising, the global economy is becoming increasingly competitive, with rising needs that conventional energy systems cannot sustainably provide, according to study by Caputo, et al. (2018). According to a report by International Energy Agency (EIA) (2018), in 2017, the world's energy consumption increased by 2.1%, with fossil fuels meeting 81% of global demand. There are demands to reduce emissions through energy efficiency and renewable energy in light of climate change. In 2017, 25 percent of the world's energy was derived from renewable sources; the proportion is expanding quickly. The Guardian (2018) stated that several nations set ambitious goals, such as a 32 percent renewable energy share by 2030 in the European Union (EU) and a 100 percent renewable energy share by 2040 in Sweden. Mengelkamp, et al. (2018) stated that due to the scattered and intermittent nature of renewable sources, new technologies are required to further this spread. Utilizing locally sourced renewable energy can help to environmental sustainability and social development. By utilizing technology advancements, distributed energy systems, including local renewable sources and energy storage, will continue to grow as stated by Calvillo, et al. (2016). While it is evident that current centralized markets cannot effectively manage future scenarios involving the complicated interaction between prosumers and smart gadgets, there is an increasing emphasis on information and communication technology (ICT) to facilitate more sustainable, distributed energy.

Indonesia, one of the world's largest producers of coal and emitters of greenhouse gases, plans to build its own carbon trading mechanism. In October 2021, President Joko Widodo of Indonesia signed "Presidential Regulation No. 98/2021 on the Instrument for the Economic Value of Carbon for Achievement of the NDC and Control of Carbon Emissions in Development," a regulation that

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will serve as the legal framework for domestic carbon pricing regulations designed to assist Indonesia in achieving the climate goals outlined in its Nationally Determined Contribution.

There are several obstacles to adopting this plan in Indonesia, but even more potential. Indonesia has been considering carbon pricing for a number of years, with considerable progress made in 2017 with the approval of "Government Regulation No. 46/2017 on Environmental Economic Instruments." This created the first requirement for ETS implementation, demanding the construction of an emissions and/or waste permit trading system by 2024, seven years after the ETS's adoption. This research is to analyse the readiness of integrating blockchain and the responsibilities of banks in Indonesia in Indonesia's forthcoming carbon trading programme as 2024 approaches.

LITERATURE REVIEW

Blockchain Technology

Blockchain technology provides an irreversible distributed ledger that is trusted and recognized by all parties involved in its operation. The technology was initially developed in the late 2000s to address vulnerabilities in the financial markets. Blockchain can create intelligent contracts that can store, encrypt, and execute company bylaws. This technology offers numerous benefits such as decreased administrative expenses, reduced fraud, and enhanced data monitoring. Blockchain has also found widespread use in the energy sector due to its underlying properties of decentralization, transparency, anonymity, and dependability. To facilitate and expedite the widespread use of blockchain solutions, open source blockchain standards are being established by organizations like the Enterprise Ethereum Alliance and the Hyperledger Project

Characteristics of Blockchain Technology

Blockchain technology's utility in the energy sector is due to its characteristics that facilitate a distributed energy system. These include openness, decentralization, traceability, automatic execution contracts, and anonymity. Openness allows for trustworthy mathematical algorithms to regulate transaction behavior and for all parties to have easy access to applicable procedures. Decentralization means that no central authority is needed as every network node in the system has the same status. Traceability ensures protection against data manipulation, trustworthiness, and security. Automatic execution contracts enable smart contracts to be established, and anonymity allows for data transfer between nodes without disclosing identity. These features make blockchain technology a reliable and secure solution for a distributed energy system.

The Role of Banks in Emission Trading Scheme

Banks have a responsibility to implement environmentally friendly policies and allocate funds for environmental management in order to combat climate change and meet net-zero criteria. To this end, they are increasingly providing financial products and services in the emerging market for offsetting carbon emissions, which is projected to be worth around $50 billion by 2030. However, the lack of a singular set of criteria for decarbonization initiatives and concerns over greenwashing have raised questions about the effectiveness of these solutions. Despite the risks, banks are competing for a leading position in this market, which has quadrupled in size since 2020, and could generate billions of dollars in trading revenues while helping lenders reduce their own CO2 footprint.

