

“Mediating Environmental Disputes with Smart Contracts: A Sustainable Approach”

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ABSTRACT

Smart contracts are digital agreements that are signed and stored in the form of blockchain technology. Blockchain technology is a decentralized system of nodes in a computer that stores all the information in the format of a ledger transaction. Smart contracts store their data in blockchain technology through the language of coding. Codes for the contracts are entered in this technology and work automatically when the predetermined conditions of these contracts are fulfilled. In the cases of environmental disputes, there are several disputes relating to various environmental issues such as water pollution, air pollution, etc, the traditional method of dispute resolution is time-consuming and does not always result in fruitful resolutions. This article is focused on evaluating the advantages of smart contracts in resolving environmental disputes to attain swift and easy dispute resolution.

Keywords: Blockchain Technology, Smart Contracts, Environmental Disputes, Alternate Dispute Resolution.

INTRODUCTION

Environmental disputes are disputes that are related to the use of natural resources, pollution, and land development projects. These disputes result in various sectors being affected such as ecological development, economic growth, social equality, etc. Environmental disputes result in a fight between environmental preservation and development hence various scholars have differing opinions on how these disputes should be tackled and the apt solution that can be beneficial to all.

Various traditional dispute resolution methods have been used to date to resolve environmental disputes such as litigation and arbitration, but these methods prove to be time-consuming and draining as there is no quick and long-term solution arising from the traditional methods.¹

Understanding Smart Contracts

Smart contracts are a technological advancement that has been beneficial to users as it helps in avoiding the traditional court system, Smart contracts are stored in a codified format in the blockchain technology in the form of a transaction ledger. These contracts are self-governing and self-executive, i.e. when a smart contract is uploaded based on its terms and conditions in the form of codes, they automatically work and get executed when these terms and conditions are met by both the parties to the contract. The satisfaction of terms and conditions and its

¹ Environmental Disputes, ICLG, <https://iclg.com/practice-areas/environmental-law/environmental-disputes> (last visited July 15, 2024).

results is also uploaded in the form of codes by the technician hence there is no chance of the technology getting hacked and the contractual terms being misused by any of the parties.²

The smart contracts are designed in such a way that there is a minimum chance of a dispute arising due to their automatic nature and well-designed and clearly incorporated terms and conditions. The nature of such technology helps in completely automated and transparent working which in turn helps in dispute resolution.

Understanding Environmental Disputes

Environmental disputes are the conflicts arising from the use or exploitation of various environmental resources or natural resources. These disputes consist of natural resources such as land, air, water, biodiversity, etc. The environmental disputes encompass various stakeholders such as environmental activists, industry owners, state and central governments, agriculturists, environmental experts, etc. The identification of stakeholders and their interest in various environmental disputes is regarded as of utmost important to resolve the dispute.

Environmental disputes are regarded as disputes between the development and protection of nature and natural resources.³ The main reason for environmental issues to arise is the rise in the need for the development of various stakeholders that exploit the environment and natural resources gained by it.

TYPES OF ENVIRONMENTAL DISPUTES

There are various types of environmental disputes arising due to the involvement of various natural resources, these disputes can be classified as the following:

1. **Pollution Disputes:** It deals with the contamination of various natural resources such as air, water, soil, and land. The word pollution means the release of harmful substances in physical, chemical, or biological form into the natural resources which contaminates the natural resources and makes them unfit for proper use. Pollution disputes arise as the contamination of these resources turns out to be harmful to a health and safe and healthy life.⁴ Pollution of natural resources such as land, air and water also affect the living conditions of various creatures and animals and affects their natural habitat.
2. **Resource Management Disputes:** It deals with the allocation of natural resources such as land for mining, logging the forests, water allocation from rivers and seas, territorial resources, etc. The dispute arises when the resources are exploited beyond a certain point to achieve development when the natural resources start depleting and the resource is scarce.⁵ The management of resources has to be in such an order that it

² Smart Contracts, Blockchain Technology, <https://www.blockchain.com/learning-portal/smart-contracts> (last visited July 15, 2024).