Digital Banks in Indonesia

Digital banks in Indonesia are legal entity banks that predominantly conduct business via electronic means without a physical office, with twelve digital banks expected to operate in Indonesia, five of which are currently operational. The development of digital banking in Indonesia follows the pattern of transitioning from traditional to digital banking, with some banks considered fully digital and others undergoing a digital transformation. Despite the potential for growth and profitability, digital banks face challenges such as high investment expenses and a dearth of digital professionals, as well as government regulations, data protection requirements, and cybersecurity risks. To succeed, digital banks must focus on strategic firm growth, risk management, human resource development, and customer management strategies.

Emission Trading Scheme

Emissions trading, also known as cap and trade, is an efficient method to reduce greenhouse gas emissions. The government sets a limit on emissions and distributes licenses or allowances to companies, which they must acquire and return for each unit of

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emissions. The permits can be obtained through government approval or through business with other enterprises. Companies that cannot acquire enough permits must either reduce their emissions or buy permits from other businesses. The Paris Agreement requested that countries make "nationally determined contributions" to reduce emissions and offered three options for public governments to do so. One of these options is to establish a carbon market through an emissions trading system. There are two types of carbon credits available: compliance carbon markets, which are mandated and controlled by governments, and voluntary carbon markets, which allow individuals and companies to trade carbon credits freely to encourage investment in carbon reduction and removal efforts.

How Emissions Trading Works

Market permits are available, however there are only a certain number of them. At the beginning of a trading session, emission permits are either made available without charge or need to be purchased through an auction. Because the number of permits that are available is decreasing over time, there is increasing pressure on businesses to make investments in more environmentally friendly manufacturing methods and to cut their CO2 emissions. This encourages innovation and, over time, leads to a reduction in the cost of newly developed technology. Carbon reduction initiatives will be able to acquire carbon offsetting credits as a consequence of their successful removal of greenhouse emissions from the environment. The planting of new trees, the prevention of deforestation, the investment in renewable energy, the capture of carbon, the completion of carbon sequestration projects in deep saline aquifers, and other similar actions are all included in these measures. If carbon emitters were unable to meet their emission restrictions, they might temporarily exceed those limits by purchasing carbon credits from efforts that reduced the amount of carbon in the atmosphere.

Emissions Trading Current Challenges

The global expansion of greenhouse gas emissions markets has resulted in a variety of programmes such as the EU ETS, EZ ETS, MGA, and California's cap-and-trade system. However, these systems lack interregional communication, are criticized for excessive crediting, unclear life cycles of issued carbon credits, and encourage double spending. The high transaction costs are another concern, which often lead to brokers and agents receiving a commission, and third-party verifiers being incentivized to approve projects that pass their cleanliness standards. The convergence of these factors may explain why global (and regional) carbon markets have not significantly reduced greenhouse gas emissions.

Relationship Between Blockchain and Emissions Trading Scheme

Blockchain technology has the potential to improve the emissions trading scheme by increasing verifiability and lowering transaction costs. Various studies have highlighted the benefits of incorporating blockchain technology into the emissions trading system, such as improving traceability, transparency, prevention of data tampering, and facilitating the allocation of carbon units. However, some researchers have claimed that the technology may not be ready yet, citing issues with privacy protection, complexity of the energy system, and constraints on implementation. Despite these limitations, a transition towards a permissioned blockchain system could serve as a potential first step towards a completely decentralised blockchain-based ETS. The use of blockchain technology in emissions trading has been explored in several studies, which suggest that it has the potential to improve the system by increasing transparency, lowering transaction costs, and addressing problems related to additionality and permanency of forestry projects.

Blockchain may also facilitate equitable allocation of carbon units, enforce contracts, and generate trustworthy confidence between network nodes. However, some studies have raised concerns about privacy protection, technological limitations, and complexity of the energy system. While blockchain may not be ready for widespread implementation, a permissioned blockchain system that mimics current ETS has been proposed as a potential first step towards a fully decentralized blockchain-based ETS. In conclusion, incorporating blockchain technology into the emissions trading scheme shows potential benefits, including increased verifiability, lower transaction costs, and improved transparency. Blockchain could also help address the issues of forestry projects' additionality and permanency. Previous studies have highlighted the potential benefits of blockchain in the emissions trading scheme, including improvements in traceability and preventing data tampering, and the equitable allocation of carbon units. However, some studies have noted privacy concerns and the technology's infancy as constraints on blockchain's implementation in the emissions trading scheme. Further research and development are needed to fully realize the potential benefits of blockchain in this area.

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Conceptual Framework

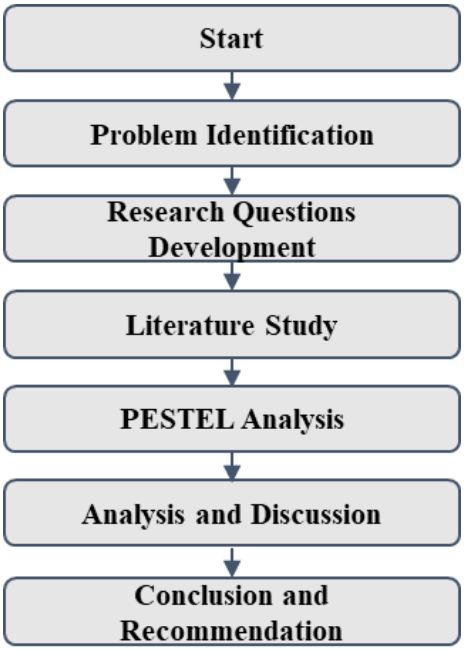
This study aims to investigate the preparedness of banks and digital banks in Indonesia for the upcoming emission trading scheme and the potential impact of blockchain technology on the scheme. Prior research suggests a reciprocal relationship between blockchain and emission trading, with blockchain aiding in establishing societal consensus and enhancing accountability and transparency. Banks have played various roles in past emissions trading schemes, but some have withdrawn from the market. The study assumes that banks in Indonesia have the necessary infrastructure to support the carbon trading plan and that blockchain will contribute to and benefit the program.

METHODOLOGY

Research Design

This work is based on a descriptive study that focuses on secondary data; the bulk of material comes from journal papers, news, and sustainability reports. Due to immaturity of emissions trading scheme in general and in Indonesia and the paucity of information on the topic, the sample size for quantitative research on the issue would be small. The selected method facilitates the comprehension of several facets of emissions trading scheme in Indonesia through the use of words rather than figures. The researcher selected qualitative research for these reasons.

Research Framework



This research begins with the identification of the problem, and then moves on to the creation of research questions and the analysis of the relevant literature. Following that, we proceed with the PESTEL analysis, followed by analysis and discussion, and finally we finish with a conclusion and some recommendations for further study.

Analysis Technique: PESTEL

PESTLE analysis is a strategic management tool that assesses the potential or risk of a project, product, or service in relation to its environment. The six key factors considered are political, economic, social, technological, legal, and environmental. Political factors include government policy and trade restrictions, while economic factors comprise interest rates and exchange rates. Social factors involve attitudes and demographics, and technological factors refer to advancements in automation and communication. Legal factors relate to consumer protection and safety regulations, while environmental factors include sustainability and climate change. This analysis helps businesses identify their operational environment and forecast future scenarios.

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RESULT AND DISCUSSION

PESTEL Analysis of Blockchain in Indonesia's ETS

Political Aspect

Blockchain technology has gained traction globally, and governments are taking notice of its potential benefits and challenges. Indonesia has recognised the utility of blockchain by legalising and regulating cryptocurrency trading, but the central bank does not recognise it as a legitimate payment method. The US government has also acknowledged blockchain's potential, as seen in West Virginia's blockchain-based voting system. However, challenges to the adoption of blockchain technology exist, such as the level of technological advancement and security concerns. While laws are necessary to stabilise the market, they may impact the adoption of blockchain technology in some nations, including Indonesia. The adoption of blockchain technology by governments around the world is varied, with some countries more open and accepting of the technology than others. While blockchain has the potential to improve government practices and increase transparency, there are also challenges related to regulation and the adoption of new technology in different economic and political contexts.