³ Environmental Disputes, Legal Information Institute, Cornell Law School, https://www.law.cornell.edu/wex/environmental_disputes (last visited July 14, 2024).

⁴ Pollution Disputes, Legal Information Institute, Cornell Law School, https://www.law.cornell.edu/wex/pollution_disputes (last visited July 12, 2024).

⁵ Resource Management Disputes, United Nations Environment Programme (UNEP),

conserves natural resources and also helps in achieving sustainable development in the economic as well as infrastructure sectors. The management of resources shall also ensure that there is little to no loss of livelihood affecting the living conditions of people around such areas.

3. **Biodiversity Disputes:** these disputes deal with the preservation of biodiversity such as flora and fauna that are present in nature. These disputes arise due to the endangered species and their conservation and protection along with their natural habitat of living. The resolution of these disputes aims at conserving the natural habitat and reducing the use of these areas for agriculture, infrastructural projects and urban development. It aims to achieve a balance among both conservation and development of these areas.⁶

POTENTIAL OF SMART CONTRACTS IN MEDIATING ENVIRONMENTAL DISPUTES

The smart contracts have a great potential to bring about a drastic shift in the resolution of environmental disputes and promote a sustainable environment for all. It is possible as the terms and conditions of a smart contract are incorporated in form of codes therefore, they can be automated in compliance, enforcement and arbitration process. This helps us in better management and resolution of pollution disputes, resource management disputes as well as biodiversity disputes arising all over the world.

A. Pollution Disputes

The pollution disputes are majorly caused by the release of harmful chemicals in form of physical, chemical or biological waste into the natural resources such as air, water and soil or land. It affects the living conditions and causes various problems to human beings as well as animals and other living beings. The traditional method of tackling and resolving this issue may be difficult due to its time-consuming nature and inefficiency seen before. Smart contracts help in this process as it streamlines the process by integrating with Internet of Things (IoT) devices. These devices help in monitoring the pollution levels and reporting it. For example, if the device is installed in a factory, it determines its pollution rate and emissions made in the factory and report the data to blockchain based smart contract. If pollution levels exceed the legal threshold, the smart contract can automatically trigger enforcement actions such as imposing fines, notifying regulatory authorities, or even shutting down operations until compliance is restored, ensuring immediate and consistent enforcement of environmental regulations.⁷ Additionally, all data collected from pollution monitoring can be recorded on the blockchain, providing an immutable and transparent audit trail. This transparency helps build trust among stakeholders, as they can verify compliance

<https://www.unep.org/explore-topics/resource-efficiency/what-we-do/addressing-resource-management-disputes> (last visited July 12, 2024).

⁶ Biodiversity Disputes, International Union for Conservation of Nature (IUCN), <https://www.iucn.org/theme/protected-areas/about/biodiversity-disputes> (last visited July 12, 2024)

⁷ Lars Fischer, Blockchain for Environmental Monitoring, *Environ. Sci. Technol.*, 52(18), 10594-10595 (2018).

data independently. In case of disputes, the recorded data serves as indisputable evidence, simplifying the resolution process and ensuring decisions are based on accurate information.

B. Resource Management Disputes

It often involves conflicts over land use, conservation efforts, and habitat protection. Resolving these disputes requires effective coordination among various stakeholders, including government agencies, environmental organizations, and local communities. Smart contracts can facilitate this coordination by managing agreements between stakeholders involved in biodiversity conservation. For example, a smart contract could govern a reforestation project, ensuring that all parties fulfil their commitments, such as planting trees, maintaining the forest, and monitoring biodiversity. The smart contract can automate the disbursement of funds based on the achievement of specific milestones, ensuring accountability and timely execution of conservation activities. Additionally, smart contracts can automate compliance with biodiversity regulations by monitoring activities that impact protected areas or endangered species. Sensors and drones can monitor wildlife habitats and report data to a smart contract, which can trigger actions if illegal activities are detected. This automated compliance system ensures that conservation efforts are effectively monitored and any violations are promptly addressed.