Economical Aspect

Blockchain technology implementation in Indonesia requires a crucial consideration of infrastructure. The government's provision of IDR 364.6 trillion for infrastructure in 2017 may encourage more equal regional deployment of cellular telecommunications infrastructure, which is vital for the expansion of FinTech in the country. Five of the top banks in Indonesia are preparing to adopt blockchain technology, which might persuade others to follow suit. The pandemic had a significant impact on business activity in Indonesia, affecting the adoption and expansion of financial technology. However, the use of blockchain in Indonesia's carbon trading plan is anticipated to generate shared benefits for all with the aid of digital transformation, sustainable investment, and policy reform, as the country has the potential to play a significant role in the global carbon trading market. Indonesia's adoption of blockchain technology faces challenges in infrastructure, but the government has allocated a significant budget for infrastructure development. The country's top banks, including BNI, BRI, Bank Mandiri, Bank Danamon, and Bank Permata, are collaborating with IBM to incorporate blockchain technology. However, the COVID-19 pandemic has impacted the FinTech industry, leading to reduced usage, decreased sales, difficulty in securing financing, and postponed corporate expansion. Despite these challenges, the use of blockchain in Indonesia's carbon trading plan is expected to bring benefits such as accelerated development goals, strengthened environmental, social, and governance ecosystem, and shared benefits through sustainable investment, policy reform, and digital transformation. With its vast forests, rich biodiversity, and significant mining and agriculture industries, Indonesia could play a significant role in the global carbon trading market, according to PricewaterhouseCoopers.

Social Aspect

Indonesia's large and growing population presents both opportunities and challenges for the adoption of blockchain technology. With a projected population of over 298 million by 2030, there is a potential abundance of human resources that can be utilized for blockchain development. However, finding proficient programmers in Indonesia remains a challenge, which may require outsourcing or utilizing platforms such as Ethereum to facilitate smart contract implementation. The distribution of FinTech users in Indonesia is still concentrated in certain areas, such as Greater Jakarta, due to less-supportive technological infrastructure and internet connection networks. Efforts are being made to address this issue by improving the overall telecommunications infrastructure in the country. A report by Setiawan et al. highlights the lack of research on the influence factors of blockchain technology adoption in payment systems in banking in Indonesia. Overall, the social aspect of blockchain adoption in Indonesia involves balancing the potential benefits of a large and productive population with the need to address disparities in technological infrastructure and support the development of skilled programmers. In addition to the challenges mentioned, cultural factors can also play a role in the adoption of blockchain technology in Indonesia. According to a study by Rahmawati and Azizah (2019), the culture of distrust in Indonesia can hinder the adoption of blockchain technology, as it is seen as a new and unfamiliar concept. Additionally, a lack of public awareness and education about blockchain technology and its potential benefits may also pose a challenge to its adoption. Nevertheless, with the increasing interest of top banks and the government in blockchain technology, it is possible that more efforts will be made to promote its adoption and overcome the challenges. The potential economic and environmental benefits of blockchain technology in Indonesia are significant, making it worth exploring and investing in its development.

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Technological Aspect

The Indonesian government has allocated a significant amount of funding towards information and communication technology (ICT), which is a positive indicator for the development of blockchain-based infrastructure in Indonesia. Bank Indonesia has a positive attitude towards the implementation of blockchain technology and recognises its potential for the emissions trading system. There have been several blockchain projects in Indonesia, such as BeKind and Hara, that focus on openness, accountability, and data exchange for the farm and food industry. However, Indonesia lacks the technology required to calculate emission reductions, which is a significant challenge for the implementation of the carbon trading plan. The proper implementation of the blockchain foundation protocol layer could enable organisations to develop decentralised applications to assist in the governance, alignment, and monitoring of various infrastructure standards. This would require genuine, standardised, and up-to-date information on infrastructure assets, including disclosures related to environmental, social, and governance norms and financial performance. The construction of a good ICT infrastructure in Indonesia is necessary for the operation of the carbon trading programme and blockchain. With the significant budget allocated to the sector, it is thought that construction can begin.