C. Bio-Diversity Disputes

It often involves conflicts over the allocation and use of natural resources such as water, land, and energy. These disputes can be particularly challenging due to the diverse interests of stakeholders and the need for equitable resource distribution. Smart contracts can enhance resource management by automating the allocation of resources based on predefined rules and real-time data. For example, in water management, a smart contract can allocate water resources among agricultural, industrial, and residential users based on current availability and usage patterns. This automated allocation ensures fair and efficient distribution of resources, reducing the potential for conflicts. Furthermore, smart contracts can enforce sustainable resource use by monitoring usage patterns and implementing corrective actions when limits are exceeded. For instance, a smart contract governing land use could monitor deforestation activities and automatically impose restrictions or penalties if unsustainable practices are detected, ensuring that resources are used responsibly and preserved for future generations. Moreover, smart contracts can facilitate collaboration among multiple stakeholders involved in resource management, such as managing a community-based water conservation project, ensuring that all parties contribute resources and share responsibilities effectively.

Additionally, Smart contracts hold the potential to transform the landscape of environmental dispute resolution through their inherent properties of automation, transparency, and immutability. By embedding the terms and conditions of agreements directly into code, smart

contracts can streamline compliance, enforcement, and arbitration processes, significantly reducing the time and cost traditionally associated with resolving environmental disputes.

A. Automating Compliance and Enforcement

Smart contracts can automate environmental regulation compliance and enforcement by integrating with IoT devices that continuously monitor parameters such as air and water quality, and emission levels. If pollution levels exceed legal thresholds, the smart contract automatically triggers enforcement actions like fines or shutdowns, ensuring immediate corrective measures. Additionally, these contracts can automatically enforce penalties, reducing the need for lengthy legal procedures, and ensuring swift, certain enforcement of environmental laws by deducting fines or freezing operations upon detecting non-compliance.

B. Transparent and Immutable Records

Smart contracts, through blockchain integration, provide transparent and tamper-proof records of compliance and enforcement actions. Blockchain ensures all transactions and contract executions are permanently recorded in an immutable audit trail, fostering trust among stakeholders who can independently verify compliance data. This transparency holds all parties accountable, as disputes can be resolved using these indisputable records, ensuring that decisions are based on accurate, factual data rather than conflicting narratives.

C. Decentralized Arbitration

Smart contracts facilitate decentralized arbitration by embedding pre-defined arbitration mechanisms within the contract code, ensuring all parties agree to the process in advance. This approach reduces uncertainty and ensures efficient dispute resolution by referring disputes to specified arbitration bodies or platforms. These platforms, powered by blockchain technology, offer neutral and efficient forums for resolving disputes with impartial experts, ensuring decisions are transparent, tamper-proof, and based on technical expertise and fairness.

D. Facilitating Environmental Impact Assessments (EIAs)

Smart contracts streamline Environmental Impact Assessments (EIAs) by automating the collection and analysis of environmental data through integration with IoT devices and environmental databases. This automation is used to gather real time data on the quality of air and water supply, biodiversity and other parameters affecting the environment and helps in reduction of manual work which saves a lot of time in the process. It also ensured that the compliance with EIA requirements is fulfilled by verification of all the necessary approvals and assessments being conducted before granting the approval to the project. It stops the approval of any project if the standards or requirements are not met, which helps in better upholding the environmental standards provided.

E. Enabling Collaborative Environmental Management

Smart contracts help in the environmental management by coordinating joint actions among stakeholders such as government agencies, private companies, NGOs, and local

communities. They manage community-based projects by ensuring all stakeholders contribute resources and share responsibilities according to predefined agreements, reducing conflicts and enhancing the efficiency of collaborative efforts. Additionally, smart contracts manage the allocation and use of shared resources like water, land, and energy, ensuring sustainable and equitable resource distribution by automating management processes and preventing overuse and depletion.