The numerous blockchain-based projects in Indonesia are evidence of the potential for blockchain technology to facilitate the digitisation of traditional industries. However, the lack of necessary technology is a significant challenge for the effective implementation of the emissions trading system. Furthermore, the establishment of a good information and communication technology infrastructure is necessary for the successful operation of the blockchain and carbon trading program in Indonesia. The government's significant funding allocation for the information and communication technology sector, which includes blockchain, is a positive indicator for the development of such infrastructure. Bank Indonesia's positive attitude towards blockchain technology and its potential use in the emissions trading system is another encouraging sign. There have also been numerous blockchain-related projects in Indonesia, such as BeKind and Hara, which demonstrate the potential of blockchain technology to facilitate the digitization of traditional industries and promote openness and accountability in the charitable sector. However, Indonesia faces challenges in implementing the carbon trading plan due to a lack of technology required to calculate emission reductions, which is essential for the success of the emissions trading system. Therefore, there is a need for investment in technology and infrastructure in order to overcome these challenges and realize the potential of blockchain technology in Indonesia.

Environmental Aspect

Blockchain technology has the potential to address a variety of pressing environmental issues. Article 6 of the Paris Agreement emphasizes the need for creative solutions to environmental concerns, and the World Economic Forum has identified 65 blockchain use cases that could improve sustainability. With blockchain, it's possible to closely monitor energy use and reduce waste, including paper waste through the use of smart contracts. Blockchain can also enhance transparency in emissions trading and governance. However, some experts remain skeptical of the environmental benefits of blockchain, citing its high energy consumption and susceptibility to "garbage in, garbage out" issues. Others believe that blockchain can reduce waste and inefficiencies in supply chains, leading to a more sustainable ecosystem. Overall, blockchain solutions are still evolving, but they offer a promising tool for addressing environmental challenges.

Legal Aspect

Indonesia does not have specific regulations related to blockchain technology, but Presidential Decree 95 of October 2018 outlines how emerging technologies can be used in the future. Although blockchain is not mentioned, it is likely to be incorporated as its application grows more widespread. According to the OECD, trading systems for emissions certificates may be made more effective through the use of a global blockchain layer, which can help monitor quota limitations and certificate circulation, maintain market integrity, and improve efficiency. A blockchain network can connect several registries at the treaty level to support the Paris Agreement. However, the appropriate government agencies in Indonesia have not yet issued the implementing laws required for the carbon trading program to be put into effect, including specific legal requirements for the transfer of ownership of carbon. Utilizing blockchain technology allows for the ownership of carbon to be transferred from one party to another, which is the goal of the process. Carbon trading is a market-based mechanism for reducing greenhouse gas emissions through buying and selling carbon units domestically or internationally, either through a carbon exchange or direct trading, according to Presidential Regulation No. 98 of 2021. Despite some uncertainty, blockchain technology can play a critical role in enhancing the transparency and efficiency of carbon trading in Indonesia.

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PESTEL Analysis of Indonesia's Banks in Indonesia's ETS

Political Aspect

Indonesia has ratified the Kyoto Protocol and the Paris Agreement, committing to reaching net zero emissions. The country is highly vulnerable to the effects of global warming due to its geographic location and high carbon emissions. To achieve this goal, Indonesia is developing a carbon trading plan that may involve banks or digital banks across the country. Financial actors, including banks and exchanges, play a crucial role in facilitating trading, especially in the early stages of the scheme. President Joko Widodo has introduced Indonesia's Green Taxonomy, which aims to serve as a foundation for sustainable economic activities and investments that support environmental protection, climate change mitigation, and adaptation. The taxonomy is intended to encourage innovation and investment in a sustainable economy and is a critical tool for financial institutions to expand their green credit portfolios with efficiency and integrity. The government's efforts towards sustainable finance legislation are beginning to align private-sector objectives with impact investment, as evidenced by the trend of increased green portfolios held by banks in recent years. The taxonomy is one of the government's initiatives to increase the amount of money directed towards sustainable finance in Indonesia.