CASE STUDIES

There have been situations in which smart contracts and technology were used. These case studies can illustrate the potential of smart contracts in mediating environmental disputes. The most notable ones are Chile's Renewable Energy Certificates and China's Carbon Trading Platform.

A. Chile's Renewable Energy Certificates

Chile has emerged as a leader in using blockchain technology to increase transparency and reliability in the renewable energy industry. The introduction of blockchain and smart contracts by the government on the issuance and trading of RECs has brought about significant improvements in compliance and checkmating fraud.⁸ In Chile, electricity producers that rely on renewable sources receive certificates symbolizing the amount of energy they have produced. The process of issuing and validating these certificates used to be laborious and could easily be manipulated by criminals. Chile has automated this entire process through the use of blockchain technology and smart contracts. Consequently, every time a green power producer generates a specific quantity of electricity, a smart contract is automatically executed which issues an equivalent certificate recorded on the blockchain.⁹ This automation ensures that there is no manual intervention in the prompt issuance of accurate certificates

B. China's Carbon Trading Platform

The potential of smart contracts in managing environmental resources is shown through China's innovative way of reducing carbon emissions using a blockchain-based carbon trading platform.¹⁰ The system automates the trade of carbon credits therefore allowing for accurate tracking and efficient functioning of the market. IoT devices together with sensors are used in this platform to monitor greenhouse gas emissions from different sources like factories as well as power plants. This information is then recorded on blockchain, which provides transparent and unchangeable records about the amount of gases emitted. In this regard, smart contracts play a very important role in validating

⁸ Renewable Energy Laws and Regulations Chile, ICLG, <https://iclg.com/practice-areas/renewable-energy-laws-and-regulations/chile> (last visited July 17, 2024)

⁹ Emily Sinnott & Diego Rivera Rivota, Green Hydrogen for Decarbonization in Chile: Certification is an Essential Step, World Bank Blogs (Nov. 7, 2022), <https://blogs.worldbank.org/en/latinamerica/green-hydrogen-decarbonization-chile-certification-essential-step> (last visited July 16, 2024).

¹⁰ Emissions Trading, Oxford Institute for Energy Studies, Chinese Climate Policy, <https://chineseclimatepolicy.oxfordenergy.org/book-content/domestic-policies/emissions-trading/> (last visited July 17, 2024)

data automatically and issuing carbon credits depending on authenticated emission reductions.¹¹ Only true emission reductions earn carbon credits; hence it increases the legitimacy of the carbon trading industry.

CONCLUSION

The use and adaptation of smart contracts in environmental dispute resolution have a significant scope of development and achieving the target of sustainable dispute resolution. The various characteristics such as providing transparency, immutable resources, promoting automation, coding format for information and facilitating decentralised arbitration help smart contracts in providing efficient, transparent and reliable solution for various environmental disputes namely, resource management dispute, pollution dispute, and the biodiversity dispute. Smart contracts help in fostering better communication and dispute resolution by undertaking the administrative burden of the various organisations and ensures the implementation and enforcement of environmental laws by taking into consideration all the stake holders of the dispute. They also help in collaborating environmental management and the adherence to various environmental standards provided for the companies through streamlining the Environmental Impact Assessment (EIAs) and help in sustainable use of resources.

The case studies of Chile and China help us understand the practical benefits of smart contract through the promotion of transparency, efficiency and accountability of the environmental management system. Utilising these case studies as direction for further environmental disputes may be beneficial in swift resolution and sustainable development of the nature along with achieving sustainable development for all.

¹¹ China Carbon, European Energy Exchange (EEX), <https://www.eex.com/en/markets/environmental-markets/china-carbon> (last visited July 17, 2024)