Economical Aspect

Indonesia aims to increase financial inclusion to 90% by 2024, with a focus on ultra-micro and micro-businesses that contribute over 60% to the country's GDP and employ 97% of its labor force. BRI, the biggest bank in Indonesia, plans to advance financial inclusion through digitization initiatives. The OJK aims to integrate ESG into risk management by introducing stringent reporting requirements, developing key performance indicators, and enhancing human capacity. Indonesia has the potential to play a significant role in the global carbon trading market due to its large forests, biodiversity, mining, and agriculture industries. Fintech could help provide financial services to the unbanked and unreachable population in the country. The digital economy in Indonesia will continue to be a vital engine of inclusive growth, with opportunities in fintech, telemedicine, and education technologies. However, the pandemic has disrupted numerous industries and affected the transaction values of phone banking, mobile banking, and internet banking, as well as P2P fintech financing. Despite this, Indonesia's fintech marketplaces have been resilient, and the government has included the fintech industry as part of its economic recovery program. The incorporation of blockchain technology into banks could create a suitable framework for bank participation in the carbon trading program.

Social Aspect

Indonesia's population is expected to reach 270.20 million in 2020, with over 70% of the population being of productive age. By 2030, this number is projected to surpass 298 million, with 68.1% of the population being of productive age. The fast expansion of the fintech industry in Indonesia has presented enormous opportunities for entrepreneurs, and it has provided an alternative for the majority of unbanked people in the country. People consider fintech services to be highly convenient compared to traditional banking services that require in-person visits. In recent years, there has been a surge in the popularity of cashless transactions, and the issuance of credit cards has increased. Banks in Indonesia have not been customer-friendly, and there are frequent cases of confusion and complications when customers try to obtain bank loans or search for information. Hence, fintech startups in Indonesia have great potential to transform the financial sector. Indonesian financial institutions need to enhance their customer-friendly approaches to better serve their clients. However, there are challenges to the growth of fintech in Indonesia. One major challenge is the need for regulatory frameworks that can keep up with the rapidly evolving industry.

Technological Aspect

The Indonesian government is working on improving the country's communication infrastructure through initiatives such as the Palapa Ring project, which includes a nationwide fiber optic network that will provide internet and telephone services to every residence in Indonesia. This project will be crucial for fintech services and internet-only banks that rely on internet access. The Ministry of Finance has allocated IDR 29.6 trillion towards information and communication technology in the State Budget for 2021 to improve Indonesia's internet access. However, Indonesia lacks the necessary technology to calculate emission reductions, which is crucial for preparing for the next carbon market. This presents an opportunity for banks to play a role as intermediaries, as they have done in the EU ETS, but they must establish the necessary technology and infrastructure to function effectively in the ETS. Without a credible technique for quantifying the quantity of pollution removed, the emissions trading system will not operate very well. The Indonesian government's efforts to improve internet access may serve as a useful starting point for establishing an emissions trading scheme. The Indonesian government's focus on improving communication infrastructure through the Palapa Ring

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project, with nationwide fiber optic network coverage, presents a potential starting point for the establishment of an emissions trading scheme. However, the lack of necessary technology for quantifying emission reductions in Indonesia poses a significant challenge. This presents an opportunity for Indonesian banks to establish the necessary technology and infrastructure to function effectively as intermediaries in the ETS.

Environmental Aspect

According to the World Bank (2020), on November 27, the Ministry of Environment and Forestry of Indonesia and the Forest Carbon Partnership Facility of the World Bank signed a landmark agreement that will release up to US $110 million for Indonesia's efforts to reduce carbon emissions from deforestation and forest degradation between now and 2025. This agreement will allow for the release of the funds. Banks might use the cash allotted by the ministry and the forest carbon partnership in order to develop the infrastructure for the planned 2024 emissions trading scheme in Indonesia. This is because the impending emissions trading scheme in Indonesia is an element of lowering carbon emissions. In addition, PricewaterhouseCoopers (2021) noted in their research that Indonesia is the location of the world's third-largest tropical rainforest. Brazil and the Democratic Republic of the Congo hold the top two spots, respectively. From 2001 to 2009, the world's woods were one of the most major carbon sinks due to the fact that they absorbed about twice as much carbon dioxide as they emitted into the atmosphere.

Legal Aspect

Indonesia has committed to lowering its greenhouse gas emissions in accordance with the UNFCCC, Kyoto Protocol, and the Paris Agreement. The Archipelagic Carbon Plan (Skema Karbon Nusantara) is a voluntary program that lacks legal consequences for organizations that do not disclose and verify their GHG emissions. To ensure the effectiveness of the emissions trading program, the government must identify which sectors and how many permits are provided to keep GHG emissions of businesses in check. However, Indonesia lacks the appropriate policy instruments and institutional framework for effective regulation of these issues. Carbon credits must be recognized as financial instruments and their management delegated to financial markets. To ensure transparency in transactions, the administration of the scheme should be decentralized through the involvement of banks and blockchain technology. The implementation of a carbon trading system requires collaboration among several parties, including ministries and institutions in charge of GHG emissions reduction programs. The lack of necessary technology to calculate emission reductions is another significant challenge for Indonesia. The Palapa Ring project aims to improve the country's internet access, a useful starting point for establishing an emissions trading scheme. Indonesian banks can play important roles in the ETS, including intermediaries. Finally, being a non-Annex I nation, Indonesia can receive funding and technology transfer from Annex I - Annex II nations to implement measures to reduce GHG emissions.

CONCLUSION AND RECOMMENDATION

Conclusion

Indonesia's enormous population and economic growth potential present both opportunities and challenges for the adoption and implementation of blockchain technology. While there may be a sufficient workforce to develop blockchain technology, finding skilled programmers remains a challenge. Moreover, economic and social factors, such as customer-friendly banking services, also play a critical role in driving or impeding the adoption of blockchain technology. The country's commitment to international climate agreements, infrastructure improvement, and forest conservation also indicates its preparedness to address climate change issues and reduce carbon emissions. However, there are still barriers to overcome, such as the lack of equipment to measure carbon reductions and the need for banks to invest in the necessary technology and infrastructure for efficient emissions trading system middlemen. The government's collaboration with the World Bank's Forest Carbon Partnership Facility to release funds for Indonesia's efforts to reduce carbon emissions is a promising development. Despite these challenges, Indonesia has shown its determination to take concrete actions to address climate change issues and foster economic growth through the adoption of emerging technologies like blockchain.

Overall, the future of blockchain technology in Indonesia remains uncertain. While the country's large population provides a potential workforce for developing blockchain technology, the shortage of skilled programmers presents a significant obstacle. Additionally, economic and social factors, including the need for improved customer-friendly banking services, must be addressed to facilitate the growth of blockchain technology. However, Indonesia has taken several steps to mitigate climate change and reduce

carbon emissions, including ratifying international agreements and initiating emissions trading schemes. The recent agreement between the Indonesian Ministry of Environment and Forestry and the Forest Carbon Partnership Facility to release up to $110 million for emissions reduction efforts is a promising development. As such, the future of blockchain technology in Indonesia may depend on the country's success in balancing economic growth and technological innovation with environmental sustainability. Only time will tell if Indonesia can successfully navigate these challenges and emerge as a leader in both blockchain technology and environmental stewardship.

Implementation Plan

Indonesia is currently in the process of assessing and developing legislation on blockchain and emissions trading. As a result, the variables affecting the industry are constantly changing, and the general public's awareness is limited. This makes it challenging to collect accurate data for the study of blockchain use and the role of banks in the emissions trading scheme. Currently, information is based on secondary sources and may be restricted due to the present market state. The research mainly focuses on investigating hypothetical use cases and provides a complete understanding of blockchain and bank usage in the emissions trading system. It is not financial advice but is intended to assist policymakers and parties planning the strategy for Indonesia's forthcoming emissions trading scheme.

Indonesia holds a lot of potential for the carbon market, and blockchain technology could bring great benefit to the industry, even though infrastructure is currently lacking. Banks have a significant role to play in the emissions trading scheme, and they need to establish the necessary technology and infrastructure to be effective intermediaries. The Indonesian government needs to prepare an adequate policy instrument and institutional framework to ensure that the emissions trading program is effective. In the long run, this can contribute to a better environment and economic growth. It is important to note that due to the constantly evolving market, discretion should be applied while considering the information in the research. The potential of the carbon market in Indonesia cannot be overlooked, and it is crucial to establish a solid framework for the success of the emissions trading scheme.

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International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-84, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

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Cite this Article: Kemal Aditira, Yudo Anggoro (2023). Utilization of Blockchain and the Roles of Banks in Indonesia in Tackling Environmental Challenges: A Qualitative Research. International Journal of Current Science Research and Review, 6(2), 1638-1648